POLISH JOURNAL OF SCIENCE
№75 (2024)

ISSN 3353-2389

Polish journal of science:

- has been founded by a council of scientists, with the aim of helping the knowledge and scientific achievements to contribute to the world.
- articles published in the journal are placed additionally within the journal in international indexes and libraries.
- is a free access to the electronic archive of the journal, as well as to published articles.
- before publication, the articles pass through a rigorous selection and peer review, in order to preserve the scientific foundation of information.

Editor in chief –J an Kamiński, Kozminski University
Secretary – Mateusz Kowalczyk

Agata Żurawska – University of Warsaw, Poland
Jakub Walisiewicz – University of Lodz, Poland
Paula Bronisz – University of Wrocław, Poland
Barbara Lewczuk – Poznan University of Technology, Poland
Andrzej Janowiak – AGH University of Science and Technology, Poland
Frankie Imbriano – University of Milan, Italy
Taylor Jonson – Indiana University Bloomington, USA
Remi Tognetti – Ecole Normale Superieure de Cachan, France
Bjørn Evertsen – Harstad University College, Norway
Nathalie Westerlund – Umea University, Sweden
Thea Huszti – Aalborg University, Denmark
Aubergine Cloez – Universite de Montpellier, France
Eva Maria Bates – University of Navarra, Spain
Enda Baciu – Vienna University of Technology, Austria

Also in the work of the editorial board are involved independent experts

1000 copies
POLISH JOURNAL OF SCIENCE
Wojciecha Górskiego 9, Warszawa, Poland, 00-033
email: editor@poljs.com
site: http://www.poljs.com

CONTENT

AGRICULTURAL SCIENCES

Falendysh N., Bobel I., Symonenko A.
PUMPKIN SEED MEAL IN THE ORGANIC WHEAT BREAD PRODUCTION 3

CHEMICAL SCIENCES

Koshchii I., Klimko Yu., Shamota T.
ADAMANTANE-1-CARBOXYLIC ACID AS A THIONECARBOXYLIC ACID SYNTHON 9

ECONOMIC SCIENCES

Mykhaylyna D.
THE ROLE OF SYMBOLS IN INTERNATIONAL ECONOMIC RELATIONS AND BUSINESS CULTURAL ENVIRONMENT 19

Pecheniuk A.
PECULIARITIES OF BUILDING EFFECTIVE FINANCIAL MANAGEMENT IN THE ENERGY SECTOR.....24

HISTORICAL SCIENCES

Ernazarov O.
LIFE OF MUSLIMS IN THE PEOPLE'S REPUBLIC OF CHINA (1949-2000 YEARS) 29

MEDICAL SCIENCES

Bukach O., Sydorchuk D., Pashkevych V., Kushnir M., Hibai R.
PREVENTION OF EMOTIONAL BURNOUT OF TEACHERS OF HIGHER EDUCATIONAL MEDICAL INSTITUTIONS.....32

PEDAGOGICAL SCIENCES

Kostadinov O.
THE ROLE OF IMPLICIT LANGUAGE ACQUISITION IN MULTILINGUALISM 37

PHILOLOGICAL SCIENCES

Norkuziyeva D.
METAPHORICAL AND LINGVOCOGNITIVE FORMATION OF ZOOMORPHISM RELATED TO A SPECIFIC PERSON IN WORKS OF ART 40

PHYSICAL SCIENCES

Antonov A.
IT FOLLOWS FROM THE SPECIAL THEORY OF RELATIVITY THAT THE INVISIBLE AFTERLIFE WORLD PREDICTED BY ALL RELIGIONS IS IN FACT PHYSICALLY REAL 45

POLITICAL SCIENCES

Tamazashvili M.
RUSSIA'S ON GOING HYBRID WAR IN GEORGIA'S AND ITS INFLUENCE ON PROTECTED CONFLICT.....52

TECHNICAL SCIENCES

Abbas B.A., Abdullahi M., Sadiku S., Aguwa J.I., Abubakar J., Kolo D.N.
INVESTIGATION INTO THE MECHANICAL PROPERTIES OF CONCRETE USING PEBBLES FROM BIDA ENVIRON AS COARSE AGGREGATE IN CONCRETE PRODUCTION 57

Bagitova L.
OPTIMIZATION OF BUSINESS PROCESSES IN THE ENTERPRISE: METHODS AND TOOLS.....64

Kitkin D., Smashov N.
RESEARCH ON DIAMOND ROCK BREAKING TOOLS ...67

AGRICULTURAL SCIENCES

ШРОТ НАСІННЯ ГАРБУЗА У ВИРОБНИЦТВІ ОРГАНІЧНОГО ПШЕНИЧНОГО ХЛІБА

Фалендиш Н.О.
кандидат технічних наук, доцент
Бобель І.М.
кандидат технічних наук, доцент
Національний університет харчових технологій
м. Київ, Україна
Симоненко А.Л.
магістр, викладач
ПТУ №46 село Лазірки Лубенського району, Полтавської області, Україна

PUMPKIN SEED MEAL IN THE ORGANIC WHEAT BREAD PRODUCTION

Falendysh N.,
PhD, associate professor
Bobel I.,
PhD, associate professor
National University of Food Technologies
Kyiv, Ukraine
Symonenko A.
Master, lecturer
VTSC №46, Lubensky district, Poltava region,
Ukraine
DOI: 10.5281/zenodo.12059081

Анотація

Домінуючу роль у продовольчих системах будь якої країни, займають хліб і зернові продукти, які є джерелом вуглеводів, білків, вітамінів групи В та мінеральних речовин. Ця продукція останнім часом стала предметом дискусій щодо її поживної цінності. Дедалі частіше в наукових публікаціях подається інформацію, що регулярне споживання зернової продукції відіграє вагому роль в запобіганні хронічних захворювань. Епідеміологічні дослідження свідчать про тісну кореляцію між споживанням цільнозернових продуктів і зменшенням ряду захворювань, зокрема, серцево-судинних, цукрового діабету другого типу, ожиріння, метаболічного синдрому та ін.

Хліб та хлібобулочні вироби, особливо з високосортного пшеничного борошна, є дещо незбалансованими за амінокислотним складом, вмістом харчових волокон, вітамінів та мінеральних речовин. Зважаючи на те, що продукти хлібопекарського виробництва є складовою щоденного раціону харчування, збагачення їх мікро- та макронутрієнтами, необхідними для нормального функціонування організму, є доцільним.

У зв'язку з погіршенням екологічної ситуації, в тому числі спровокованої застосуванням різного виду зброї, яка забруднює довкілля, збільшується негативний вплив на стан всіх верст населення незалежно від статусу. В цих умовах зростає інтерес споживачів до сегменту органічних та оздоровчих продуктів.

Метою роботи було дослідження доцільності використання шроту насіння гарбуза у виробництві органічного хліба збагаченого макро- та мікронутрієнтами.

За результатами досліджень розроблено рецептуру органічного хліба із борошна пшеничного першого сорту з раціональним дозуванням шроту насіння гарбуза у кількості 10 % до маси борошна. Даний виріб має покращений нутрієнтний склад за вмістом харчових волокон, незамінних амінокислот та цинку.

Abstract

Bread and cereal products play a dominant role in the food systems of any country, being a source of carbohydrates, proteins, B vitamins and minerals. These products have recently become the subject of debates about their nutritional value. More and more often, scientific publications present information that regular consumption of grain products plays a significant role in preventing chronic diseases. Epidemiological studies show a close correlation between the consumption of whole grain products and the reduction of a number of diseases, including cardiovascular diseases, type 2 diabetes, obesity, metabolic syndrome, etc.

Bread and bakery products, especially from high-grade wheat flour, are a somewhat unbalanced in content of amino acids, dietary fiber, vitamins and minerals. Considering that bakery products are a part of the daily diet, it is reasonable to enrich them with micro- and macronutrients necessary for the normal functioning of the human body.

Due to the deteriorating environmental situation, including that provoked by the use of various types of weapons that contaminate the environment, the negative impact on the health of all segments of the population, regardless of status, is increasing. In these conditions, consumer interest in the organic and health products segment is growing.

The aim of the study was to investigate the practicability of using pumpkin seed meal in the production of organic bread enriched with macro- and micronutrients.

Based on the results of the research, a recipe of organic bread made from first-grade wheat flour with a rational dosage of pumpkin seed meal in the amount of 10% of the flour weight was developed. This product has an improved nutritional composition in the content of dietary fiber, essential amino acids and zinc.

Ключові слова: шрот насіння гарбуза, харчова цінність, харчові волокна, клейковина.

Keywords: pumpkin seed meal, nutritional value, dietary fiber, gluten.

Ставлення проблеми. Хлібопекарська промисловість України, є стратегічно важливою для життєзабезпечення суспільства і гарантування продовольчої безпеки держави. Особливо важлива роль хлібопекарської галузі на теперішній час, в умовах збройної агресії, для забезпечення Збройних Сил та населення України.

У зв'язку з погіршенням екологічної ситуації, в тому числі спровокованої застосуванням різного виду зброї, яка забруднює довкілля, збільшується негативний вплив на стан всіх верст населення незалежно від статусу. В цих умовах зростає інтерес споживачів до сегменту органічних та оздоровчих продуктів.

Для збагачення хлібобулочних виробів із пшеничного сортового борошно, яке є нетрадиційним для хлібопекарської промисловості: гречане, вівсяне, рисове, кукурудзяне, соєве, люпинове, та ін. Поширення набуває використання шротів олійних культур, які отримують після віджиму олії холодним способом [1, 2].

Широкої популярності у світі, в тому числі і в європейських країнах, набувають продукти органічного виробництва. Розвиток органічного виробництва є досить актуальним через низку явних екологічних, економічних та соціальних переваг, що притаманні цій сфері діяльності.

Органічне виробництво відіграє подвійну соціальну роль: з одного боку, забезпечує специфічний ринок, який відповідає потребам споживача у органічній продукції, а з іншого – забезпечує загальне благо, сприяючи захисту довкілля, належному утриманню тварин, а також розвитку сільської місцевості [3].

Завдяки природно-кліматичним умовам, родючості ґрунтів наша держава наділена усіма можливостями та перспективами для розвитку органічного виробництва. В умовах війни українські оператори гідно несуть свою «службу» на ниві органічного виробництва.

Не дивлячись на повномасштабну війну, заблоковані порти та інші труднощі, рівень експорту української органічної продукції у 2022 році лише трохи впав порівняно з 2021 роком, це падіння склало менше 6%. У 2022 році Україна експортувала органічну продукцію до 36 країн світу, проте заблокований морський шлях вплинув на географію експорту. Значно зросла частка експорту до країн ЄС з 74% у 2021 році до 85% у 2022 році [4].

Щодо внутрішнього ринку споживання органічної продукції у 2022 році, спостерігається зниження її продажів, що безумовно зумовлено війною. Проте, оператори органічного виробництва з досвідом роботи на ринку продовжують працювати, розширюють асортимент, сертифікують нові продукти. До органічного сектору долучаються нові виробники [5]. У 2023 році спостерігається зростання на органічному ринку України, у порівнянні із 2022 роком [6].

Асортимент хлібобулочних виробів сьогодні є надзвичайно широким. Проте органічних хлібобулочних виробів, та виробів функціонального призначення виготовляється недостатньо.

У даній роботі розглянуто доцільність використання шроту насіння гарбуза у технології хлібобулочних виробів та розроблення органічного хліба функціонального призначення.

Метою роботи є удосконалення технології органічних хлібобулочних виробів функціонального призначення, збагачених шротом насіння гарбуза.

Матеріали і методи. В ході роботи проводили дослідження тіста та хліба із борошна пшеничного першого сорту з доданням шроту насіння гарбуза. Для досліджень використовували методи: стандартні загальноприйняті, фізико-хімічні, структурно-механічні, виконані з використанням сучасних приладів і комп'ютерних технологій.

Результати та обговорення. Для встановлення раціонального дозування шроту насіння гарбуза до рецептури хліба з борошна пшеничного першого сорту, проведено пробні випікання та досліджено вплив даної сировини на зміну якості тіста, готових виробів, а також зміну хімічного складу та біологічної цінності хліба.

Оскільки шрот насіння гарбуза містить значну кількість білкових речовин та харчових волокон, можна передбачити зміни структурно-механічних властивостей тіста, які доцільно дослідити.

За результатами досліджень встановлено, що зразки із доданням шроту характеризуються меншим розпливанням кульки тіста по відношенню до контрольного зразка (рис. 1), що, ймовірно, можна пояснити підвищенням в'язкості тіста за рахунок збільшення у ньому кількості білків та харчових волокон, які є водозв'язуючими речовинами.

Наступним кроком дослідження було визначення газоутримувальної здатності тіста. Дослідження тривало 3 год, протягом яких спостерігали

інтенсифікацію процесу бродіння. На четвертій годині тісто почало опадати, тому дослідження було зупинену.

Найвищим питомим об'ємом характеризується контрольний зразок (рис 2). Це пояснюється інтенсивним розгалуженням клейковинних білків у тісті. Виявлено подібну динаміку у зразках, що містили 5% та 10% ШНГ.

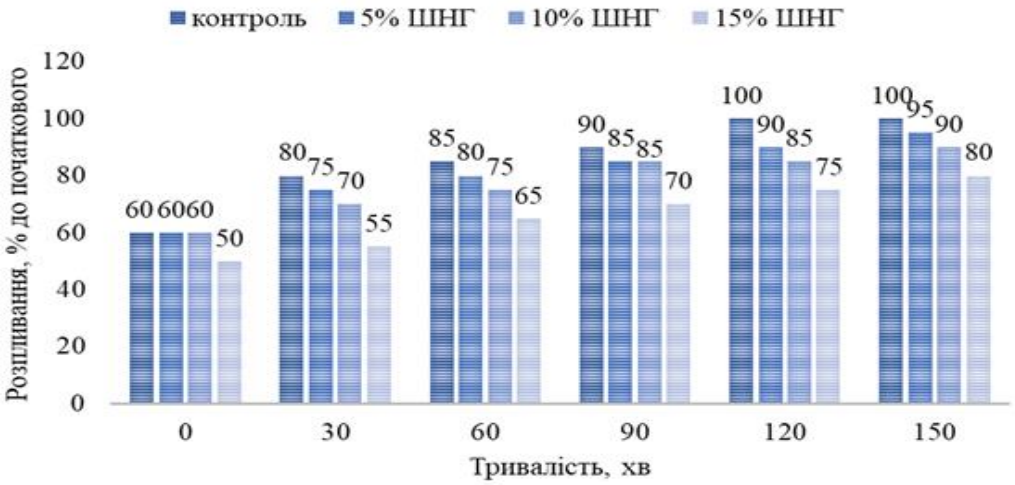

Рисунок 1 – Розпливання кульки тіста дослідних зразків

Найменшим питомим об'ємом характеризується зразок із вмістом ШНГ 15%, який на 19,5% менше, ніж у контролі, що можна пояснюється зменшенням інтенсивності бродіння тіста з ШНГ і недостатнім розгалуженням в тісті клейковинного каркасу.

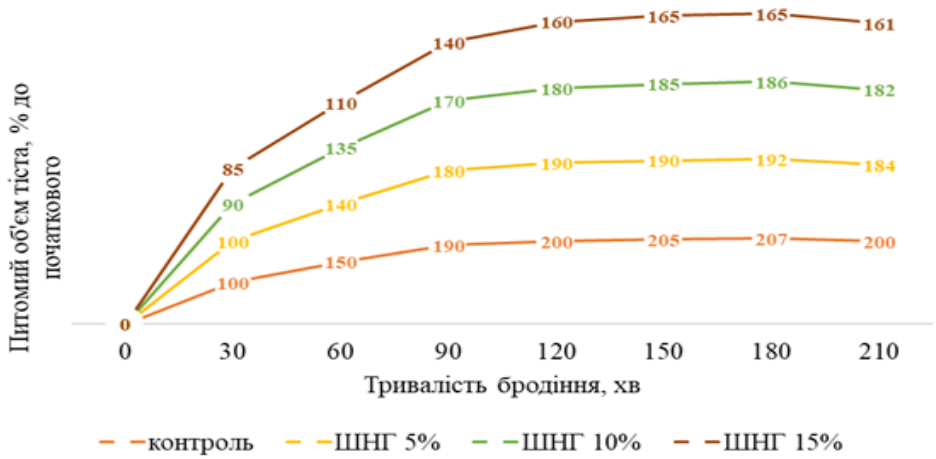

Рисунок 2 - Питомий об'єм тіста дослідних зразків

Для визначення органолептичних та фізико-хімічних показників готових виробів проводили пробне лабораторне випікання.

Бальна оцінка органолептичних показників готових виробів представлена у вигляді профілограм (рис. 3).

Результати дослідження показали (рис.3), що дозування гарбузового шроту у кількості 5 та 10 % дозволяє отримати вироби, що за органолептичними показниками відповідають контрольному зразку. Додання гарбузового шроту у кількості 15% негативно впливає на забарвлення скоринки, колір м'якушки та структуру пористості.

Встановлено, що питомий об'єм виробів (рис. 4) із додаванням шроту насіння гарбуза зменшується порівняно з контрольним зразком.

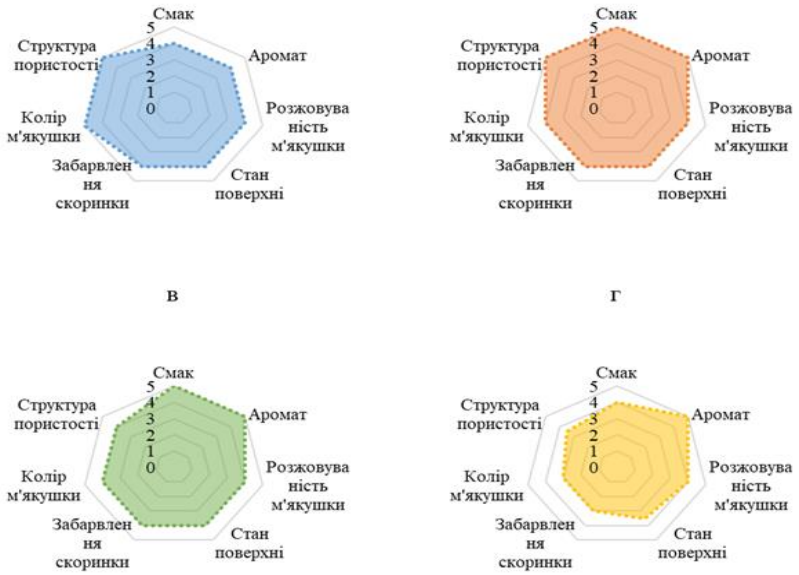

Рисунок 3 - Бальна оцінка досліджуваних зразків: а-контроль, б – 5 % ШНГ; в- 10% ШНГ, г- 15% ШНГ.

Так за додання 5% та 10 % ШНГ питомий об'єм хліба зменшується 3,8% та 4,7% відповідно, при внесенні 15% ШНГ – зменшується на 16% порівняно з контролем.

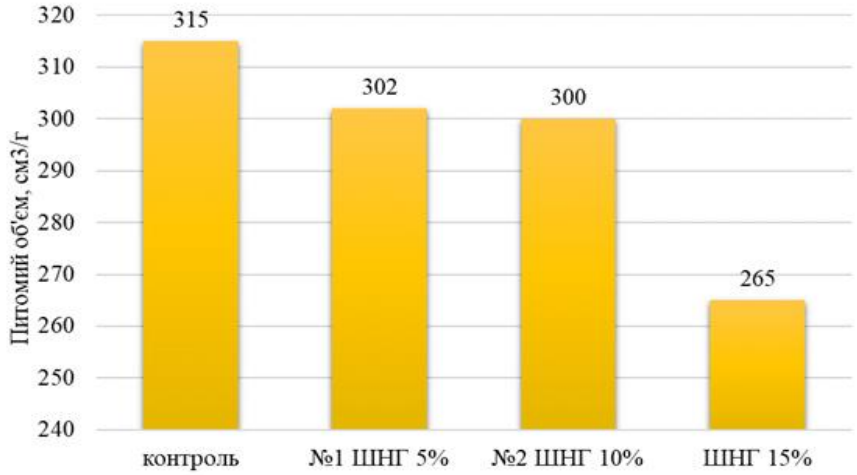

Рисунок 4 – Питомий об'єм хліба

З'ясовано, що внесення у виріб 15% шроту насіння гарбуза погіршує структурно-механічні властивості виробу. В той час як внесення 5% та 10% ШНГ суттєво не змінює дані властивості виробу.

Вміст ессенціальних речовин формує біологічну цінність хліба. Тому, для дослідження впливу шроту гарбуза на біологічну цінність хліба, доцільно провести розрахунки.

Розрахунок біологічної цінності хліба проводили за тими речовинами, вміст яких суттєво відрізняється у борошні пшеничному та у шроті насіння гарбуза: незамінними амінокислотами, харчовими волокнами та цинком. Результати розрахунків представлені у табл. 1.

Таблиця 1

Біологічна цінність хліба на 100 г виробу

Показник	Контроль	Хліб з ШНГ 5%	Хліб з ШНГ 10%	Хліб з ШНГ 15%
Амінокислоти, мг				
Ізолейцин	384,04	437,13	486,56	532,61
Лейцин	637,65	765,88	885,30	996,57
Метіонін	115,94	136,39	155,43	173,18
Фенілаланін	420,27	587,59	743,43	888,69
Треонін	239,12	353,27	459,58	558,69
Валін	369,55	447,64	520,37	588,14
Лізин	210,13	311,30	405,51	493,34
Триптофан	86,95	97,57	107,45	116,65
Інші ессенціальні речовини				
Харчові волокна, г	3,55	4,51	5,41	6,24
Цинк, мг	0,72	0,98	1,21	1,43

Встановлено, що додання ШНГ у кількості 5, 10 та 15% до маси борошна суттєво покращує амінокислотний склад хліба. А саме: вміст ізолейцину збільшується на 14%, 27%, 39% відповідно; вміст лейцину збільшується на 20%, 39%, 56%; метіоніну – на 18%, 34%, 49%; валіну – на 21%, 41%, 59%; триптофану – на 12%, 24%, 34%.

Слід відзначити, що при дозуванні 5% та 10 % ШНГ до маси борошна, вміст фенілаланіну зростає на 40% та 77% відповідно, а при дозуванні 15% – у 2,1 рази.

На особливу увагу заслуговує збільшення кількості треоніну, а також лізину, яка є лімітуючою амінокислотою у пшеничному борошні. При внесені 5% та 10% ШНГ до маси борошна вміст кожної з вказаних амінокислот зростає на 48% та 93 % відповідно. А додавання 15 % ШНГ до маси борошна кількість цих амінокислот у хлібі зростає у 2,8 рази.

У хлібі із доданням шроту насіння гарбуза помітно підвищується вміст харчових волокон, з внесенням 5 % - на 27 %, 10 % - на 52 %, 15 % - на 76 %.

Шрот насіння гарбуза містить у 7 разів більше цинку, ніж пшеничне сортове борошно. При внесенні у рецептуру хліба ШНГ у кількості 5%, 10% та 15% до маси борошна вміст цинку зростає на 36%, 68% та 97% відповідно.

Важливим показником споживчих властивостей харчових продуктів, є інтегральний скор, який вказує на скільки добове споживання певного продукту задовольнить добову потребу організму у тих чи інших речовинах.

Розрахунок інтегрального скору хліба зі ШНГ показав, що внесення шроту насіння гарбуза до рецептури хліба сприяє зниженню забезпечення добової потреби організму у вуглеводах. При дозуванні ШНГ 5%, 10% та 15% до маси борошна добове забезпечення у білках підвищується на 12%, 24% та 34% відповідно.

Отже, проведене комплексне дослідження органолептичних, фізико-хімічних показників хліба, а також розрахунок харчової цінності, вказує на те, що ШНГ має позитивний вплив на якість хліба. Встановлено, що погіршення органолептичних показників хліба відбувається при внесенні 15% ШНГ до маси борошна. Також дане дозування спричинює погіршення і фізико-хімічних показників тіста та готових виробів. При внесенні 5% та 10% ШНГ до маси борошна фізико-хімічні показники хліба та тіста також нижчі, порівняно з контролем, проте це зниження не є суттєвим.

Була встановлена закономірність, що зі збільшенням дозування ШНГ значно підвищується харчова та біологічна цінність хліба. Внесення 5% ШНГ до маси борошна дозволило покрити добову потребу досліджуваних нутрієнтів хліба на 12…50%. Тоді як 10% ШНГ забезпечувало покриття добової потреби досліджуваних нутрієнтів на 14…64%. Відповідно, найвище покриття добової потреби забезпечував зразок хліба, що містив 15% ШНГ, що складало 14,8…77%.

З огляду на те, що внесення 15% ШНГ до маси борошна спричиняло значне погіршення органолептичних та фізико-хімічних показників хліба, вважаємо недоцільним рекомендувати таке дозування до рецептури хліба. Тоді як внесення 10% ШНГ до маси борошна у виріб забезпечувало відповідні органолептичні та фізико-хімічні показники готового виробу. Крім цього, дане дозування підвищує харчову та біологічну цінність хліба. За вмістом харчових волокон інтегральний скор становить вище 50%. Це дозволяє стверджувати, що за даним нутрієнтом хліб, що містить 10% ШНГ до маси борошна, є харчовим продуктом функціонального призначення.

Відповідно до Закону України «Про інформацію для споживачів щодо харчових продуктів» встановлені референсні величини щодо кількості окремих нутрієнтів. Згідно визначення цього закону продукт має покращений хімічний склад, якщо окремий його компонент міститься у такій кількості, яка покриває 15 % добової потреби організму у ньому. Тому можемо стверджувати, що внесення шроту насіння гарбуза покращує хімічний склад хліба і дозволяє значною мірою покрити добову потребу організму у лізині, фенілаланіні, треоніні та цинку.

За результатами досліджень прийнято рішення щодо раціонального дозування шроту насіння гарбуза у кількості 10 % до маси борошна. Розроблено рецептуру та технологічний режим органічного хліба із пшеничного борошна першого сорту із доданням шроту насіння гарбуза.

Висновки. Сучасні харчові продукти не забезпечують організм людини ессенціальними речовинами в повній мірі. Важливими ессенціальними компонентами їжі є харчові волокна, незамінні амінокислоти, мінеральні речовини та вітаміни.

Органічні продукти можуть містити більше вітамінів, мінеральних речовин та антиоксидантів, ніж традиційні продукти. Відмінні смакові якості, відсутність шкідливих добавок, високі стандарти якості органічної продукції, мають позитивний вплив на наш організм, охороняють наше здоров'я. Тому споживання органічних продуктів слід сприймати як потужну зброю проти хвороб, а не як полегшення від хвороб.

Встановлено доцільність збагачення хлібобулочних виробів продуктами переробки рослинної сировини. З цією метою запропоновано використовувати шрот насіння гарбуза для розроблення функціональних органічних хлібобулочних виробів, збагачених харчовими волокнами і незамінними амінокислотами.

За результатами досліджень розроблено новий виріб – органічний хліб із борошна пшеничного першого сорту з раціональним дозуванням шроту насіння гарбуза у кількості 10 % до маси борошна, який має покращений нутрієнтний склад за вмістом харчових волокон, незамінних амінокислот та цинку.

Список літератури

1. Борошно стародавніх пшениць, продукти переробки круп'яних культур та шроти у технології хліба: моногр. / В.І. Дробот, Л.А. Михонік, А.Б. Семенова, Н.О. Фалендиш – К.: ПрофКнига, 2018. – 188 с.

2. Фалендиш, Н.О. Нетрадиційна сировина у виробництві хлібобулочних виробів. / Фалендиш, Н.О., Федорова Т.О., Симоненко А.Л. Polish science journal. 2023. Issue, №63 (2023) VOL. 1, p. 3-6.

3. Постанова Ради (ЄС) № 834/2007 від 28 червня 2007 року стосовно органічного виробництва і маркування органічних продуктів, та скасування Постанови (ЄЕС) № 2092/91.

4. https://organicinfo.ua/news/organic-export-2022/ (дата звернення: 05.02.2024).

5. https://organicinfo.ua/news/news-jan2-2024/ (дата звернення: 28.02.2024).

6. https://www.epravda.com.ua/columns/2024/01/18/708903/ (дата звернення: 18.02.2024).

CHEMICAL SCIENCES

ADAMANTANE-1-CARBOXYLIC ACID AS A THIONECARBOXYLIC ACID SYNTHON

Koshchii I.,
PhD in Chemistry, Associate Professor
Department of Organic Chemistry and Technology of Organic Substances
National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"
Kyiv, Ukraine
Klimko Yu.,
PhD in Chemistry, Senior Lecturer
Department of Organic Chemistry and Technology of Organic Substances
National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"
Kyiv, Ukraine
https://orcid.org/0000-0001-6274-3449
Shamota T.
Master of Science, Assistant
Department of organic chemistry and technology of organic substances
National Technical University of Ukraine "Ihor Sikorsky Kyiv Polytechnic Institute"
Kyiv, Ukraine
https://orcid.org/0000-0002-7228-6883
DOI: 10.5281/zenodo.12059312

Abstract

Adamantane-1-carboxylic acid (AdCOOH) is an important chemical compound that can be used in the fields of science and industry. The purpose of the work was a detailed study of adamantane-1-carboxylic acid, its chemical properties and reactivity, in the context of the development of new derivatives.The reaction of adamantane-1-carboxylic acid methyl ester with phosphorus pentasulfide in dimethoxyethane or dioxane was the first to produce adamantane-1-thioncarboxylic acid methyl ester. Its reactions with hydroxylamine and O-methylhydroxylamine lead to the predominant formation of 1-adamantyl cyanide and 1-adamantyl isocyanate, respectively. The reaction products of the thionester with piperidine are thiolester and the piperidinium salt of adamantane-1-thiolcarboxylic acid, the formation of which is accompanied by N-alkylation of the amine. The reaction of the thionester with diazomethane produces adamantyl-containing thiadiazoles and thiadiazolines.

Keywords: adamantane-1-carboxylic acid methyl ester, phosphorus pentasulfide, adamantane-1-thioncarboxylic acid methyl ester, adamantyl-containing thiadiazoles and thiadiazolines.

Introduction.

Adamantane-1-carboxylic acid (AdCOOH) has attracted considerable attention of scientists due to its special characteristics and possible applications in various fields of chemistry. Adamantane-1-carboxylic acid is used to prepare various adamantane derivatives and is known for its ability to form complex compounds with a variety of metals, including dimetallic clusters and coordination polymers. The obtained compounds were subjected to structural analysis using various methods, including IR, ^{1}H and ^{13}C nuclear magnetic resonance (NMR). Some of these substances were studied using X-ray structural analysis, which provided an opportunity to obtain significant information about their molecular structure and conformation.

O. Velichko and others. developed a technique for the synthesis of complexes of 1-adamantanecarboxylic acid with metals. As part of the study, the spectral and thermal properties of the obtained complex compounds were studied in detail [1]. Adamantane-1-carboxylic acid has been shown to interact with various metals, such as rhenium, iron, copper, and others, forming stable complexes. Complex compounds with 1-adamantyl carboxylate and 1-adamantyl acetate were synthesized and characterized by ultraviolet spectroscopy by A.V. Shtemenko and others. [2]. Using the X-ray diffraction method, the structure of the solvate of the adamantyl carboxylate compound with rhenium was established. Such complexes were investigated in the context of anticancer activity by N. Shtemenko et al. [3]. Reaction complexes of diarenium(III) with cis- and trans-diadamantyl carboxylate acids were found to have similar antitumor activity, with a slight advantage in the case of the cis analogue. As a result, the difference in the mechanisms of anticancer action of these compounds was established, which consists in the formation of monofunctional adducts and subsequent cross-linking and formation of cross-links between proteins and DNA. The anti-radical and DNA-binding properties of the studied substances were also considered. These findings indicate the potential effectiveness of using these complexes in the treatment of cancer. However, in dierenium clusters, the gradual replacement of halide ligands with carboxylates leads to a decrease in the reaction rate, as noted by A. Shtemenko et al. [4]. However, it is also indicated that there are prospects for use in medicinal preparations due to low toxicity and anti-radical properties arising from the δ-component of the electronic transition of the quadruple Re-Re bond. Another feature of AdCOOH is its ability to coordinate polymerization, which was reviewed in detail by I. Antonyuk [5]. The paper presented the synthesis of new (PEG, Ada)-grafted dextran obtained by azide-alkyne cycloaddition catalyzed by Cu(I), with a high degree of

substitution by PEG and Ad groups. It was found that the affinity of these polymers to monomeric βCD and their ability to form surface layers with β-cyclodextrin polymers strongly depend on the degree of Ad substitution. Using Ad-modified dextrans, the resulting microgels can be physically cross-linked to obtain hierarchical 3D hydrogels with a gel-sol transition temperature in the physiological range.

On the basis of obtaining the results of the synthesis of similar acidic acids, adamantane-1-carboxylic acid is supplemented with a reactive acidic acid. Among these, 1-aminoadamantane hydrochloride is also easily synthesized, which is an antiviral drug and is used to fight infections caused by influenza A [7]. The statistics have a great emphasis on the likes of admantan. Zokrem, with the help of differential scanning calorimetry, enthalpy, melting point and heat capacity of the solid phase were removed [8]. The findings in the robot are correlated with the powerful chemical characteristics of adamantane-1-carboxylic acid, which were helixed and under constant investigation. During subsequent syntheses, similar acids can be solidified by reaction, so that admantan-1-carboxylic acid readily undergoes condensation/cyclization reactions. This is confirmed by the work of M. Soseliya et al., which indicated that a series of similar acids were synthesized through the direct condensation of adamantane carboxylic acid with methyl 3,4-diaminobenzoate from trimethylsilyl polyphosphate [9].

One of the important findings is that 1-adamantanecarboxylic acid can create mononuclear tris(carboxylate) coordination complexes with various transition metals, such as Mn, Ni, Co and Zn. This is confirmed by various scientific evidence. For example, according to the statistics of D. Lita in. Photoreactive complexes in a discrete form were investigated, including 4-stilbazole and 1-carboxyadamantane [10]. Based on the results, studies with zinc(II) showed photoinertness; however, when zinc(II) was substituted with honey(II), the complexed compound exhibited a slight photoreaction through photoinduction similar to cyclobutene.

Work by J. Wang Ta in. is directed at the understanding of authorities and the accumulation of α-/β-/γ-cyclodextrins (CDs) and the like in drug delivery systems [11]. The inclusion of β-CD with various simple and bioconjugated adamantane-like compounds was investigated and it was found that all six compounds created inclusion adducts. The focus is directly on the creation of complexes of the "guest-guest" type with vicistristans similar to adamantane, which will take place of biologically active groups. Article by K. Jita in. It also confirms the creation of supramolecular complexes through the release of 1,3,4-oxadiazole, functionalized with adamantane [12]. Such scientific results will be useful for further investigation of the creation of the "master-guest" complexes and in the context of further developments of this work. For example, in the work of H. Yoshiyuki and in. a study was made of vikorstan photochemically stable sums, as well as the adduct of 1-adamantanecarboxylic acid, glycidyl methacrylate (AdC-GMA) and vikristan for the preparation of smelt from polymethacrylate mesh (CAP), which mixed cycle blocks odextrin-adamantane-gospodargist [13].

The details of the recognition of various monocarboxylic acids with the help of a group of substituted imidazoles, which include a pyridyl fragment, have been studied. Work by S. Prajapati et al. examines the influx of substitutes and the release of "nitrogen" from the peridine part of the receptors during the recognition process [14]. The most effective recognition is prevented if the receptor contains a 2-peridyl fragment. Imidazoles with a 3-pyridyl layer demonstrate weak binding properties, similar to phenyl-substituted imidazoles. The size of monocarboxylic acids is also important for the creation of "gospodar-gist" complexes. The characteristics of adamantane-like ligands were obtained from the article by V. Slyusarchuk, which is a reliable introduction to a complete description of the properties of admantane-1-carboxylic acid [15]. The results may be used as a source for future scientific research.

Although this work did not examine the biological activity of similar adamantane-1-carboxylic acids, this aspect can clearly be considered through their potential importance in biological applications. Adamantane-1-carboxylic acid compounds are characterized by a variety of potential biological properties that provide not only antiviral, antibacterial and antifungal properties, but also the ability to provide in medicinal applications and in cancer treatment [16]. Similar adamantane-1-carboxylic acids, such as amantadine and others, are known to have antiviral activity. They are likely to stagnate in patients infected with influenza virus type A. In addition, studies have shown their potential effectiveness in combating other illnesses caused by viruses, such as viral hepatitis Other respiratory viruses [17]. Various modifications of adamantane-1-carboxylic acid potentially exhibit antibacterial activity [18]. Knowledge about this may be useful in the treatment of bacterial infections, which are becoming increasingly important for the use of essential antibiotics. For example, the robot studied in detail the action of similar acids in the fight against tuberculosis. Based on further studies, the most potent indolamides based on adamantanol/adamantane 8j/8k showed increased effectiveness against extensive strains of M. tuberculosis with minimal values and inhibitory concentration. Studies of indole-2-carboxamide, which replace adamantanol, have shown an immediate difference in water and silicon, as well as experimentally compared with adamantane analogues [19]. It is noted that the antimycobacterial and physical-chemical profiles of these compounds confirm the findings that the adamantane component is a suitable replacement for the adamantane framework in the indol-2-carboxam series Some MmpL3 inhibitors.

Research has shown that adamantane-1-carboxylic acid and related compounds may have antifungal activity against various types of fungi, including candidiasis and other fungal infections. Among them are new studies on the development of antimicrobial peptides. In this study, N- and C-modified biomolecular peptide analogues of VV-hemorphin-5 and VV-hemorphin-7 were synthesized to replace different amino acids, 1-adamantanecarboxylic acid and qin.

This compound was synthesized by solid-phase peptide synthesis and assessed in aqueous solutions at different pH values using spectroscopic and electrochemical methods [20]. It has been revealed that they exhibit interaction between light and electricity, preserving structural and conformational integrity in components. New research methods have been used to modify textile materials, and the binding of peptides to the surface of bulk fibers has been confirmed. The antiviral and antimicrobial activity of these compounds has been studied, revealing their effectiveness against various types of viruses and bacteria [21].

It is known that sulfur-containing derivatives of adamantane - thioamides, thiadiazoles - show high antiviral activity [1, 2]. Unexplored adamantyl-containing thionesters could serve as convenient synthons for their synthesis. This work is devoted to the synthesis and study of some chemical properties of the methyl ester of adamantane-1-thioncarboxylic acid (II).

Materials and methods.

IR spectra were obtained on a Specord 751R spectrometer for samples in KBr tablets containing 0.25% of the substance. Or in a thin film, layer thickness 0.6 mm. PMR spectra were taken on Bruker AVANCE III HD (400 MHz).GLC analysis was carried out on a Цвет-500 device, glass column 2000x3 mm, 15% Apiezon L on Inerton N-AW-HMDS carrier, temperature 150-260°C (10 deg/min), carrier gas – helium (40 ml/min). The mixtures were separated by column chromatography on Silicagel L 40/100 sorbent. Adamantane-1-carboxylic acid was synthesized according to the procedure [23]. P_2S_5 from Aldrich.

Adamantane-1-thionecarboxylic acid methyl ester (2). *a*. 4.44 g of P_4S_{10} was added to a solution of 1.94 g of adamantane-1-carboxylic acid methyl ester (1) in 20 ml of anhydrous dimethoxyethane. The mixture was boiled with vigorous stirring for 6 hours. The solvent was evaporated in vacuum. The residue - yellow oil - was dissolved in hexane and washed 2 times with a 5% solution of sodium carbonate and water. After drying with sodium sulfate, the solvent was removed in vacuo. Yield 2.1 g of a mixture of compounds containing, according to GLC data, 10% compound (1), 66% compound (2), 24% unidentified compounds. The mixture of substances was passed through a chromatographic column and eluted with hexane. Yield of compound (2) 1.35 g (64%), retention time 792 s.

b. From 1.94 g of ether (1) in 20 ml of anhydrous dioxane, 2 g of a mixture of compounds was obtained, which, according to GLC data, consisted of 11% compound (1), 89% compound (2). After passing through a chromatographic column, the yield of compound (2) was 1.76 g (88%).

5-(1-Adamantyl)-1,3,4-thiadiazole (3) and 5-(1-adamantyl)-1,2,3-thiadiazole (4). A solution of diazomethane and diethyl ether obtained from 5.85 g of nitrosomethylurea was added to a solution of 2.1 g of thioneether (2) and 20 ml of methanol. The reaction mixture was left in the dark at room temperature for 48 hours. Then 100 ml of ether was added and washed with dilute hydrochloric acid. The organic layer was separated and dried over sodium sulfate. The solvent was removed in vacuo. A mixture of thiadiazoles in an amount of 2.1 g was passed through a chromatographic column, eluent: hexane-ether, 1:1. We obtained 1.25 g of thionester (2), 0.15 g (7%) of 5-(1-adamantyl)-1,3,4-thiadiazole (3), 0.7 g (32%) of 5-(1-adamantyl)-1,2 ,3-thiadiazole (4).

5-(1-Adamantyl)-5-methoxy-1,2,3-thiadiazoline (5) and 1-(1-adamantyl)-1-methoxyethylene (6). A solution of diazomethane in 50 ml of ether, prepared from 5.85 g of nitrosomethylurea, was added to a solution of 2.1 g of thioneether (2) in 20 ml of diethyl ether. The reaction mixture was left in the dark at room temperature for 48 hours. After washing with dilute hydrochloric acid, the ethereal solution was dried with sodium sulfate. The solvent was evaporated. A mixture of reaction products in an amount of 2.4 g was passed through a chromatographic column, eluent: hexane-diethyl ether 5:1. We obtained 0.5 g of a mixture of compounds containing, according to PMR data, 20% of compound (2), 80% of compound (6). Yield of compound (5) 0.55 g (22%).

1-(1-Adamantyl)-1-methoxyethylene (6) from 1-adamantylmethylketone. To a solution of 0.89 g of 1-adamantyl methyl ketone in 25 ml of anhydrous dioxane, 10.6 g of orthoformic ether and 0.1 g of *p*-toluenesulfonic acid were added and boiled for 4.5 hours. The solvent was evaporated in vacuum. The residue (0.96 g) was passed through a chromatographic column, eluent: hexane-diethyl ether 5:1. Yield of compound (6) 0.79 g (83%).

Decomposition of 5-(1-adamantyl)-5-methoxy-1,2,3-thiadiazoline (5). A solution of 0.1 g of compound (5) in 10 ml of a 1:1 mixture of methanol and diethyl ether was boiled for 3 hours. The solvent was evaporated. We obtained 0.09 g of a mixture of substances consisting, according to PMR data, of 75% compound (5) and 25% compound (6).

Reaction of adamantane-1-thionecarboxylic acid methyl ester (2) with hydroxylamine. 0.22 g of sodium metal was added to 30 ml of absolute methanol with ice cooling and stirring. After complete dissolution of sodium, 9.42 g of hydroxylamine hydrochloride was added to the solution. Then, a solution of 1.05 g of thionester (2) in methanol was added dropwise over 2 hours and stirred for another 1 hour. The solvent was evaporated in vacuum at 40°C. Water was added to the residue and acidified with dilute hydrochloric acid until neutral according to the universal indicator. The precipitate of **N-hydroxyiminomethyl ester of adamantane-1-carboxylic acid (8)** was filtered off, dried in air, and washed with pentane. Yield 0.3 g (29%). M. p. 130-132°C. NMR spectrum (δ, ppm): 1.5-2.0 (15H), 3.88 (3H), 8.62 (1H). IR spectrum (cm^{-1}): 1670 (C=N), 2800-3000 (CH), 3300 (OH). Found, %: C 69.11; H 9.17; N 6.80.$C_{12}H_{19}NO_2$. Calculated, %: C 69.20; H 9.19; N 6.73.

The aqueous filtrate was acidified with hydrochloric acid and extracted with diethyl ether. The extract was dried with sodium sulfate. The solvent was evaporated in vacuum. Yield of **1-adamantylisothiocyanate (7)** 0.3 g (71%). M. p. 165-167°C, avg. [14]: 166-168°C. IR spectrum (cm-1): 2100 (NCS), 2800-3000 (CH). Found, %: C 68.32; H 7.85; N 7.21. $C_{11}Y_{15}NS$. Calculated, %: C 68.34; H 7.82; N 7.24.

Hydrolysis of adamantane-1-carboxylic acid N-hydroxyiminomethyl ester (8). 20 ml of 10% Hydrochloric acid was added to 0.1 g of compound (8) and boiled for 2 hours. The precipitate that formed after cooling the reaction mass was filtered off and dried in air. Yield of adamantane-1-carboxylic acid (11) 0.09 g (quantitative). M. p.178-181ºC, average: [15] 180-181ºC. Data GLC, retention time, s: 540 (glass column 1000x3 mm, 5% Apiezon L, temperature 150-260°C, 15 deg/min, helium, 40 ml/min). IR spectrum (cm^{-1}): 1680 (C=O), 2800-3000 (CH), 3100 (OH). NMR spectrum (δ, ppm): 1.62 (6H), 1.93 (3H), 9.1 s (1H). Found, %: C 73.28; N 8.91. $C_{11}H_{16}O_2$. Calculated, %: C 73.30; H 8.95.

Reduction of N-hydrolsiiminomethyl ester of alamantane-1-carboxylic acid (8). To a suspension of 0.3 g of LiAlH4 in 20 ml of absolute diethyl ether, a solution of 0.25 g of compound (8) in 10 ml of ether was slowly added with cooling and stirring. Then boiled for 1 hour. 0.3 ml of water, 0.3 ml of a 15% KOH solution, and 0.9 ml of water were added sequentially to the reaction mass while cooled. The precipitate that formed was filtered off and washed with ether on the filter. The filtrate was dried with KOH. The solvent was evaporated. Yield of **1-adamantylmethylamine (10)** 0.16 g (82%). n_D^{20} 1.453. NMR spectrum (δ, ppm): 0.81 s (2H), 1.40 d (6H), 1.64 d (6H), 1.89 (3H), 2.18 s (2H). IR spectrum of amine hydrochloride (10) (cm-1): 2800-3000 (CH), 3050 (NH3+). Found, %: C 79.92; H 11.55; N 8.44. $C_{11}H_{19}N$. Calculated, %: C 79.94; H 11.59; N 8.47.

Reaction of adamantane-1-thionecarboxylic acid methyl ester (2) with O-methylhydroxylamine. *a*. 0.22 g of sodium metal was added to 30 ml of absolute methanol with ice cooling and stirring. After complete dissolution of sodium, 0.42 g of O-methylhydroxylamine hydrochloride was added to the solution. Then a solution of 1.05 g of ether (2) in 10 ml of methanol was added and boiled for 13 hours. The solvent was removed in vacuum. Water was added to the residue and acidified with dilute hydrochloric acid until neutral according to the universal indicator. Extracted with diethyl ether. The extract was dried with sodium sulfate, and the ether was evaporated in vacuum. The yield of the mixture of compounds is 0.8 g, according to GLC data, 52% compound (2), 48% compound (9). The mixture was washed several times with boiling pentane. The resulting precipitate of adamantane-1-carboxylic acid nitrile (9) was filtered off. Yield 0.37 g (46%). M. p. 190-193ºC, compare: [18] 193-196ºC (acetone). Retention time (GLC) 558 s. NMR spectrum (δ, ppm): 2.70 (6H), 2.90 (9H). IR spectrum (cm^{-1}): 2250 (CN), 2800-3000 (CH). Found, %: C 81.92; H 9.35; N 8.71. $C_{11}H_{15}N$. Calculated, %: C 81.94; H 9.38; N 8.69.

b. Similar to experiment *a*, 0.84 g of O-methylhydroxylamine hydrochloride was added to a solution of sodium methoxide (from 0.44 g of Na). We obtained 0.85 g of a mixture of compounds, consisting, according to GLC data, of 9% compound (2) and 91% compound (9).

Reaction of adamantane-1-thionecarboxylic acid methyl ester (2) with piperidine. *a*. 40 ml of piperidine was added to 1.05 g of ether (2) and boiled for 6 hours. Piperidine was removed in vacuo with the addition of toluene. The residue was dissolved in methanol and boiled with activated carbon. The solution after filtering was evaporated. Yield of adamantane-1-carboxylic acid N-piperidylamide (15) 0.93 g (75%).

b. 40 ml of piperidine was added to 1.05 g of ether (2), boiled for 0.5 h, and treated as indicated above. We obtained 1.7 g of a mixture of substances containing, according to the PMR spectrum, 29% thiol ester (12), 57% piperidinium salt (13), 14% thione ester (2).

Piperidinium salt of adamantane-1-thiolcarboxylic acid (13). 4 ml of absolute acetone was added to the mixture of substances obtained by method *b*. The resulting precipitate was filtered off. Salt yield (13) 0.97 g (69%).

Adamantane-1-thiolcarboxylic acid methyl ester (12). The acetone solution, after isolating salt (13), was evaporated in vacuum. We obtained 0.73 g of residue. Thiol ester (12) was isolated using column chromatography on silica gel, eluent: hexane-ether 5:1 (R_f 0.8). Yield 0.12 g (12%).

Adamantane-1-thiolcarboxylic acid (16). 0.3 g of piperidinium salt of adamantane-1-thiolcarboxylic acid (13) was dissolved in 3 ml of distilled water and acidified with hydrochloric acid. The precipitate that formed was filtered off. Yield 0.21 g (quantitative).

Thermolysis of piperidinium salt of adamantane-1-thiolcarboxylic acid (13) in piperidine. 20 ml of piperidine was added to 0.2 g of salt (13) and boiled for 6 hours. Piperidine was removed in vacuo with the addition of toluene. Yield of N-piperidylamide adamantane-1-carboxylic acid (15) 0.17 g (quantitative).

Thermolysis of piperidinium salt of adamantane-1-thiolcarboxylic acid (13) in N-methylpiperidine was carried out similarly. Yield of N-piperidylamide adamantane-1-carboxylic acid (15) 0.17 g (quantitative).

Detection of N-methylpiperidine in the reaction products of adamanthanthione carboxylic acid methyl ester (2) with piperidine. 10 ml of piperidine was added to 0.5 g of thioether (2) and boiled for 0.5 h. The solvent was distilled off at atmospheric pressure, and the residue was washed with acetone. The precipitate that formed was filtered off. We obtained 0.4 g of salt (13). The distillation was analyzed by GLC: piperidine 98.27% (τ 306 s), N-methylpiperidine 1.73%. The content of N-methylpiperidine in the distillate corresponds to the formation of 0.42 g of salt (13).

Interaction of adamantane-1-thiolcarboxylic acid methyl ester (12) with piperidine. To 0.06 g of ether (12) 5 ml of piperidine was added and boiled for 4.5 hours. Piperidine was removed by adding toluene in a vacuum. Yield of the mixture of substances is 0.1 g. PMR spectrum data: 61% thioleether (12), 21% salt (13), 18% amide (15).

Interaction of methyl ester of adamantane-1-thionecarboxylic acid (2) with piperidine at different ratios of ester (2) - piperidine. 0.1 g of ether (2) was added to 6 reactors and piperidine was added according to table 3. Boiled for 0.5 hours. Piperidine was removed with the addition of toluene. The residue was analyzed by NMR. The ratio of reaction products is presented in table 3.

Piperidinium salt of adamantane-1-carboxylic acid (17). 30 ml of toluene and 10 ml of piperidine were added to 1.8 g of adamantane-1-carboxylic acid. The solution was left for 24 hours at room temperature. The solvent was distilled off in vacuum. Salt yield (17) 2.65 g (quantitative).

Adamantane-1-carboxylic acid N-piperidylamide (15). To 30 ml of piperidine, while cooling with ice and stirring, 3.97 g of adamantane-1-carboxylic acid chloride was added in portions. Left it overnight. Piperidine was removed in vacuo. 50 ml of 10% hydrochloric acid was added to the residue. The resulting precipitate was filtered off, washed with water, dissolved in 50 ml of methanol and boiled with activated solution. After filtration, the solvent was removed in vacuo. Yield 4.3 g (86%).

Discussion of results.

Usually thionesters are synthesized by the action of esters of carboxylic acids with phosphorus pentasulfide [3, 4]. To do this, use inert, dehydrated solvents such as diethyl ester, benzene, toluene. However, their use failed to obtain the target reaction product (2). During the reaction in dimethoxyethane or dioxane, the highest yield of thionester (2) was achieved by adding 1.5-fold molar excess of P_2S_5 in portions to a solution of boiling adamantane-1-carboxylic acid methyl ester (1) in 6 hours. In dimethoxyethane, the yield did not rise above 69%. In dioxane the yield was 89% in the complete absence of by-products of the reaction.

The reaction was monitored by GC. Thionester (2) was isolated by column chromatography on silica gel. In the IR spectrum of compound (2) there is an absorption band at 1250 cm-1, which corresponds to the valence fluctuations of the C = S bond, and in the PMR spectrum in the region of 3.88 ppm. there is a singlet of protons of the methyl group, shifted by 0.4 ppm in a weak field relative to the original ester (1).

Among the most important chemical properties of thioncarboxylic acid esters are their reactions with diazomethane, which lead to thiazoles and thiadiazolines [5, 6-8], interaction with primary amines, which leads to loss of sulfur function [5] or in the case of hydroxylamine - to thiohydroxy acids [9], reactions with secondary amines, which result in the formation of thioamides [5, 10].

The reaction of the methyl ester of adamantane-1-thioncarboxylic acid (II) with diazomethane was carried out in ether-methanol solution at room temperature according to the method described in [6]. 5-(1-Adamantyl)-1,3,4-thiadiazole (3) and 5-(1-adamantyl)-1,2,3-thiadiazole (4) were formed. The reaction products were isolated by column chromatography on silica gel with yields of 32 and 7%, respectively. Characteristic signals [5, 6] of protons of the group = CH- at 8.25 ppm were observed in the PMR spectra of the synthesized compounds. for 1,2,3-thiadiazole (4) and 8.87 ppm for 1,3,4-thiadiazole (3). The shift of the proton signal in the latter case to a weak field is explained, apparently, by the presence of two adjacent heteroatoms (Table 1).

Intermediates in the synthesis of thiadiazoles are thiadiazolines [7]. One of the isomeric thiadiazolines we were able to obtain by reacting thionester (2) with diazomethane in diethyl ether. With a yield of 22%, 5-(1-adamantyl)-5-methoxy-1,2,3-thiadiazoline (5) was isolated, in the PMR spectrum of which methoxyl proton signals (2.81 ppm, singlet) and methylene proton signals were observed. groups at 4.37 and 5.0 ppm, J 20 Hz (Table 1). However, it remained unclear which of the two isomeric thiadiazolines corresponds to the reaction product. This was determined by the decomposition of thiadiazoline (5) in boiling methanol. The formation of 1,2,3-thiadiazole (4) (according to the PMR spectrum) indicates that the parent compound has the structure of 1,2,3-thiadiazoline (5).

As a by-product of the reaction with diazomethane, 1-(1-adamantyl)-1-methoxyethylene (6) is formed, which was isolated only in a mixture with the starting thionester (2). In the PMR spectrum of the mixture, along with the signals corresponding to the initial ester (2), a singlet of protons of the methoxyl group and two doublets at 3.50 and 3.56 ppm, J 2Hz are observed.

The counter-synthesis of compound (6) from 1-adamantylmethyl ketone and orthomuracin ester of the method [11] confirmed the structure of the reaction product.

By analogy with known examples [9], the interaction of thionester (2) with hydroxylamine should form adamantane-1-thionehydroxamic acid. However, the main product of this reaction in methanolic sodium methylate solution was isolated with 71% yield of 1-adamantyl isothiocyanate (7). This is clearly evidenced by the data of the IR spectrum, in which there is a characteristic absorption band at 2100 cm-1, as well as the coincidence of the melting temperature with that indicated in the literature [12].

Table 1

Properties of thionester (2) and products of its interaction with diazomethane

№ Comp.	Yield, %	M.p., °C or n_D^{20}	R_f (eluent)	Spectrum PMR, δ, ppm	IR spectrum, cm^{-1}
2	88	1.5182	0.9(гексан	1.63 (6H), 1.88(9H),	1250, 2800-3000
				3.88(3H)	2800-3000
3	7	34-36	0.4(гексан	1.5-2.25 (15H), 8.25	
4	32	137-139	0.75(гексан	(1H)	2800-3000
5	22	78-79	-етер)	1.5-2.25(15H),8.87	
6	83[a]	(пентан)	0.5(гексан	(1H)	2800-3000
		1.4983	-етер)	1.25-2.0(15H),2.81	
			0.9(гексан	(3H), 4.37(1H, *J* 20Гц), 5.0(1H, *J*	
			-етер)	20Гц)	1210, 1700,
				1.31-2.0(15H),3.31	2800-3000
				(3H), 3.5(1H, *J* 2 Гц), 3.56(1H, *J* 2 Гц)	

Note. [a] The yield is indicated in the counter-synthesis.

The second reaction product, which was isolated in 29% yield after acidification of the reaction mass, was N-oxyiminomethyl ester of adamantane-1-carboxylic acid (8). In the IR sector of compound (8) there is an absorption band C = N (1670 cm-1), and in the PMR spectrum at 3.88 ppm. and 3.95 ppm - singlets of protons of methyl and hydroxyl groups, respectively.

An additional proof of the structure of the ester (8) is its quantitative conversion under acid hydrolysis to adamantane-1-carboxylic acid (9) [13]. At the same time, reduction of ester (8) with lithium aluminum hydride leads to 1-adamantylmethylamine (10) [14].

Thus, if the N-hydroxyiminoester (8) is a common reaction product, the migration of the hydrocarbon radical to the nitrogen atom, which leads to isothiocyanate (7), was observed by us in similar transformations for the first time.

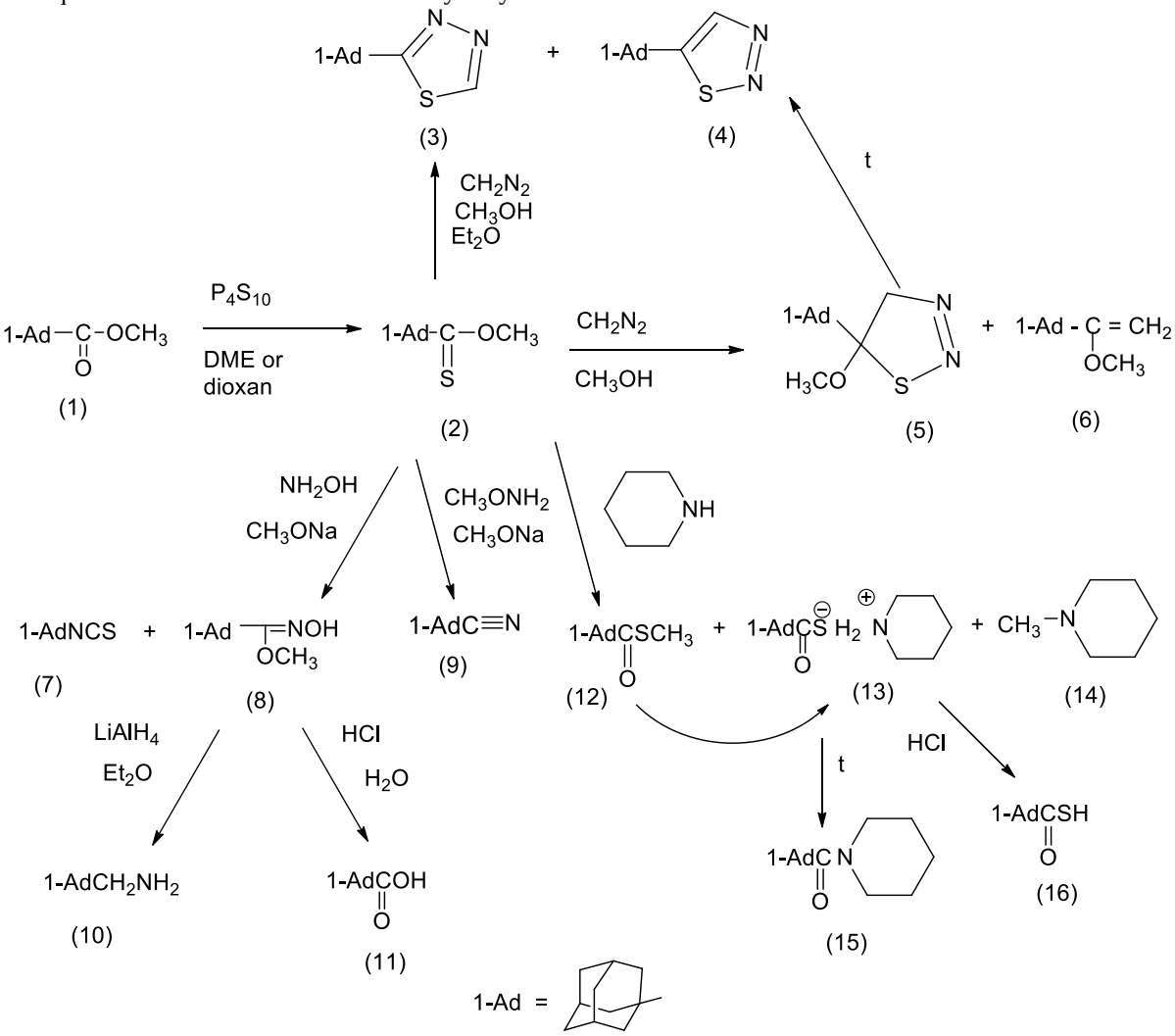

Figure 1. General synthesis scheme

The interaction between hydroxylamine and thionester (2), apparently, takes place by the mechanism of attachment of nitrogenous bases to the carbonyl or thiocarbonyl group under alkaline catalysis, thus forming an adduct (A). Sodium hydrosulfide cleavage is sufficient to convert the latter to the iminoester (8). In turn, the elimination of the methanol molecule should lead to thiohydroxamic acid (B). In an alkaline environment, it will exist as a salt, in the molecule of which the excess electron density is distributed between four atoms. It is logical to assume that devoid of stabilizing effects, for example, aryl substituent [9], salt (B) by cleavage of sodium hydroxide and rearrangement of the Lossen type forms isothiocyanate (7). It remained unclear which of the two hydrogen atoms (hydroxyl or amine) is involved in the elimination of NaSH. To answer this question, we reacted thionester (2) with O-methylhydroxylamine under the same conditions. As a result, the only reaction product was isolated - 1-adamantylcyanide (9).

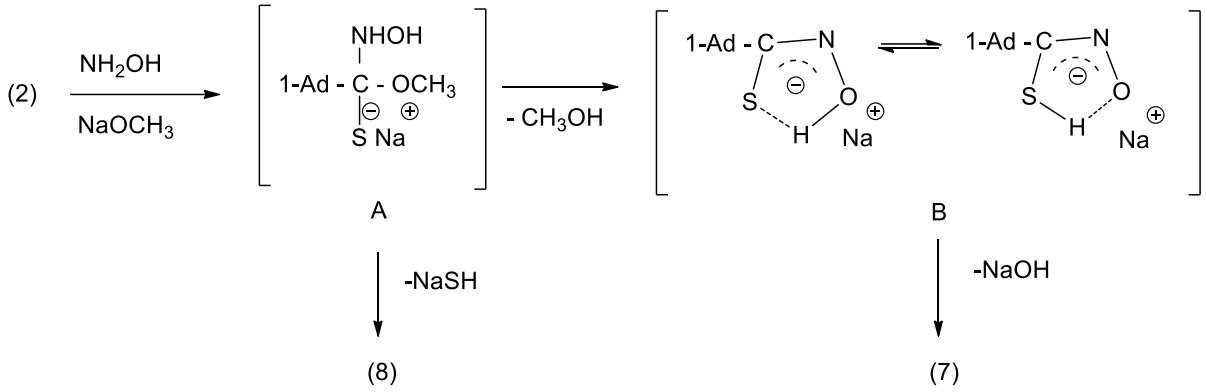

Figure 2. The mechanism of formation of products (7) and (8).

The synthesis was performed under conditions of prolonged boiling of the reaction mass and controlled by GC. Moreover, depending on the ratio of substrate-reagent (1: 1 or 1: 2) nitrile (9) was obtained with a yield of 49 and 91%, respectively. In the IR spectrum of compound (9), a valence band of the C≡N group is observed at 2250 cm-1. The melting temperature, IR spectrum data and retention time in GC coincided with similar parameters for the nitrile obtained from adamantane-1-carboxylic acid amide by a known method [15].

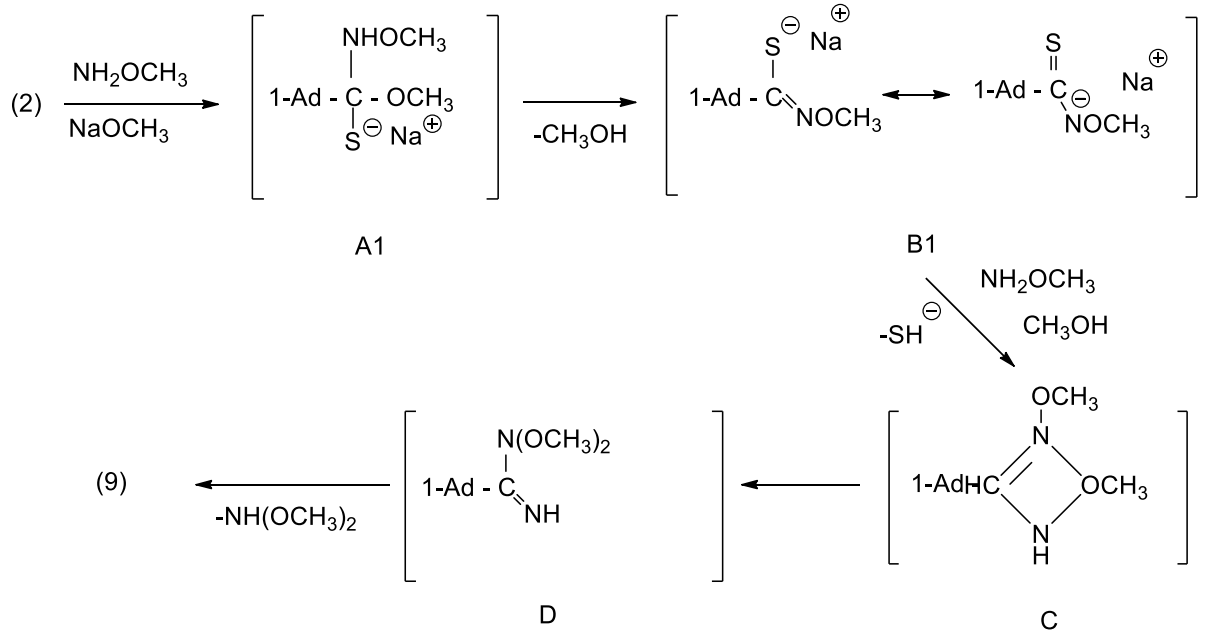

Figure 3. The mechanism of formation of product (9)

The first stage of the reaction is apparently the same as with hydroxylamine, and proceeds with the formation of an adduct (A1). The absence of iminoester reaction products indicates that the corresponding direction of reaction is excluded due to the substitution of hydroxyl hydrogen on the methyl group. Then the only possible direction of decomposition of intermediate (A1) is the elimination of methanol and the formation of methyl ester of thionhydroxamic acid (B1). The latter has the possibility of conversion to isothiocyanate, but the lack of promotion of sulfur to the cleavage of methoxyl in the ester (B1), as is the case in intermediate (B), prevents this reaction. In this case, it is possible to interact with the second molecule of O-methylhydroxylamine by one of the variants of the mechanism known for imidoyl halides and related compounds [16], which, apparently, is realized by conversion to amidine (C). The formation of nitrile (9) in the reaction under consideration shows that the substrate in one of the stages must be reduced. O-methylhydroxylamine should preferably be oxidized. One of the variants of this redox process is a scheme proposed for the conversion of amidine (C) to amidine (D), which is implemented by the type of intramolecular nucleophilic attack on the nitrogen atom [17]. The oxidation product of O-methylhydroxylamine - dimethoxyamine - must be cleaved from intermediate (D). However, without isolating this amine or evidence of its formation, this scheme remains imaginary.

By analogy with the literature [5, 10], the interaction of thionester (2) with secondary amines should lead to the formation of substituted thioamides. However, the first experiments on the interaction of thionester (2) with anhydrous piperidine, taken in large excess, showed the complete absence of N-piperidylamide adamantane-1-thionecarboxylic acid in the reaction products. Instead, after 6 hours of boiling in

amine with a yield of 75% was isolated N-piperidylamide adamantane-1-carboxylic acid (15). In the PMR spectrum of amide (15) in the region of 3.48 ppm there is a multiplet of four protons in the α-position to the nitrogen atom of the piperidine ring. Valence oscillations of the carbonyl group in the IR spectrum are observed in the region of 1610 cm-1. In addition to the spectral characteristics, the melting temperature also coincides with the characteristics of the sample of amide synthesized from adamantane-1-carboxylic acid chloride (table 2).

This unexpected result of the reaction suggests the formation of an intermediate, the decomposition of which leads to the amide (15). We tried to isolate this compound by reducing the synthesis time to 30 minutes. As a result, with a yield of 69%, a water-soluble crystalline compound was isolated, in the PMR spectrum of which proton signals in the range of 9.05 and 3.3.0 ppm are observed. In the IR spectrum, in addition to the valence vibrations of the carbonyl group at 1500 cm^{-1}, which fall into the region of valence vibrations of the C = O group in carboxylate anions [18], an intense band 2200-2700 cm^{-1} was observed, which corresponds to NH valence vibrations in compounds of type RNH2 + (table 2). These data suggest that the isolated compound is a piperidine salt of either adamantane-1-carboxylic acid (17) or adamantane-1-thiolcarboxylic acid (13). The choice in favor of compound (13) was made on the basis of comparison of IR and PMR spectra (table 2) of salts (13) and (17). The latter was obtained from adamantane-1-carboxylic acid.

Table 2

Properties of the reaction products of thionester (2) with piperidine

№ Comp.	Yield %	M.p.,°C or n^{20}_D	Spectrum PMR, δ, ppm	IR spectrum, cm^{-1}
12	12	1.5286	1.63 (6H), 1.78 (6H), 1.93 (3H), 2.08 (3H)	1600, 2800-3000
13	69	187 (разл.)	1.83-1.58 (21H), 3.0 (4H), 9.05 (2H)	1500, 2200-2700, 2800-3000
15	86	86-87	1.55 (6H), 1.7 (6H), 1.93 (3H) 3.48 (4H)	1605, 2800-3000
16	100	138-140	1.6 (6H), 1.78 (6H), 1.93 (3H), 3.85 (1H)	1680, 2500, 2800-3000
17	100	210 (разл.)	1.60-1.80 (21H), 2.93 (4H), 9.95 (2H)	-

In addition, the acidification of the aqueous salt solution (13) isolated adamantane-1-thiolcarboxylic acid (16), the structure of which was confirmed by IR and PMR spectra (table 2). Prolonged boiling of the salt (13) in the piperidine revealed that the amide (15) is indeed the product of its decomposition.

The second compound formed in the reaction under study, adamantane-1-thiolcarboxylic acid methyl ester (12), was also isolated by column chromatography (yield 31%). Its IR spectrum contains the absorption band of the C = O (1660 cm-1) bond, and the PMR spectrum contains a singlet at 2.08 ppm. (3H), shifted to a strong field compared to esters (1) and (2) by 1.4 and 1.8 ppm, respectively (table 2).

If the thermal rearrangement of thionesters to thiolesters is described in the literature [19, 20], the formation of the thiolcarboxylic acid salt was observed by us for the first time. There should be a rupture of the O – CH3 or S – CH3 bond and migration of the CH3 group, and its only acceptor may be piperidine. In other words, the process of salt formation (13) must be accompanied by N-alkylation of piperidine. In the piperidine removed from the reaction mass, N-methylpiperidine was indeed detected by GC (14). Its content in the distillation was equivalent to the amount of salt (13) formed.

Table 3

The effect of excess piperidine on the ratio of salt (13) - thiorester (12) [a]

Excess piperidine relative to the thionester (2), mol	Correlation salt (13) - thiolester (12)
20	3.34
40	2.94
80	2.90
160	2.82
320	2.67
640	2.33

Note. [a]The reaction time is 30 minutes. The data were obtained by integrating the PMR spectrum. The intensities of the corresponding signals of the salt protons (13) and the amide (15) were added.

Thiolester (12), like thionester (2), is converted to salt (13) under the reaction conditions, although much more slowly (Table 3). This indicates in favor of the fact that thiolester (12) and salt (13) are formed by parallel reactions with thionester (2).

Conclusions.

The study of adamantane-1-carboxylic acid and its derivatives showed that this compound has significant potential for further research in various fields of chemistry and science in general. Adamantane-1-carboxylic acid is characterized by high structural stability and can be used during the synthesis of various derivatives, for example, esters, amides, and other substances, which opens wide prospects in organic synthesis and some industrial fields. Using the example of the synthesis of methyl ester of adamantane-1-thioncarboxylic acid from P2S5, the importance of this method can be emphasized. First, the use of phosphorus pentasulfide as a reagent contributes to a high yield of the product under moderate reaction conditions. Such conditions preserve

the properties and structure of the initial acid, which has an impact on further applications of the obtained product. Secondly, the use of dimethoxyethane or dioxane as a reaction medium allows for good solubility of the reactants and the product, which facilitates the reaction and subsequent purification of the obtained ether. In addition, these reaction media are safe and quite affordable. Thirdly, the synthesis occurs with a high product yield, which indicates the effectiveness and reliability of this method. High product yield is an important factor in large-scale production and in the development of new synthesis approaches.

Analysis of the derived products of methyl ester of adamantane-1-thionecarboxylic acid reveals interesting possibilities and properties of this compound. The structural analysis of the products is confirmed spectrally. The stability of the obtained substances is important for their future use in methods of obtaining biologically active compounds and medicines. According to the fact that the biological activity of adamantane-1-carboxylic acid has promising potential medical applications, the research of its derivatives in the field of medicine and pharmaceuticals may be relevant for further research.

References

1. Velichko, E.V., Golichenko, A.A., Neykovsky, S.I., Shtemenko, A.V. 2014. The synthesis of cis-tetrachlorodi-μ-carboxylate of dirhenium(III) with 3-acetilamino-1-adamantanecarboxylic acid. Bulletin of Odesa National University. Chemistry, 3(17), 5-12. https://doi.org/10.18524/2304-0947.2012.3(43).31915

2. Shtemenko, A.V., Golichenko, A.A., Domasevitch, K.V. 2001. Synthesis of novel tetracarboxylato dirhenium(III) compounds and crystal structure of $[Re_2(1\text{-adamantylcarboxylate})_4Cl_2]$ 4 $CHCl_3$. Zeitschrift für Naturforschung B, 56(4-5), 381-385. https://doi.org/10.1515/znb-2001-4-510

3. Shtemenko, N., Polokhina, K., Golichenko, A., Babiy, S., Shtemenko, A. 2020. Determination of the anticancer properties of cis- and trans-diadamanthylcarboxylates of dirhenium(III). ScienceRise: Biological Science, 4(25), 8-12. https://doi.org/10.15587/2519-8025.2020.217554

4. Shtemenko, A., Tretiak, S, Golichenko, A. 2007. Interaction of quadruple bonding rhenium unit with free radicals. Chemistry Journal of Moldova, 1(2), 93-97. https://dx.doi.org/10.19261/cjm.2007.02(1).08

5. Antoniuk, I. 2016. Elaboration of hierarchical host-guest nanoparticles. https://theses.hal.science/tel-01459138

6. Pham, V.H., Tran, T.H., Vu, B.D., Le, B.H., Nguyen, H.T., Phan D.C. 2020. A simple process for the synthesis of 1-aminoadamantane hydrochloride. Organic Preparations and Procedures International, 52(1), 77-80. https://doi.org/10.1080/00304948.2019.1697618

7. Santiago-Sosa, O., Camarillo, E.A., García-Pineda, S., Solano-Altamirano, J.M., Hernández-Pérez, J.M., Flores, H., Rodríguez-Santiago, J., Hernández-Esparza, R. 2023. Phase change enthalpies of some monosubstituted derivatives of adamantane: An experimental and theoretical study. Structural Chemistry, 34, 193-202. https://doi.org/10.1007/s11224-022-02073-0

8. Soselia, M., Lomidze, M., Tabatadze, T., Zurabishvili, D., Trapaidze, M., Samsoniya, S. 2020. Synthesis of novel N-(R)-2-(1-adamantyl)-1H-benzimidazole-5(6)-carboxamide, carbohydrazide and 1,3,4-oxadiazole derivatives. Letters in Organic Chemistry, 18(6), 490-499. https://doi.org/10.2174/1570178617999200812134408

9. Lee, D.H., An, J., Oh, J., Park, I.H. 2023. Zinc(II) and copper(II) complexes of 4-styrylpyridine and 1-adamantanecarboxylic acid: Syntheses, crystal structures, and photopolymerization. Crystals, 13(8), 1226. https://doi.org/10.3390/cryst13081226

10. Wang, J.W., Yu, K.X., Ji, X.Y., Bai, H., Zhang, W.H., Hu, X., Tang, G. 2021. Structural insights into the host-guest complexation between β-cyclodextrin and bio-conjugatable adamantane derivatives. Molecules, 26(9):2412. https://doi.org/10.3390/molecules26092412

11. Ji, Q.T., Mu, X.F., Hu, D.K., Fan, L.J., Xiang S.Z., Ye, H.J., Gao, X.H., Wang, P.Y. 2022. Fabrication of host-guest complexes between adamantane-functionalized 1,3,4-oxadiazoles and β-cyclodextrin with improved control efficiency against intractable plant bacterial diseases. ACS Applied Materials & Interfaces, 14(2), 2564-2577. https://doi.org/10.1021/acsami.1c19758

12. Yoshiyuki, H., Kaito, S., Mitsuhiro, S. 2023. Self-healing photocured methacrylic resins utilizing host-guest interactions of cyclodextrin and adamantane. European Polymer Journal, 196, 112244. https://doi.org/10.1016/j.eurpolymj.2023.112244

13. Prajapati S., Sinha P., Suryavanshi K., Jana S. 2022. Recognition of monocarboxylic acids by imidazole containing receptors. Journal of Physical Organic Chemistry, 35(9), e4397. https://doi.org/10.1002/poc.4397

14. Slyusarchuk, V., Kruger, P., Hawes, Ch. 2020. Cyclic aliphatic hydrocarbons as linkers in metal-organic frameworks: new frontiers for ligand design. ChemPlusChem, 85(5), 845-854. https://doi.org/10.1002/cplu.202000206

15. Colliere, V., Verelst, M., Lecante, P., Axet, M.R. 2023. Colloidal ruthenium catalysts for selective quinaldine hydrogenation: Ligand and solvent effects. Chemistry – A European Journal, 30(13), e202302131. https://doi.org/10.1002/chem.202302131

16. Wang, S., Chen, L., Wu, C. 2023. SupEnzyme: Combining enzymes with supramolecules for recyclable catalysis. Colloids and Surfaces A: Physicochemical and Engineering Aspects, 672, 131719. https://doi.org/10.1016/j.colsurfa.2023.131719

17. Jaros, S.W., Florek, M., Bażanów, B., Panek, J., Krogul-Sobczak, A., Oliveira, M., Król, J., Śliwińska-Hill, U., Nesterov, D., Kirillov, A., Smoleński, P. 2024. Silver coordination polymers driven by adamantoid blocks for advanced antiviral and antibacterial biomaterials. ACS Applied Materials & Interfaces Article ASAP, 16(11), 13411-13421. https://doi.org/10.1021/acsami.3c15606

18. Shahinda, A., Shichun, L., Payne, A., Bishai, W., Gunosewoyo, H. 2020. Design, synthesis and antimycobacterial evaluation of novel adamantane and adamantanol analogues effective against drug-resistant tuberculosis. Bioorganic Chemistry, 106, 104486. https://doi.org/10.1016/j.bioorg.2020.104486

19. Todorov, P., Georgieva, S., Staneva, D., Peneva, P., Grozdanov, P., Nikolova, I., Vasileva-Tonkova, E., Grabchev, I. 2022. Study of novel peptides for antimicrobial protection in solution and on cotton fabric. Molecules, 27(15), 4770. https://doi.org/10.3390/molecules27154770

20. Wu, G., Jiao, T., Li, H. 2023. Self-assembly of a purely organic bowl in water via acylhydrazone formation. Molecules, 28(3), 976. https://doi.org/10.3390/molecules28030976

21. Пат. 3962328 (1976). США // С.А. 1977. Vol. 86. №7. 43297.

22. Пат. 523274 (1972). Швейцарія // РЖХим. 1973. 2Н281П.

23. Beiler J.M., Lecadet P., Paquer D., Thuillier A., Viall J. // Bull. Soc. chim. 1973. N 9. P.1979-1985.

24. Scheeren J.W., Voms P.H.J., Nivard R.J.F. // Synthesis. 1973. N 2. P. 149-162.

25. Trebaul C., Teste J. // Bull. Soc. chim. 1970. N 10. P. 2272-2277.

26. Raap R. // Canad. J. Chem. 1968. Vol. 46. N 10. P. 2255-2263.

27. Beiler J.M., Lecadet P., Paquer D., Thuillier A., Viall J. // Bull. Soc. chim. 1973. N 9. P.1979-1985.

28. Schmidt U., Heymann E., Kabitzke K. // Chem. Ber. 1963. Bd 96. N 8. S.1478-1487.

29. Schmeithauer S., Mayer R. // Chem. Ber. 1967. Bd 100. N 8. S. 1428-1436.

30. Пат. 6827842 (1962). Японія // С.А. 1969. Vol. 70. 57472.

31. Tao N.S., Scheithauer S., Mayer R. // Z. Chem. 1972. Bd 12. N 1. S. 133-140.

32. Общая органическая химия. М.: Химия, 1982. Т. 2. С. 584.

33. Пат. 3203970 (1965). США // РЖХим. 24Н208.

34. Stetter H., Schwarz M. // Chem. Ber. 1959. Bd 92. N 9. S. 1629-1635.

35. Бирзниекс К.А. Синтез и изучение свойств аминов ряда адамантана // Дисс. ... канд. хим. наук. Волгоград, 1988. 120 с.

36. Общая органическая химия. М.: Химия, 1982. Т. 3. С. 658.

37. Общая органическая химия. М.: Химия, 1982. Т. 3. С. 593.

38. Grayston M.W., Liemal D.M. // J. Am. Chem. Soc 1976. Vol. 98. N 8. P. 1278-1287.

39. Браун Д., Флойд А., Суйнзбери М. // Спектроскопия органических веществ. М.: Мир, 1992. С. 72.

40. Smith S.G. // J. Am. Chem. Soc. 1961. Vol. 83. N 4. P. 4285-4297.

41. Smith S.G. // Tetrahedron Lett. 1962. N 25. P. 979-981.

ECONOMIC SCIENCES

THE ROLE OF SYMBOLS IN INTERNATIONAL ECONOMIC RELATIONS AND BUSINESS CULTURAL ENVIRONMENT

Mykhaylyna D.
PhD, Associate Professor of International Economics Department,
Yuriy Fedkovych Chernivtsi National University
ORCID: https://orcid.org/0000-0002-3430-784X
ResearcherID: D-2655-2016
DOI: 10.5281/zenodo.12059673

Abstract

Along with other aspects of the cultural environment, the understanding and interpretation of symbols are of key importance in international economic relations and business communication. In the context of modern processes of digitization and overloaded flow of compact informative items, graphic symbols have gained special importance. Their significance and diversification in fact correlate with the civilizational development of mankind. Appearing as a cultural artifact, they are able to unite people across time, countries and continents, performing an anthropological, metalinguistic, communicative function. At the same time, a special role in the cultural and communicative sphere of modern international business is played by globally standardized and generally accepted categories of symbols, which include Universal Coded Character Set (UCS) ISO / IEC 10646, Unicode, emojis, flags and emblems of countries and cities, currency symbols and commercial logotypes. Due to their simple and accessible forms, they are perceived intuitively, appealing to the human subconscious and forming a universal language that is understood by people from all over the world. Forming a global symbolic system of visual images and a common semantic foundation, graphic symbols are able to be better remembered, accelerate the transmission of messages, broadcast the same meanings, knowledge, ideas, feelings, emotions, ideas and values within the planetary cultural-communicative space.

Keywords: cross-cultural communication, cultural environment, globalization, graphic symbols, international economic relations, international business, symbolism.

Introduction

In the context of global interdependence deepening and national economies intertwining, the importance of a particular country or region cultural environment is also increasing. This is especially noticeable in the field of international economic relations and business, since, operating in different countries of the world, companies face diverse cultural contexts, which requires the so-called "cultural sensitivity and tolerance" [6, p. 101].

A large number of modern experts focus attention on issues of cross-cultural management, empathetic leadership, cultural intelligence, diversity and inclusion, which along with questions of gender, race and ethnicity now include different aspects of a person such as diverse religious and political beliefs, education, socioeconomic background, sexual orientation, personality, ability, personal characteristics and stages of life, cultural background and even disabilities [7, 12]. Among international companies that have successfully implemented such a concept of cultural diversity and inclusion, Nike, P&G, Coca-Cola, and McDonald's are known in particular [7, 26]. A Boston Consulting Group study found that companies with more diverse management teams have 19% higher revenues due to innovation [17]. McKinsey research revealed that companies that manage culture effectively in their integration planning are around 50% more likely to capture cost and revenue synergies [23]. Global collaboration has become a significant aspect for businesses success and this cannot occur if businesses do not have the resources, knowledge, and talents of cultural intelligence [26].

And this concerns competent cultural interaction both with employees and with consumers, potential partners, suppliers, stakeholders from different countries, primarily in the context of diplomacy, management and communication. This requires a deep awareness of a whole range of cultural features, nuances and details, including the perception and interpretation of symbols.

The importance of culture as a factor of international business environment is particularly meaningful in the context of its complexity, invisibility and significant impact on another environmental areas. In particular, as emphasized by D. C. Thomas and M. F. Peterson, "the economic, legal, and political characteristics of a country are a manifestation of a nation's culture" [24]. There are many interpretations of the term "culture", for example, G. P. Ferraro defines it as "everything that people have, think, and do as members of their society" [8]; G. Hofstede as "collective programming of the mind" or "a system of values" [10]; J. W. Berry, Y. H. Poortinga, M. H. Segall, P. R. Dasen as "the shared way of life of a group of people" [5], A. Phillips as "an accumulation of the beliefs, traditions, language and values of a particular group of people" [21].

At the same time, religion, language, education, material culture, social institutions, aesthetics [5, 6, 9, 11, 24, 25] are the most common elements of the study of international business cultural environment. However, the perception and interpretation of symbols is an equally important category for understanding the specifics of the cultural environment of a particular country or society. As stressed by C. Kluckhohn, "culture

consists in patterned ways of thinking, feeling, and reacting, acquired and transmitted mainly by symbols, constituting the distinctive achievements of human groups, including their embodiment in artifacts" [16].

Analysis of recent research and publications

The importance of culture is widely disclosed in many educational and scientific publications, covering the issue of its role as a component of international business environment, cross-cultural management and psychology, as a principle of building effective cross-cultural teams and workplaces and prevent conflicts, including the works of such authors as G. Hofstede, E. Meyer, G. P. Ferraro, L. Ting, A. J. Ali, L. Yan, R. Holcomb, D. C. Thomas, M. F. Peterson, J. W. Berry, Y. H. Poortinga, M. H. Segall, P. R. Dasen, Y. Yehia, et al.

The discovering of the meaning of symbols as a component of culture and psychology was reflected in many scientists' researches, including the interpretation of archetypes as a collective unconscious by C. G. Jung, the identification of the role of visual and other symbols in the cultural humanity space by R. Addams, O. Boyko, T. I. Kireeva, O. G. Kireeva, M. Manolache, A. Phillips, V. Pylypiv, etc.

The purpose of the study is to identify the role of symbols (especially graphic symbols) in the cultural environment of modern international economic relations and business communication.

Results

As a research object symbol is of interdisciplinary significance, being at the intersection of such fields as history, philosophy, art, cultural studies, psychology, linguistics, semiotics, economics, etc. From the economics point of view, in particular in the context of international economic relations and business, they are primarily the object of the socio-cultural environment research. Some authors claim that "symbols are the basis of culture" [22] and are "called to create and communicate values and traditions to the cultural group" [21], to "express specific ideologies and social standards of the culture that are communicated amongst the group, reflecting the values, beliefs, and identity of a society" [18]. A symbol may be defined as "a universal phenomenon that expresses, preserves, and transmits ideas and values that are essential for the development and functioning of culture in a sensory-receptive form" [3].

In general, symbols are a broad category and can include such concepts as objects, colors, shapes, marks, drawings, gestures, actions, words, sounds or signs that stand for certain meanings, which mostly perform a cultural and communicative function. We all communicate with each other appealing to the symbols (words, gestures, texts, sounds, signs, actions). In the general sense, a symbol is a conventional sign, a universally recognizable aesthetic feature. The structure of the symbol (object image and deep meaning) "is aimed at recreating a complete image of the world through a separate phenomenon" [15]. It is everything that conveys meaning and causes the same social reaction.

In terms of their functionality and structure, symbols are an extremely complex phenomenon, dialectically combining material and immaterial, concrete and abstract, individual and general, obvious and hidden. Symbolism has a wide interpretive and creative function, generating subjective images of objective reality. Symbols are able to provide a meaningful way of expressing not only knowledge and ideas, but also "feelings, intuitive insights, mystical experience, they are able to influence both rational reflection and the sensory-emotional level" [3]. A symbol is both an image and a sign. Linguistic signs (sign system) and non-linguistic signs (copy signs, symbols) are distinguished. Signs and symbols are something concrete (object, image), something that has its own particular meaning and, at the same time, reflects something general, abstract (concept, idea, hypothesis, concept). Signs and symbols embody a visual image and are used "to reveal the most significant, ancient meaning, for example, the ancient Greek theatrical mask as a symbol of modern stage art" [15].

In general, next types of symbols can be distinguished:

- verbal - words, sounds, language and speech;
- non-verbal - gestures, eye contact, tactile communication, para-language (tone, speed, emphasis, pause), body language, movements, dances, non-verbal signs-indicators (facial expression, tears, laughter - expression of emotions, feelings);
- natural - objects or phenomena of nature: plants, animals, insects, birds, minerals, etc., natural signs- indicators (weather signs, animal tracks, smoke sign);
- artificial - numbers, mathematical symbols, musical notes, letters, hieroglyphs, pieces of art, etc.;
- iconic / specific - portraits, photographs, geographical maps, casts, impressions, traces, models, etc.);
- conventional / abstract - traffic lights and signs, indices, cartographic signs, coats of arms, emblems, diagrams, graphics, technical schemes, trademarks, quality marks, etc.;
- functional and status - clothes, houses, interior, cars;
- ethnic and mythical - Druid symbols, ancient Scandinavian, Greek, Egyptian, Indian, Slavic symbols;
- religious - Christian, pagan, Buddhist symbols;
- occult - Tarot, alchemical, zodiac symbols;
- artistic - artworks, architecture, music;
- representative - state, political, professional, educational, Olympic, gender, LGBT, heraldic symbols;
- audio - intangible items in sound, non-graphic form (songs, music, hymns, titles, names, etc.);
- graphic - drawn symbols (pictures, icons, hieroglyphs, letters, numbers, musical notes, etc.).

Namely graphic symbols or sign systems of writing and images are of particular interest within the framework of this study. According to anthropologists, they are secondary to verbal and non-verbal, arose with the appearance of writing and are a sign of civilizational development. It is not surprising that today we live in an era of high-quality information diversity and an increasing flow of graphic symbols, given the influence of social networks (Instagram, Facebook, Tik-Tok), which create a new format of the world perception. In the modern information society, such phenomena of a

meaningful order as symbols acquire special significance. Today, "the cultural language of mankind includes more and more visual forms of communication" [22]. Symbols are better remembered and at the same time speed up the transmission of messages.

A graphic symbol is a visual embodiment of a word, idea, concept, sound, a specific type of image that has a form, the content of which reveals the characteristic features of a specific visual object, information about its properties, and/or the more significant content of an abstract idea. It is based on the image of the object being depicted.

Acting as an artifact of culture, graphic symbols also perform an anthropological, metalinguistic, communicative function, allowing participants to communicate across time and space. For example, numerous cave paintings found in many parts of the world reveal scenes of the daily life of ancient peoples, including the processes of cattle grazing, gathering, farming, ritual ceremonies, battles, games, celebrations, etc. In general, in ancient civilizations, symbols were often imbued with spiritual or religious significance. Symbolic representation has been inherent in humanity throughout history. These symbols were integral to cultural identity and were woven into various forms of art, such as sculptures, pottery, and murals [18]. Different clans and tribes used their own symbols to decorate flags, shields and clothes. Thus, the symbol unites single things into a certain integrity, fixing it in the cultural code and transmitting it to the next generations [22].

It is obvious that the meanings of symbols really exist only within the limits of human communication, but their perception, interpretation and application may differ depending on the cultural affiliation, which is associated with different experiences and ideas about some of them. They record the social statuses of individuals, and are also an expression of social ties and relationships, and the decoding of the symbol involves knowledge in accordance with the ideological and worldview context accepted in a certain culture, within the framework of which the individual undergoes socialization. On the one hand, it promotes a sense of belonging and cultural uniqueness, and on the other hand, it can cause cross-cultural misunderstanding. In the process of intercultural communication, there is always a risk that its participants may attach different meanings to the same symbol.

For example, as a symbol of power and authority in many European and Western countries an eagle is used, while in many Asian countries - a dragon; on the flags of mainly European countries, a cross is used as a Christian symbol, and on the flags of Islamic countries - a symbol of a crescent and one or more stars. There are examples of negative perception of certain symbols in different countries, for example, violet in Greece is interpreted as a symbol of death, a pig or a dog is a symbol of impurity among Muslims, the cross, as well as the letter "t" in some typefaces may be undesirable for representatives of non-Christian religions. Nazi symbols (swastika) and depictions of body parts should also not be used to avoid cross-cultural misunderstandings. In a cross-cultural context, one should also remember that colors have different meanings in different countries. For example, in Western countries white is considered the color of purity and peace, but in some parts of Asia it is the color of mourning, like purple in most Latin American countries, dark red in Ivory Coast, blue in China, yellow in Syria etc.

In general, the science of symbols (symbolism, semiotics, semiology) is quite complex and, intertwined with many issues of history, philosophy, psychology, etc., constantly seeking answers to the questions of the coding process using sign systems of visual images, alternative interpretations of symbols, putting forward assumptions about why there are similar symbols in different parts of the world, why one symbol has several interpretations. Symbolic thinking has a universal and specific meaning, "universal - because it goes beyond the boundaries of a certain culture, and specific - because it belongs to a certain period of history" [15].

In connection with globalization, widespread information exchange and the increasingly unified communication space of the Internet and social networks, more and more symbols appear in the modern world, which are recognized and understood by millions of people around the world. Exactly through such symbols people with different languages and cultures can form a semantic space in which it will be easier to find mutual understanding, serving as a "visual language that transcends linguistic barriers, connecting believers across time and space" [18]. Primarily due to their simple and accessible forms, such symbols are perceived intuitively, appeal to the human subconscious and form a universal language understood by people from all over the world. In this connection, they are part of what C. G. Jung called "collective unconscious" or "patterns of instinctual behavior" [14, p. 44].

Among such universal symbols, the following are particularly well-known: Heart Symbol (❤) - iconic representation of love and affection, emotions related to love, friendship, and compassion; Peace Symbol (☮) - peace and anti-war movements; Yin-Yang Symbol (☯) - dynamic balance and harmony present in the natural world; Cross Symbol (†) - Christianity, crucifixion, hope, redemption, and sacrifice; Star of David (✡) / Magen David - Jewish identity and heritage [2, 18] and a large number of similar ones.

And there is an extremely large number of such symbols. We meet them everywhere in our daily life: on traffic, stations, airports, supermarkets, exchange points signs, in public toilets and transport, we notice them on the passers-by tattoos and clothes, on flags, cars, smartphones and other appliances, on geographical and playing cards, in various digital applications and modern means of communication through messengers and social networks, including the use of emojis, emoticons, stickers, GIFs, memes. Some of these symbols are more common and used in many areas of human activity and communication, including international business.

Speaking of universal symbols that can have a direct impact on the cultural and communicative aspect of international economic relations and business, the following categories can be outlined:

1) Universal coded character set (UCS) - a standard set of symbols defined by the International Standard ISO / IEC 10646, which is the basis of many character encodings. The latest version contains over 136,000 abstract symbols, each identified by a unique name and an integer called a code point [13]. These symbols are designed to serve communication in many areas of human activity, including production, technological processes, trade, transportation, etc.;

2) The Unicode character set, which is supported jointly with the UCS standard, ISO / IEC 10646 and has an identical code system. It is an industry standard designed to provide digital representation of characters from all world scripts and special characters. The Unicode Consortium is the standards body for the internationalization of software and services. Deployed on more than 20 billion devices around the world, Unicode also provides the solution for internationalization and the architecture to support localization [1]. It is a non-profit organization supported by Apple, Google, Facebook, Adobe and other major technology companies;

3) Emojis are symbols, in turn, taken from the universal symbol library of the Unicode Consortium, which today represent a repository of 180 symbols. Although the emoji has a long and ambiguous history of origin, with its invention attributed to such authors as V. Nabokov, A. Bierce, A. Lincoln, J. Gutenberg, H. Zapf, Ch. Bigelow, & K. Holmes, the technical groundwork for emoji was originally laid in 1999 by Sh. Kurita, who worked for the Japanese mobile phone company DoCoMo [4];

4) Logotypes of commercial, non-commercial, political, governmental, non-governmental, international organizations. At the same time, commercial logos play the role of an element of the company's corporate style and image, act as a visual image market component that occupies a central place in the company's individuality, reflects its philosophy and general vector, creates a first impression in the audience and, along with communicative, performs such functions as mnemonic, perceptual, synesthetic and fractal [20]. Symbolic languages of the worlds of technology, law, games, and sports can turn symbolic meaning into a brand thanks to a graphic identity that is built on a symbol of one of these subcultures [22]. Due to the harmonious application of biomimicry methods and such components as shape, color, font, which is able to make the logo more understandable already at the subconscious level, that is, to universalize or internationalize its perception, it is able to perform the role of a ready-made memory block, filled with associative and motivational content, additional sensory qualities, mechanisms of creating a complete image [20];

5) Countries and cities flags and coats of arms are legally defined symbols of state sovereignty, created taking into account the study of historical legends and annals, heraldry of national rulers and territories and/or the modern economic, political and social situation of the state. Such symbols are used to identify different countries, regions, cities, organizations;

6) Symbols of foreign currencies are primarily independent graphemes, different from the letters that begin the name of the corresponding monetary unit, which arose or were built on the basis of individual letters of the Cyrillic or Latin alphabet, used for the shortest and at the same time unique (excellent from other monetary units) currency designation. In the Unicode standard, the section dedicated to currencies is called "Currency Symbols".

The above groups of symbols are designed to universalize and simplify the process of communication at the global level, aimed at facilitating the search for ways to identify international subjects, objects and processes. In particular, the last three categories of symbols generally help to denote subjects of international economic relations at the micro, meta, and macro levels: from firms, companies, enterprises, political, governmental, non-governmental structures to cities, states, and international organizations. The last two categories of symbols represent the concept of national sovereignty, encoding a message about the state and economic, currency policy of individual countries. The interdependence between the mentioned groups of symbols is also obvious, in particular, emojis and Unicode symbols are based on the universal international base of standard symbols UCS, ISO, which also includes symbols of national flags and currencies. Commercial logos often use patterns or elements of standard symbols. Thus, in addition to the intuitive comprehensibility of the most common symbols in the world, their universal interpretation is ensured due to the existence and development of such international bases of standard symbols, which creates the basis of a global communication culture.

Conclusions

Therefore, the perception and interpretation of symbols is an important research direction regarding the cultural environment of international economic relations and business and includes such concepts as objects, colors, shapes, marks, drawings, gestures, actions, words, sounds or signs and such types of symbols as verbal and non-verbal, natural and artificial, iconic and conventional, functional and status, ethnic and mythical, audio and graphic. However, today graphic symbols play a special role, performing a global, universal cultural and communicative function, filling the digital information flow between people from different countries with a special compact content, opening a space for their common interpretation. The basic role in the cultural-communicative sphere of modern international economic relations and business is played by globally standardized and generally accepted categories of symbols, which, along with intuitive perception, are designed to convey the same meanings, knowledge, ideas, feelings, emotions, performing a metalinguistic, communicative function on a global scale.

References

1. About the Unicode Consortium. Unicode. URL: https://home.unicode.org/

2. Addams R. World's Most Famous Symbols and Their Unknown Stories. Zillion Ddesigns. Sep 3, 2020. URL: https://www.zilliondesigns.com/blog/famous-symbols-stories/

3. Boyko, O. Symvol u mizhkul'turniy komunikatsiyi. [Symbol in intercultural communication]. Worldview - Philosophy - Religion: Collection of scientific work. Sumy, 2011. № 1(1). URL: http://dspace.nbuv.gov.ua/handle/123456789/39476 (in Ukr.).

4. Brownlee, J. The Real Story of Who Invented Emoji (Hint: They're Ancient). 2018. Magenta. URL: https://magenta.as/the-real-story-ofwho-invented-emoji-hint-theyre-ancient-136bed3c06d9

5. Berry, J. W. Poortinga, Y. H., Segall, M. H., Dasen, P. R. Cross-cultural psychology: Research and applications. Cambridge University Press, 2002. 588 p.

6. Cateora, Ph. R. International Marketing - 8th ed. IRWIN, INC., 1993. 776 p.

7. Eswaran, V. The business case for diversity in the workplace is now overwhelming. World Economic Forum (2019). Apr 29, 2019. URL: https://www.weforum.org/agenda/2019/04/business-case-for-diversity-in-the-workplace/

8. Ferraro, G. P. The Culture Dimension of International Business. Englewood Cliffs, N.J.: Prentice Hall, 1990. 216 p.

9. Hill, Ch.W.L. International Business. Competing in the Global Marketplace, Second Edition // Irwin McGraw-Hill. Postscript. 1997. 630 p.

10. Hofstede, G. Culture's Consequences: International Differences in Work Related Values. Beverly Hills, CA: Sage, 1984. 327 p.

11. Holcomb, R. Cross-Cultural Management: Insights and Innovations in International Business. Journal of Research in International Business and Management (ISSN: 2251-0028), Vol. 10(5) pp. 01-02, October, 2023. DOI: http:/dx.doi.org/10.14303//jribm.2023.037

12. Inclusion and diversity. An inclusive and diverse business builds trust and growth. KPMG. 2024. URL: https://kpmg.com/nl/en/home/about/our-people/inclusion-and-diversity.html

13. ISO/IEC 10646:2020. Information technology - Universal coded character set (UCS). Published (Edition 6, 2020). URL: https://www.iso.org/standard/76835.html

14. Jung, C.G. The Archetypes and the Collective Unconscious. Second Edition. Translated by R.F.C.Hull. Bollingen Series. Princeton University Press, 1969. 451 p.

15. Kiryeyeva, T.I., Kiryeyeva, O.H. Symvoly mystetstva u chasi. [Symbols of art in time]. Science. Religion. Society. № 2'2011. URL: http://dspace.nbuv.gov.ua/bitstream/handle/123456789/85512/39-Kireeva.pdf?sequence=1 (in Ukr.).

16. Kluckhohn, C. Anthropology and the Classics. Providence, Brown University Press, 1961. 76 p.

17. Lorenzo, R., Voigt, N., Tsusaka, M., Krentz, M., and Abouzahr K. How Diverse Leadership Teams Boost Innovation. Boston Consulting Group. January 23, 2018. URL: https://www.bcg.com/publications/2018/how-diverse-leadership-teams-boost-innovation

18. Manolache, M. Visual Language of Cultural Signs and Symbols. Level. January, 24. 2024. URL: https://different-level.com/visual-language-of-cultural-signs-and-symbols/

19. Meyer, E. The Culture Map: Breaking Through the Invisible Boundaries of Global Business, PublicAffairs. 2014. 180 p.

20. Mykhaylyna, D. G. & Rogovska-Ischuk, I. V. Alternatyvni funktsii lohotypu v umovakh hlobalizatsii rynkovoho seredovyshcha [Alternative functions of a logotype in the conditions of the market environment globalization]. Bulletin of the Trade and Economic Institute. 2017 Issue I-II (65-66). Economic sciences. Chernivtsi, 434-443. http://nbuv.gov.ua/UJRN/Vchtei_2017_1-2_45 (in Ukr.)

21. Phillips, A. Cultural Symbol. Definition, Uses & Examples. Study.com. URL: https://study.com/learn/lesson/cultural-symbols-importance-examples.html

22. Pylypiv, V. Symvoly u kul'turnomu prostori lyudstva. [Symbols in the cultural space of humanity]. Bulletin of the National Academy of Managers of Culture and Arts. 2019. № 2. DOI: https://doi.org/10.32461/2226-3209.2.2019.177454

23. The importance of cultural integration in M&A: The path to success. McKinsey & Company. February 1, 2024. URL: https://www.mckinsey.com/industries/oil-and-gas/our-insights/the-importance-of-cultural-integration-in-m-and-a-the-path-to-success

24. Thomas, D. C., Peterson, M. F. Cross-Cultural Management: Essential Concepts. Fourth Edition. SAGE Publications, 2018. 336 p.

25. Ting, L., Ali, A. J., & Yan, L. Cross-cultural Conflict Management in International Engineering Contracting Firms Performance. International Journal of Academic Research in Business and Social Sciences, 2023. 13(5), 2868 - 2880. DOI:10.6007/IJARBSS/v13-i5/16435

26. Yehia, Y. The Importance of Cultural Intelligence in International Business. GlobalEdge. Michigan State University. 2/16/2018. URL: https://globaledge.msu.edu/blog/post/55562/the-importance-of-cultural-intelligence

PECULIARITIES OF BUILDING EFFECTIVE FINANCIAL MANAGEMENT IN THE ENERGY SECTOR

Pecheniuk A.
cand. sc. (econ.), assoc. prof.,
associate professor at the department
of energy-saving technologies and energy management,
Podillia State University, Kamianets-Podilskyi
DOI: 10.5281/zenodo.12059978

Abstract
The article reveals the essence of financial management in the context of energy companies; emphasis is placed on the importance of the processes of financial planning and financial analysis in energy; the need to build effective financial control for energy companies is substantiated; the main financial risks in the field of energy were analyzed; the peculiarities of the processes of financing and capital investment in the energy sector were investigated; the main requirements for the formation of an effective strategy for the financial development of energy enterprises are analyzed.
Keywords: financial management, energy, energy companies, financial risks, financial planning, financial analysis, financial control.

The development of the energy sector has a significant impact on the economic condition of the country and the standard of living of its population, since one of the key aspects of well-being in the modern world is the provision of citizens and companies with the necessary energy resources. The energy complex is a capital-intensive industry that requires significant financial investments for the search for raw materials, production and transportation of energy carriers. Therefore, the optimization of production processes and the maximization of profits from invested capital are critically important for the industry, as it is related to the proper level of financial management at enterprises of the energy sector [1].

The essence of financial management in the context of energy companies is the effective management of financial resources and the optimization of their use in order to achieve the company's strategic goals in the energy sector. Key aspects of this entity include:

– financial planning – development of strategic and operational financial plans that take into account the company's needs in investments, development, operating expenses and other financial aspects of activity.

– management of working capital and fixed capital – effective use of capital to ensure the company's current activities and the development of new projects in the energy sector;

– financial analysis – conducting financial analysis to assess the company's financial condition, identify trends and risks, as well as make informed financial decisions;

– risk management – management of financial risks associated with fluctuations in energy prices, changes in legislation, economic factors and other factors that may affect the profitability and financial stability of the company;

– investment strategy – development and implementation of an investment strategy aimed at achieving a competitive advantage and maximizing value for the company's shareholders in the energy market.

Financial management in energy companies is a key component of the successful operation of the enterprise in the conditions of constant changes and challenges inherent in this industry.

The financial stability of energy-generating companies is a key condition for the successful conduct of the country's economic activity, shaping the image of the business entity and serving as its business card. Therefore, one of the most important tasks is to ensure effective management of financial resources, which is closely related to the development and implementation of financial planning. Particular importance is attached to financial planning, as it covers the formation, placement and use of financial resources, as well as obtaining profit on invested capital [1].

Financial planning in the energy sector is the process of developing strategic and operational plans aimed at the effective use of financial resources to achieve the company's goals in this sector. The main aspects of financial planning in energy companies include:

– forecasting of financial flows – assessment of current and future financial flows of the company, taking into account the costs of electricity production, fuel purchase, equipment maintenance, as well as forecasting of income from the sale of energy and other services;

– budgeting – development of budgets for various departments and projects of the company, including capital investments, development of new energy projects, maintenance and other expenses;

– assessment of investment opportunities – analysis of investment projects from the point of view of their profitability and risk, selection of the most promising projects for capital investment;

– working capital and fixed capital management – determining the optimal levels of working and fixed assets, which are necessary to ensure the stable financial condition of the company and meet its current needs;

– risk management – taking into account various financial risks, such as fluctuations in fuel prices, changes in legislation and policy, technical problems

and other factors that may affect the financial stability of the company.

Financial planning in the energy industry is critical to ensure the stable operation of companies in this sector, given the large investments and complexity of energy markets. This process helps companies rationally use financial resources and effectively respond to changes in the internal and external environment.

The main tool for developing the company's financial strategy is financial analysis, which assesses liquidity, solvency and financial stability, determines ways to achieve sustainable development and provides a qualitative approach to the formation of a financial strategy. The implementation of this strategy has a positive effect on the company's activities. The effectiveness and validity of financial analysis create a basis for forecasting various aspects of operational, financial and investment activities, as well as determining promising directions of development. Financial analysis is a complex of scientific and methodical tools that investigate the real financial condition of the enterprise. The use of a wide range of analytical tools allows timely development and implementation of effective anti-crisis measures [2].

Financial analysis in energy companies plays an important role in determining the financial status, efficiency of operations and making informed decisions. Key aspects of financial analysis in this sector include:

– analysis of financial statements - includes the evaluation of financial statements, such as the profit and loss statement, the statement of financial position and the report on the readiness of the company. This analysis allows to assess the general financial condition of the company, its profitability and liquidity;

– comparative analysis – comparison of financial indicators of the energy company with similar indicators of other players on the market or with industry average values. It helps to determine the company's competitive advantages and disadvantages

– analysis of project profitability – evaluation of the effectiveness of investment projects in the field of energy, including projects for the construction of new power plants, the introduction of alternative energy sources and energy conservation. This analysis helps to choose the most profitable and risky projects;

– analysis of liquidity and financial stability – assessment of the company's liquidity and its ability to fulfill financial obligations on time. An analysis of financial stability is also carried out, including an assessment of the level of indebtedness and the degree of financial risk;

– forecasting of financial results – development of forecasts regarding the future financial results of the company based on the analysis of its financial activities and taking into account current and future trends in the energy industry.

Financial analysis in energy companies is an important tool for making informed management decisions, ensuring financial stability and achieving strategic goals in the energy sector. It helps identify problem situations and opportunities to improve the company's performance.

Financial control in the energy industry includes systematic monitoring and analysis of the company's financial results in order to ensure financial stability, effective management of resources and achievement of strategic goals. The main aspects of financial control in energy companies include:

– monitoring of financial indicators – systematic analysis of financial reports and company indicators, such as profit, expenses, turnover of assets, liquidity, etc. It helps identify potential problems and trends in the company's financial activities;

– Internal control – Developed internal control system that includes procedures and control mechanisms to prevent financial abuse, errors and fraud. This may include an audit of internal processes, segregation of duties and a system of internal financial controls.

– analysis of the financial efficiency of projects – assessment of the efficiency of investment projects and the risks associated with them. The cost of the project, potential income and expenses, as well as the internal rate of return (IRR) and the investment payback period are analyzed;

– cost monitoring and budgeting – comparison of actual costs with planned budget indicators to identify deviations and take appropriate corrective measures;

– forecasting and strategic planning – use of analytical methods to forecast future financial results of the company and develop strategies to achieve goals and optimize financial resources.

Financial control in the energy industry helps companies effectively manage their finances, ensures the reliability of financial statements and helps prevent financial risks. It is an important element of risk management and ensuring stability and success in the energy industry.

Modern enterprises of the electric power industry quite often function in unfavorable conditions, which negatively affects their activities due to constant changes in the external environment, a high level of threats and financial risks. One of the most common management mistakes is to evaluate the company's performance only based on current profit and turnover, without taking into account strategic goals and risk forecasting. In the context of the introduction of a new model of the electricity market, the issues of ensuring the financial and economic security of energy supply enterprises through the use of effective risk management mechanisms, methods and tools are becoming particularly relevant [3].

During the period of liberalization of world markets, such processes as globalization, liberalization of the energy market, diversification, decentralization and modernization have a significant impact on the development of the fuel and energy complex of countries.

The essence of the impact of these processes is as follows:

– Globalization contributes to the strengthening of the integration of energy systems at the economic (electricity market, investments), technological (expansion of territories with centralized electricity supply), interstate and intercontinental (interstate and intercontinental energy associations) levels.

– Liberalization of the energy market leads to the growth of deregulation and competition, contributing to the development of regional, interregional and interstate energy markets.

– Diversification leads to an increase in the use of various types of fuel and sources of power supply, as well as various types of power plants.

– Decentralization allows for the implementation of small power plants instead of the construction of large electric power facilities, while maintaining the role of the transport and distribution electric network as an infrastructure that ensures the efficiency, reliability and quality of electricity supply to consumers. This phenomenon is called distributed generation.

– Modernization leads to an increase in the efficiency of traditional technologies and the creation of new highly efficient installations [4].

Threats to the energy security of European countries include physical, economic, social and environmental risks. Physical risks include the possibility of depletion of deposits of major energy resources such as oil and natural gas. In addition, significant natural disasters and geopolitical crises are possible, which can affect the stability of energy supply. Economic risks are associated with the instability of prices for the main energy resources on world markets, which causes imbalances in the financial and trade spheres and creates significant threats to the economic well-being of countries. Social risks are also associated with price fluctuations, which can cause serious dissatisfaction among consumers. The price of gasoline is now as important a factor in stability as the price of bread was two centuries ago. Environmental risks include the possibility of accidents at nuclear and thermal power plants, oil leaks and spills, gas leaks and other accidents at power plants, as well as continuous emissions of pollutants. Special attention is paid to measures to prevent global warming [4].

Among the financial risks faced by energy companies, the following should be highlighted:

– price – changes in the prices of energy carriers, such as oil, natural gas and coal, can significantly affect the profitability of energy companies. For example, a drop in oil prices may reduce revenues from exports or production of electricity using petroleum products;

– political – changes in legislation, tax policies and regulation can have a major impact on energy companies. For example, the introduction of new taxes or emission limits may increase the cost of energy production;

– technical – failures of technical equipment, accidents and other technical problems can lead to a decrease in productivity and an increase in repair and maintenance costs;

– environmental risks – changes in climatic conditions may lead to an increase in the risk of negative impact of natural disasters, such as floods or droughts, on the energy infrastructure;

– market – include changes in energy demand due to economic fluctuations or the impact of alternative energy sources, such as renewable energy sources;

– currency – since many energy companies operate on an international scale, changes in exchange rates can affect their profits and costs.

Preventing and managing these risks is an important element of strategic management for energy companies. This may include diversifying energy sources, using financial instruments to hedge against price fluctuations, and improving technical and operational processes to reduce the risk of technical problems.

Financing and capital investment in the energy sector are key aspects for developing and modernizing infrastructure, supporting innovation and ensuring the stability of energy production. The main methods of financing and capital investment include:

– private capital – attracting private capital by issuing shares or bonds on open markets or through private placements. This may include large investment funds, pension funds, hedge funds and other institutional investors;

– state funding – government subsidies, grants and other forms of funding provided by state or international organizations to support the development of energy infrastructure and initiatives in the field of renewable energy;

– lending – obtaining loans from banks and financial institutions to finance new projects, modernize existing facilities or cover current costs;

– partnership and joint ventures – joint investments with other companies or investors to implement joint projects or develop new technologies;

– internal sources of financing – use of internal resources, such as earnings or generation of internal capital through effective management of working capital and fixed capital.

In recent decades, the issues of global investments in world energy and their impact on the domestic energy market and economy have become increasingly relevant. About two-thirds of all investments go to EU countries, North America and China. At the same time, in developing countries, the lack of strategic policies, insufficient access to financing and fossil fuel subsidies create significant obstacles to investing in energy efficiency. Decisions to invest capital in the energy sector are increasingly being made on the basis of government policy rather than market conditions. In many countries, governments directly influence investments in energy. Practice shows that a significant number of states retain ownership of more than 70% of the world's oil and gas reserves and control almost half of the world's generating capacity through state-owned companies [5].

Capital investments in the energy sector can be aimed at the construction of new power plants, development of renewable energy sources, modernization of existing facilities to increase energy efficiency and reduce emissions, as well as research and implementation of new technologies in the energy sector. It is important to ensure effective management of these capital investments, balancing risks and prospects in order to achieve the company's strategic goals and meet the needs of energy consumers.

To create effective financial management in the energy sector, it is necessary to take into account the current global trends in its development. Constant fluctuations in the prices of energy carriers on the world

market make it difficult to forecast their value for several years ahead. Because of this, many choose systems with optimal adaptability in the use of energy carriers, usually with two energy sources. Even more freedom is provided by the use of one's own household installations for the production of electricity from renewable natural sources.

One of the leading trends in the energy market of the developed countries of the European Union is the decentralization of the production of energy resources, especially electricity, with an emphasis on joint production of heat and electricity. This is due to the rejection of centralized electricity production. For example, in Germany, nuclear power plants are being shut down, and the use of renewable energy plants such as solar, wind and water is increasing. These sources of electricity have uneven production, depending on natural factors: cloud cover, wind speed, seasons, etc. Accordingly, energy consumers can no longer dictate the volume of its production, and generation manages consumption.

However, technologies have emerged that allow even individual private households to become more independent or fully autonomous through electricity generation. This electricity can be accumulated and used at any time and for various needs. The production of electricity is possible in different ways: with the help of individual photocells, fuel cells as part of thermal energy generators or a Stirling engine [6].

The combination of a photovoltaic installation with a heat pump makes the system autonomous and fully dependent on renewable energy sources. The heat generator uses free environmental heat, and the electrical equipment is powered by the current produced by its own photovoltaic installation, using free solar energy.

The generation of electricity using fuel cells in heating equipment is a world novelty. Japan is a leader in the development of such elements, and from there they are supplied en masse to the leading European manufacturers of boiler equipment.

Another cogeneration technology uses the Stirling engine, a heat engine with external heat input. Although this technology is not new, low-power devices designed for domestic use have appeared on the market.

Self-generated electricity can be used for any household needs, for example, to power a washing machine. This function is provided in the equipment menu.

To store electricity, you can use compact wall-mounted lithium batteries, which are already presented in the range of electrical equipment of the world's leading companies. The battery stores excess electricity produced by the generating equipment. If the battery is fully charged and none of the connected consumers are working, electricity is transferred to the public grid.

Today, the market offers compact household batteries capable of storing electricity obtained from the sun. The capacity of such devices, for example, 10 kWh, is sufficient to create energy reserves and its further use. Heat accumulators are also used in systems with electricity accumulators.

Another trend in the heating market, which is gaining momentum, is the improvement of control systems. Boilers with the most simplified management, thanks to intuitive symbols, appeared on the market.

Some modern heat generators have an energy management module that provides the user with complete information about the amount of energy produced and consumed. This may include data on energy produced by a connected solar installation or gas consumption for heating and hot water [6].

The popularity of managing systems via the Internet is growing, because every year the number of smartphone users and subscribers of global network providers increases. Such remote control systems are becoming more and more accessible and easier to use, even with the complexity of microclimate creation schemes.

Many modern household appliances are equipped for access to the global network. Leading manufacturers offer applications for various portable devices (tablets, smartphones) that can be used to control the microclimate and smart home systems to achieve maximum comfort and energy efficiency.

Modern electronic control technologies allow the use of several types of equipment for energy production, creating so-called hybrid systems. This is especially relevant for heat supply systems.

Hybrid devices are a new category of equipment that allows users not to depend on a single energy source. Thanks to the combination of different energy carriers, the user can always ensure minimum costs at variable energy prices. Two or three energy sources are usually used. In Europe, a combination of liquid, solid or gaseous fuel (traditional boiler) and electricity (heat pump) is popular.

Control systems for such schemes allow you to choose one of two modes of operation of the equipment: economic or ecological. In economic mode, the device automatically selects the optimal operating mode depending on the cost of a specific energy resource (the amount of the tariff is entered by the user) at the moment. For example, it is more profitable to use electricity at a discounted rate at night. In ecological mode, the control system adjusts the operation of the equipment to minimize CO_2 emissions.

Hybrid technologies allow not only to save during the operation of the equipment, but also to optimally select its power. This makes it possible to use wood pellets or gas as the main energy carriers, and cover peak loads with electricity.

Financial development strategies in the energy industry can be aimed at ensuring the stable financial condition of companies, attracting investments for the development of new projects and modernization of existing infrastructure, as well as at stimulating innovation and the introduction of new technologies. Here are some strategies that can be used:

– diversification of energy sources – the development and implementation of various energy sources, such as coal, gas, wind, solar, hydropower, etc., allows companies to reduce dependence on one source and expand their capabilities;

– investments in renewable energy – attraction of investments in renewable energy sources, such as solar and wind energy, which are ecologically clean and sustainable sources of energy;

– energy efficiency – making investments in increasing the energy efficiency of equipment and production processes to reduce energy consumption and costs;

– network development – investing in the development and modernization of energy networks, including the creation of "smart" networks that use advanced technologies to increase efficiency and reliability;

– stimulation of innovation and research: Attracting investments in research and development of new technologies in the field of energy, which contribute to increasing productivity and reducing emissions;

– financial risk management strategies – implementation of strategies to reduce the impact of financial risks, such as fuel price fluctuations, exchange rate changes, political and regulatory risks;

– attraction of alternative financing – use of alternative financing methods, such as cash flows from alternative sources, environmental funds, green investment bonds, etc.

These strategies can be used by companies in the energy industry depending on their specific needs, goals and resources. Implementation of these strategies helps ensure sustainable financial development and competitiveness in the modern energy sector.

Conclusions. Effective financial management requires detailed strategic plans that take into account the company's long-term goals, risks and market opportunities. This ensures flexibility and adaptability in changing market conditions. Systematic analysis and cost control are key to improving the company's performance. The use of modern methods of cost management helps to identify and eliminate unjustified costs, which contributes to increasing profitability. Taking into account all possible financial risks and developing appropriate measures for their minimization are critically important to ensure the stability and continuity of energy companies. The integration of the latest information technologies and process automation into financial management significantly increases the accuracy and speed of decision-making, and reduces the cost of time and resources. The use of big data analysis tools makes it possible to more accurately forecast financial results, identify trends and make informed and effective management decisions.

References

1. Kostiuk H.V., Usenko O.M. (2013) The main problems of financial planning at energy-generating enterprises and ways to solve them. Efficient economy, 4. URL: http://www.economy.nayka.com.ua/?op=1&z=2000.

2. Savastieieva O.M. (2021) Financial analysis as a tool for determining the financial strategy of a business entity. URL: https://dspace.onu.edu.ua/server/api/core/bitstreams/7c21c09c-31e9-47c9-a99d-38f48cea6ced/content.

3. Levytska A.V., Hrytsenko A.A. (2019) Risk management of the energy company during the transition to a new model of the electricity market. Economic Journal of Odessa Polytechnic University, 1(7), 26-31. URL: https://economics.opu.ua/ejopu/2019/No1/26.pdf. DOI: 10.5281/zenodo.3332881.

4. Karaieva N.V., Voitko S.V., Sorokina L.V. (2013) Risk management of sustainable energy development: information support for decision-making. Kyiv: Alfa Reklama, 308. URL: https://core.ac.uk/download/pdf/323531417.pdf.

5. Stepanova A. (2016) Investing in global energy: main trends. Bulletin of Taras Shevchenko Kyiv National University, 7(184), 28-32.

6. Kopylov M. (2022). World know-how in energy. AW Therm. URL: https://aw-therm.com.ua/svitovi-nou-hau-v-energetici.

HISTORICAL SCIENCES

LIFE OF MUSLIMS IN THE PEOPLE'S REPUBLIC OF CHINA (1949-2000 YEARS)

Ernazarov O.
PhD in History, Associate Professor,
UNESCO Chair on religious studies and the comparative study of world religions,
International Islamic Academy of Uzbekistan
DOI: 10.5281/zenodo.12060295

Abstract
The article provides information about the social, political and cultural life of Muslim communities in China after the period of imperialism. The article analyzes the results of the centralized solution of the needs of Muslims in the country through the activities of the Chinese Islamic Association.
Keywords: Tang dynasty, Song dynasty, Yuan dynasty, Ming dynasty, Qing dynasty, “religion of Hui”, Emperor Xianzong.

From the time Islam entered China until the founding of New China in 1949, Chinese Muslims experienced various situations. Muslims (especially in the Northwest) faced many hardships during the Qing dynasty and the Provisional Military Government. After the founding of New China in 1949, the people's government pursued policies based on ethnic equality and religious freedom. The government has guaranteed a new life and economic, political, ethnic and religious freedom for Muslims of different nationalities in the country. According to the 2000 census, more than 20 million Muslims live in the territory of the People's Republic of China. They mainly lived in Xinjiang, Ningxia, Gansu, Qinghai, Yunnan, Henan, and also in Shanghai, Hebei and Shandong provinces.

After the founding of New China in 1949, Muslims of all ethnic groups in the country were guaranteed equal political and religious freedom, enshrined in the constitution. In order to stabilize the social order and restore the economy, the people's governments in the regions paid attention to the protection of religious attributes such as mosques, mausoleums, and respect for Muslim faith, traditions, and holidays. For example, the State Council, which were responsible for coordinating the organization of holidays and festivals of ethnic minority groups in the country, has declared Ramadan and Eid al-Adha as holidays for all Chinese Muslims. In addition, the Council of State decided to exempt Muslims from the tax on sheep and cattle used for sacrifice during various festive events. In addition, the Ministry of Finance issued an instruction that the land allocated for the construction of mosques and mausoleums should be exempted from land tax.

The following system of regional autonomy was established in areas where Muslims were the majority: Xinjiang Uyghur Autonomous Region (established on October 1, 1955), Changji Hui Autonomous Region in Xinjiang (November 27, 1954), Ningxia Hui Autonomous Region (October 20, 1958), Zangjiachuan Hui Autonomous County in Gansu (July 1, 1953), Menyuan Hui Autonomous County in Qinghai (December 19, 1953), Hualong Hui Autonomous County (March 2, 1954), Dachang Hui Autonomous County in Hebei (December 7, 1955) [4 : 47]. In this way, all the Muslims in the country started to solve their personal issues independently to a certain extent.

The changes in the life of Muslims in China included the implementation of land reform along with the acquisition of certain political rights. At the initial stage, the Muslims in the villages had no other opportunities except political rights. Like the land reform carried out in the territories belonging to the Hans, Muslims also wanted to implement land reform in their own territory. In response to the wishes of the Muslims, the people's government began to implement land reform based on the opportunities of the areas where the Muslims were the majority. Some time after the land reform, Muslims began to make a significant contribution to the development of the country, along with the effective establishment of agriculture in their respective areas.

In the integration of Muslims into the life of the country, it was important to solve the issues that arose among them centrally within the framework of religious organizations. In 1952, influential Chinese Muslim representatives, including Baoerhan Shahidi, Liu Geping, Saifudin Azizi, Da Pusheng and Ma Jian, united to form the China Islamic Association. These individuals introduced this plan to Islamic circles and ordinary Muslims in the country. In 1952, appointed representatives from various ethnic groups met in a preparatory meeting and formed a preparatory committee to establish the China Islamic Association. In this situation, Baoerhan Shahidi was appointed as the director, Da Pusheng as the assistant director, and the other 27 people were appointed as committee members.

From the founding of the People's Republic of China until 1952, the members of the "preparatory committee" were sent on a pilgrimage to inform the world about the conditions created for Muslims in the country, as well as to establish friendly relations with the Muslims of the world. The members of this delegation consisted of 16 people selected from among the Muslims of the whole country, in addition to the president of the association, Imam Da Pusheng (Hui) and vice-president Yiming Mahesum (Uyghur). The delegation tour, which began in August 1952, ended early

due to the failure to establish diplomatic relations with Saudi Arabia [1 : 82].

In April 1955, Imam Da Pusheng, the vice president of the Chinese Islamic Association, attended the "Bandung Conference" in Bandung, Indonesia as a religious adviser to Prime Minister Zhou Enlai. The Bandung Conference was considered a great success in the history of Chinese diplomacy [5 : 94]. As a result of Prime Minister Zou Enlai's successful negotiations with Egyptian President Nasser and King Faisal of Saudi Arabia, Imam Da Pusheng and the first delegation of pilgrims from New China (19 people) visited Mecca to perform Hajj in August 1955.

In July 1957, the first issue of the magazine "Muslims in China" devoted to various issues was published in Beijing by the Chinese Islamic Association. In this magazine, along with introducing the activities of the association to the Muslims of the country, articles were published about the life and lifestyle of Muslims. It also acted as a mediator for the exchange of information and experiences between local Islamic associations and ordinary Muslims in different regions. Its activity was stopped in 1959, when the 24th issue of the magazine was published.

On November 21, 1955, the Islamic Institute of China was established in Beijing. The students of the institute consisted mainly of promising young Muslims who received a certain level of education in mosques. The following subjects are taught at the institute: Aqidah (theology), Tajweed, Hadith, Fiqh and Arabic literature. In addition, Chinese language (mainly in Uyghur classes), history, geography and politics are taught as secondary subjects at the institute.

In the early and mid-1950s, much attention was paid to the study and publication of Islamic literature. Even an Arabic edition of the Holy Qur'an was copied three times and a number of selected works were lithographed by the Chinese Islamic Association. In 1950, Peking University Press published Ma Jian's translation of the Holy Qur'an. With the efforts of the Chinese Islamic Association, during this period, many publishers published works such as "The Life of Chinese Muslims", "Islam in China" and "The Religious Life of Chinese Muslims" with titles written in Chinese, Arabic, English, French and Malay [2 : 184]. Also during this period, the constitution of the People's Republic of China was translated into Arabic. Despite the scientific and literary development, in the autumn of 1958, under the influence of "leftist" views, Islamic teachings, the study of the history and culture of Chinese Muslims, and the publication of religious literature were suspended for 18 years, that is, until the Cultural Revolution in 1976.

After the Third Plenary Session of the Eleventh Party Central Committee, the Central Committee of the Communist Party, the State Council, the Party Committees, and various authorities tried to abolish the order of chaos that had arisen during the Cultural Revolution (1966-1976). In the course of this process, the names of Muslims who were accused of various crimes during the past period were vindicated and their reputation was restored. The activities of a number of Islamic organizations have been resumed.

The revival and reopening of religious places was an important step in the implementation of the policy of religious freedom. As a result of this reform, 64 mosques opened in Beijing, 53 in Tianjin (including the Hui service center), and 6 in Shanghai. By the end of the 1980s, there were 2,800 mosques, 80 mausoleums, 5 khanaqahs (a place where menhuan (sect) representatives gather and perform certain rituals), 2,900 imams in Gansu; 118 mosques in Shaanxi; 2,700 mosques and 3,600 imams Ningxia; 867 mosques and 3,562 imams in Qinghai; 20,000 mosques in Xinjiang. According to national statistics of registration of religious places conducted between 1994-1996, 34014 mosques were registered across the country. Of these, there were 23,331 mosques in Xinjiang, 2,610 in Gansu, 2,984 in Ningxia, 817 in Henan, 728 in Yunnan, 397 in Hebei, and 409 in Shandong [6 : 96]. In the first decade of the 21st century, the number of mosques in the country remained approximately this amount.

In June 1982, the Islamic Institute of China began accepting a limited number of students again. Not only high-level, but also short-term education courses were opened there. By early 2000, 512 students from eight ethnic groups in the country (including Uyghur, Kazakh, Kyrgyz) graduated from the institute. On the other hand, since 1983, 8 Islamic institutes have been established in Shenyang, Lanzhou, Inchuan, Beijing, Xining, Urumqi and Kunming.

On September 25, 1981, the activity of the magazine "Islam in China" was restarted. In 1983, with the support and efforts of several hundred thousand people, the first bimonthly issue in Uyghur was published. In 1980, Ma Jian's complete translation of the Holy Qur'an was published by the China Social Science Press [8 : 225]. In 1986, using this version, the King Fahd Holy Qur'an Printing Complex printed an Arabic-Chinese version of the Qur'an, which became the most popular version of the Qur'an in Chinese.

Offices dealing with ancient books of ethnic minority groups have been established in some provinces, autonomous regions and municipalities, and many ancient Islamic works have been published. In 1980, the Chinese Islamic Association, in cooperation with several publishers, published the Holy Qur'an in 160,000 copies, "Mukhtasar Tafsir", "Masterpieces of Hadith", Hadith collections of Imam Bukhari and Imam Muslim, "Kutubah", "Life of the Prophet Muhammad", "Islam" translated by Ma Jian. source illustration', published works such as 'Nine Years in Mirs' written by Pang Shikian.

In the 1980s and 1990s, the level of literacy of Chinese Muslims continued to grow. By the beginning of 2000, about 30,000 Muslim students studied in 21 universities and colleges in Xinjiang, and about 10,000 in 7 colleges in Ningxia [6 : 61]. Since 1987, the policy of open dialogue with the outside world has increased the number of Muslims working in various spheres of government, people's congress and consultative political bureaus.

The introduction of Islam to China dates back to the middle of the 7th century. During 1,300 years, that is, during the reign of the Tang, Song, Yuan, Ming, and

Qing dynasties, as well as during the Republican administration (1912-1949), the number of Muslims in China reached 20 million people [3 : 52].

Islam has been called by several names at different times: during the Tang Dynasty (618-907) "Dashi Jiao" ("Dashi" refers to the Arabs, therefore, in the Tang Dynasty, Islam was called "the religion of the Arabs" in the language of the local population), during the Ming Dynasty (1368-1644) "Tianfng Jiao" (Religion of Arabia) or "Hui Hui Jiao" (during this period, all ethnic groups belonging to the Islamic religion were called "Hui" in general, so the term "Religion of the Hui" was widespread in relation to Islam), during the end of the Ming Dynasty and the beginning of the Qing Dynasty (1616-1911), Qingzhen Jiao (Pure and True Religion), during the Republican period (1912-1949) "Hui Jiao" (the term "Hui religion" was applied to the Dungans, a Muslim ethnic group in China).

After the establishment of the People's Republic of China in 1949, in 1956 the State Council issued the "Notice Concerning the Name of Islam", which stated the following: "Islam is a world religion. "Islam" is the general international term used for this religion, since it should not be called "Hui religion" but simply "Islam" [7 : 147]. After that, the concept of "Islam" began to be used in general throughout China. To date, ten of China's 56 ethnic groups have adopted Islam as their national religion. These are Dungan (Hui), Uyghur, Kazakh, Dunsyan, Kyrgyz, Salar, Tajik, Uzbek, Baoan and Tatars. At the same time, a small number of Muslims also live among the Mongols, Tibetans, Bai, and Dai in China.

Islam had a great influence on the social life of China, especially on the social development of the above-mentioned ethnic groups. Consequently, Muslims in China are still contributing to the political, economic and cultural development of the country.

References

1. Atwill, David G. The Chinese Sultanate: Islam, Ethnicity, and the Panthay Rebellion in Southwest China, 1856-1873. – Stanford: Stanford University Press, 2005.

2. Benite, Zvi Ben-Dor. The Dao of Muhammad: A cultural history of Muslims in late imperial China. – Cambridge: Harvard University Press, 2005.

3. Benson, Linda. The Ili Rebellion: The Moslem challenge to Chinese authority in Xinjiang 1944-1949. – New York: ME Sharpe, 1990.

4. Dillon, Michael. China’s Muslim Hui Community: Migration, Settlement and Sects. – Surrey: Curzon Press, 1999.

5. Israeli, Raphael. Islam in China: religion, ethnicity, culture, and politics. – Lanham: Lexington Books, 2002.

6. Islam in China / Written by Mi Shoujiang and You Jia; Translated by Min Chang. – China intercontinental Press, 2004.

7. Gillette, Maris Boyd. Between Mecca and Beijing: Modernizations and Consumption Among Urban Chinese Muslims. – Stanford: Stanford University Press, 2000.

8. Gillette, Maris Boyd. Between Mecca and Beijing: Modernizations and Consumption among Urban Chinese Muslims. – Stanford: Stanford University Press, 2000.

MEDICAL SCIENCES

PREVENTION OF EMOTIONAL BURNOUT OF TEACHERS OF HIGHER EDUCATIONAL MEDICAL INSTITUTIONS

Bukach O.,
Bukovyna State Medical University,
assistant of the department of internal medicine
Sydorchuk D.,
Pashkevych V.,
Kushnir M.,
Hibai R.
DOI: 10.5281/zenodo.12060647

Abstract

Emotional burnout syndrome is a condition manifested by psycho-emotional, mental and physical exhaustion, which leads to the paralysis of our forces and feelings and is accompanied by a loss of joy and satisfaction in life in response to long-term exposure to stressful and psycho-traumatic factors.

Analysis of the problem of "emotional burnout", which is a response to chronic emotional stress, confirms its destructive effect on the professional activity and personality of a medical university teacher. Burnout intensifies in conditions of distance learning and quarantine restrictions. The teaching activity of scientific and pedagogical workers of universities requires constant self-development, improvement of professional knowledge, abilities and skills, somatic and mental health, which are limited in quarantine conditions. Timely prevention of a teacher's professional deformation and stabilization of his psycho-emotional state will prevent the occurrence of emotional burnout and contribute to the quality performance of his professional duties. The reason for the development of emotional burnout at work is "chronic fatigue", caused by a discrepancy between the personality and the demands placed on it. Constant stresses associated, first of all, with the peculiarities of professional activity, namely: information overload, extreme situations, intensive level of communication, high degree of responsibility - contribute to the development of the syndrome of "emotional burnout" in teachers of higher education and are accompanied by disorders of psychosomatic and of a somatopsychic nature. The lack of conditions for relieving psychological fatigue and insufficient competence in matters of preserving and strengthening professional health deepen the problems arising in this situation among teachers. Recommendations for the prevention of emotional burnout of medical university teachers should include: optimization of the work and rest regime; reasonable load distribution; reduction of conflict at work; psychological relief; manifestation of self-care; a careful attitude to work planning in the conditions of "quarantine" education, a balanced approach to the amount of independent tasks for students and the most important thing in this situation - work should be a joy.

That is why the study of the peculiarities of development and ways of prevention requires a systematic approach, the use of various methods, as well as the development of modern technologies to preserve psychological health among teachers of higher educational institutions and is an urgent issue today.

Keywords: emotional burnout, depersonalization, welcome instability, reduction of professional achievements, aromatherapy.

Specific factors of professional activity in higher education, which negatively affect the professional and personal development of university teachers, are the following: multifunctionality of professional activity; large amount of work; the intensity of communicative interaction in the "person-to-person" sphere; heterogeneity of the student audience in terms of intellectual and socio-cultural features, level of responsibility, general education, direction of educational and professional motivation, etc. According to the conclusions of researchers in the field of social psychology, occupational health psychology, and work psychology, on the one hand, work contributes to the personal and professional development of a specialist, and on the other hand, it can negatively affect him. Therefore, preventing the impact of negative factors related to professional activity is an important task of maintaining the professional's ability to work. Among these, a negative phenomenon in professional activity is professional burnout (emotional exhaustion). Therefore, one of the tasks of training in a higher educational institution is the formation of psychophysical stability and self-organizational competence of the future specialist, thanks to which he is able to choose the appropriate style of behavior and organization of activities in order to prevent the negative influence of the profession [1, 8].

In the scientific literature, a number of terms are used to denote the phenomenon of burnout: emotional burnout, emotional exhaustion, professional burnout, professional exhaustion. N. Konovchuk notes that the phenomenon of emotional burnout (exhaustion) is broader and includes the concept of "professional burnout", the main cause of which he identifies as an organizational factor (working conditions, working atmosphere, relations with superiors and colleagues, etc.) [3].

Professional burnout of a higher school teacher can be caused by objective and subjective factors [18].

The objective factors are the following [12]:

- socio-economic transformations in Ukraine that affect the material stability of society members, psychological state and professional well-being;

- risk of job loss due to lack of funds, associated with low (absent) funding and insufficient number of applicants during the admissions campaign;

- failure to provide the employee with a full working rate if he wishes to work fully and qualitatively;

- overloading the teacher with work tasks in the absence of encouragement and appropriate remuneration, etc.

Subjective factors include the following:

- insufficient motivation or unformed value attitude to professional activity;

- some personal characteristics: anxiety, introversion, perfectionism, workaholism, presenteeism, etc.;

- inadequacy of professional expectations, self-esteem, etc.

There are the following definitions of burnout syndrome [20]:

- a mechanism of psychological protection developed by the individual in the form of complete or partial exclusion of emotions in response to some psycho-traumatic actions, an acquired stereotype of emotional, mostly professional behavior. Burnout is partly a functional stereotype, as it allows a person to dose and economically spend energy resources. At the same time, its dysfunctional consequences may arise, when burnout negatively affects professional activity (V.V. Boyko);

– the process of gradual loss of emotional, cognitive and physical energy, manifested in symptoms of emotional and mental exhaustion, physical fatigue, personal detachment and decreased satisfaction from the work performed (P. Sidorov);

- an appropriate reaction to long-term professional stresses of interpersonal communication, which contains three components: emotional exhaustion, depersonalization and reduction of personal achievements (S. Maslach and S. Jackson) [6];

- physical, emotional or motivational exhaustion, characterized by a decrease in work productivity, fatigue, insomnia, increased susceptibility to somatic diseases, as well as the use of alcohol or other psychoactive substances for the purpose of obtaining temporary relief, which tends to the development of physiological dependence.

Symptoms of emotional burnout syndrome are as follows (K. Maslakh) [6]:

1) emotional exhaustion: the employee develops chronic fatigue, mood deteriorates (sometimes even just at the mention of work), sleep disturbances, diffuse physical ailments, susceptibility to diseases;

2) depersonalization/dehumanization – a cynical attitude towards work and its objects (subjects): negative attitude towards colleagues and those who need help, feelings of guilt, the employee often chooses formal functioning and avoids workloads at all costs;

3) reduction of professional achievements - employees feel incompetent and aware of failure in their professional field; the employee suffers from a lack of recognition, success, loss of control over the situation, feels unsolicited and excessive demands on himself;

4) welcome instability (H.Sonnek, 1994): depression, depressed mood, excitability, feeling of oppression towards oneself, anxiety, restlessness, feeling of hopelessness, irritability.

There are four groups of workers who are most susceptible to professional burnout [7]:

1) introverts, whose individual and psychological characteristics do not agree with the professional requirements of communicative professions. They do not have an excess of vital energy, are modest, shy, prone to introversion and concentration on the subject of professional activity, which causes emotional discomfort;

2) employees who experience a constant internal conflict related to work;

3) women who experience an internal contradiction between work and family, as well as pressure due to the need to constantly prove their professional capabilities in conditions of fierce competition with men;

4) specialists whose professional activity takes place in conditions of acute instability and chronic fear of job loss, as well as employees who occupy the position of external consultants on the labor market, forced to find clients on their own.

In the psychological and pedagogical scientific literature, there are three approaches to explaining the emergence of the syndrome of professional burnout [9]:

1) individual-psychological: discrepancy between high expectations of individuals regarding work and reality;

2) socio-psychological: the cause of burnout is considered to be the specificity of work itself, which is characterized by a large number of contacts in the "person-to-person" sphere;

3) organizational-psychological: the cause of burnout is associated with personality problems in the organizational structure: lack of autonomy and support, role conflicts, inadequate or insufficient feedback from management regarding an individual employee, and others.

The diagnostic tools for identifying the symptoms of professional burnout are widely presented in the psychological and pedagogical literature. Let's name some of the methods that can be used to diagnose this problem: "Diagnosis of the level of emotional burnout" (V.V. Boyko), "Definition of mental burnout" (V.V. Rukavishnikov), "Burnout syndrome in professions of the "person-to-person" system "" (G.S. Nikiforov), "Assessment of one's own potential for "burnout"" (J. Gibson), "Research of the syndrome of "burnout"" (J. Greenberg), "Express diagnosis of the level of psycho-emotional tension (PEN) and its sources " (O.S. Kopina, E.S. Suslova, E.V. Zaikin); "Professional stress test" (T.D. Azarnykh, I.M. Tyrtyshnikov); "Assessment of the level of social and psychological adaptation of a teacher of a higher school" (modified questionnaire of N.S. Nikiforov); self-actualization questionnaire (SAMOAL); study of sources of social and psychological support (modified questionnaire of V. O. Ananiev); questionnaire "Mental burnout" (N.E. Vodopyanova, O.S. Starchenkova); the author's questionnaire to identify factors that complicate the pedagogical activity of university teachers (I. A. Fomenko); a questionnaire to find out organizational factors of pedagogical activity (I. A. Fomenko) and others [2, 16].

The ability of an individual to effectively perform professional roles is justified by S. Cherniss as the concept of self-efficacy. In his understanding, self-efficacy

reflects an individual's sense of confidence in his ability to control actions that affect his professional life. Among the components of professional self-efficacy, he singled out: professional skill, the ability to maintain friendly relations with others, and the ability to influence the state of affairs within the organization. At the same time, he determines that the ability to set goals and the success of their implementation increase the feeling of self-efficacy. The areas of preservation and strengthening of professional health and prevention of professional burnout of higher school teachers are educational, diagnostic and psychocorrective work, the separate aspects of which are [15]:

- increasing the literacy of teachers on issues of professional efficiency and preservation of professional health;
- provision of organizational and individual conditions in order to prevent professional deformations;
- creation of a comprehensive program of pedagogical support for young teachers with the aim of their adaptation to professional activity, subsequent self-regulation and self-organization of professional actions and self-realization in work, etc.

Psychologists have developed recommendations on ways to overcome professional burnout of an employee. They proposed the following methods of action [5]:

1) study one's needs, understand one's goals and imagine the image of one's future, find the meaning of what one does;

2) make a transition to a field of activity that is close to the one being performed. This will make it possible to apply the acquired knowledge, skills and abilities (the employee makes a so-called horizontal career);

3) without abandoning this type of activity, make it a tool for achieving more global ideas;

4) the employee, remaining in the same situation, should focus not on what he knows, knows how to do well, and what he has mastered, but on what is a problem for him. This is how you can find a new meaning in an old profession, and its transformation into a tool for self-development becomes a prevention of burnout.

Stress factors during professional activity can be minimized using the following methods [10]:

- determination of the purpose of the activity;
- establishment of the activity regime;
- planning of the working day;
- improvement of the working space (space-time self-organization);
- delegation of powers;
- observance of executive discipline and work culture, etc.
- formation of activity goals;
- provision of the necessary training, methodical assistance to the employee;
- timely informing about tasks, events related to professional activity and incentives, employee support;
- motivation of employees;
- formation and use of an adequate system of incentives;
- maintaining an optimal social and psychological climate in the team;
- involvement of employees to participate in decision-making on improving the efficiency of activities;
- creation of staff schedules;
- equal distribution of duties and assignments between teachers and others.

An essential factor in the prevention of professional burnout is the training of future professionals in ways of self-organization and organization of professional activities. The initial course "Fundamentals of self-organization in professional activity" is aimed at revealing the internal resources of the individual's activity regarding the analysis and reflection of the situation, circumstances, actions in the future profession and the formation of their ability to optimally choose strategies of functional and role behavior in professional activity [11].

The curriculum includes three modules [13]:

- theoretical aspects of self-organization by a teacher of a higher school of professional and pedagogical activity;
- pedagogical and psychological conditions of effective self-organization by a teacher of professional activity;
- technologies of self-organization in the professional activity of a teacher of a higher school.

The training course program provides for the following methods and types of work: organizational and business games, the role perspective method, project activities, compiling personal and reflective diaries, drawing up professional development plans, training exercises, etc. Thus, prevention of teacher burnout requires the action of a number of organizational, individual and professional factors. One of the conditions for the professional effectiveness of teachers is a comprehensive program aimed at the formation of appropriate motivation, knowledge, skills in organizing and organizing one's own personality, life and professional activities in teachers, which aims to preserve one's health and professional longevity. Nevertheless, the formation of teachers' ability to self-organize their professional activities, which implies their psychological and pedagogical competence regarding the rational organization of work and rest, preservation and restoration of strength and professional efficiency, will contribute to maintaining professional health and mobilizing their efforts in professional activities [14, 19].

In order to establish emotional burnout at the Bukovyna State Medical University, we study the features of the development and prevention of emotional burnout syndrome among teachers of theoretical and practical departments. To diagnose the level of emotional burnout, we use the adapted method of V.V. Boyko, according to which it was established that symptoms of emotional burnout develop in 44% of teachers. In which the presence of psychosomatic and psychovegetative disorders and the development of such symptoms as emotional and moral disorientation, which is manifested by the uncontrolled influence of mood on relationships with others and the development of indifference in communication with colleagues, is noted. There is also the formation of a symptom of the expansion of the sphere of emotion economy, which is characterized by emotional isolation, alienation, the desire to curtail

any communications, and a symptom of the reduction of educational duties, manifested in the desire to spend as little time as possible on the performance of professional duties. To prevent the occurrence of this syndrome, it is possible to use various methods of harmonizing mental and physical health, by influencing the physical and emotional state and influencing thoughts and changing the worldview [17].

We try to follow the general recommendations regarding the correction of physical, mental and spiritual components of health [4, 7]:

I. Recommendations for correction of the physical component.

1. The simplest, universal way to restore personality and the primary need of the human body is an established sleep regime (8 hours). After all, a constant lack of adequate sleep, due to excessive teacher overload, leads to negative acquired habits and stimulates the development of "professional burnout".

2. Diet according to the biological rhythm and the teacher's regimen. Balanced and healthy food is the key to not only physical but also emotional health of a specialist (it is advisable to use useful anti-stress products with a high content of magnesium and vitamin E).

3. Physical activity, namely: sports, morning gymnastics, yoga, fitness, dancing, etc.; massage - will help to restore strength as quickly as possible and will allow to relieve the tension of the whole body.

4. Aromatherapy is a method of therapy using essential oils that are introduced into the body through the respiratory tract (inhalation, inhalation) and through the skin (massage, compress, etc.). This method has a beneficial effect on the human body (smells of citrus fruits, bergamot, spices have a positive effect on the nervous system, there is a feeling of invigoration).

5. Breathing exercises (respiratory gymnastics, bodyflex, etc.) tone the nervous and vascular systems, increase blood circulation, contribute to the formation of the ability to concentrate, eliminate psycho-emotional stress and their consequences.

II. Recommendations for correction of the mental component.

1. Art therapy is a type of psychotherapy and psychological correction based on art and creativity. A special place should be given to "color treatment" isotherapy. The use of green and blue colors promotes relaxation, red and yellow when there is a need to renew energy. Music therapy also contributes to the harmonization of the psycho-emotional state and helps to get rid of negative emotions.

2. Keeping a diary with introspection. It is appropriate to make records of both positive and negative changes and reactions to certain events.

3. Time management consists in planning and correcting the activity schedule for the week. This technique will help the teacher to correctly allocate time for work and rest, without missing anything.

4. Positive psychology is based on positive constructive thinking of the individual, avoiding the use of negative clichés, in order to successfully achieve clearly defined productive goals.

III. Recommendations for correcting the spiritual component.

1. Communicating with family, friends, nature, animals (the environment always helps restore strength and energy).

And although there is no universal recipe for burnout, this problem can still be solved if you deal with it purposefully. It is necessary to separate the work part of life and family life and not to mix them, not to take work home, not to stay too long at work. Useful physical exercises and walks to distract from work. It is also quite useful to take short breaks when you feel that the situation is too stressful.

Conclusion

Modernization of education leads to a higher level of requirements for higher school teachers, whose activities are aimed at creating optimal conditions for revealing and realizing potential opportunities, abilities and needs of students. Professional and high-quality performance of pedagogical activity requires activation of mental processes, concentration of attention, somatic and mental health. Pedagogical activity, due to its oversaturation with stressogenic factors, requires a specialist to have powerful reserves of self-regulation, and that is why it is one of the most emotionally stressful types of work. In this regard, one of the negative consequences of long-term stress is the syndrome of professional burnout. Professional burnout of higher education teachers involves a gradual loss of emotional, cognitive, and physical activity, which is manifested by the corresponding symptoms of exhaustion and fatigue, a decrease in satisfaction from the performance of professional duties, and exacerbation of chronic diseases. The professional destruction of teachers leads to a decrease in the quality indicators of the training of future specialists. Therefore, the specificity of the pedagogical activity of higher school teachers requires effective mobilization of the specialist's internal energy resources, which is impossible without timely detection, prevention and prevention of the phenomenon of professional burnout. The above requires a deeper consideration of the theoretical aspects of the "burnout" syndrome, which will allow developing measures and means of protecting teachers of higher education institutions from the negative impact of psychogenic factors of professional activity.

References

1. Berezovska L. I. Professional burnout of employees of modern educational organizations. Scientific Bulletin of Mukachevo State University. 2015. No. 1 (1): 130-135.

2. Boyarchuk O. D. Biochemistry of stress: teaching. manual for students higher education closing / Govt. closing "Luhan. National Taras Shevchenko University". Luhansk: Publishing House "Taras Shevchenko LNU", 2013. 177 p.

3. Bulatevych N.M. How not to get exhausted while working during the quarantine period and avoid professional burnout [Internet]. Kyiv: KNU named after T. Shevchenko; 2020. Available: http://www.univ.kiev.ua/news/11073.

4. Dical M. V. Chernyukh O. G. Prevention of emotional burnout syndrome in teachers of educational

medical institutions. Bulletin of the Carpathian University. Physical culture. 2019;32:60-64.

5. Konovchuk N.S. The main causes and prevention of professional burnout in managers / Konovchuk N.S. // Law Bulletin of "KROK" University. – 2012. – Issue 14. – pp. 91-95. 3. Langle A. Emotional burnout from the position of existential analysis / A. Langle // Questions of psychology. - 2008. - No. 2. - P. 3-16.

6. Koshechko N. V. Prevention of the syndrome of "emotional professional burnout" of a university teacher. Pedagogy. 2016. 1(3): 21-28.

7. Kredenzer O. V. The syndrome of professional burnout during the pandemic [Internet]. Psychological support of the organization's personnel; 2020. Available: https://m.facebook.com/psy.pers/photos/a.107395840933227/130104031995741/?type=3&source=54.

8. Kumar S, Sinha P, Dutu G. Being satisfied at work does affect burnout among psychiatrists: A national follow-up study. Int. J. Soc. Psychiatry. 2013. № 59: 460-467. doi: 10.1177/0020764012440675.

9. Lalymenko O.S., Bekkelman I., Kapustnyk V.A., Zavgorodny I.V., Zabashta V.F., Tretyakova K.A., Tymbota M.A. Peculiarities of the formation of professional burnout among teachers of a medical higher education institution. Ukrainian Journal of Occupational Medicine Problems. 2019;15(2):121-130.

10. Lembryk I. S., Pryimak R. Yu. Syndrome of emotional burnout in a teacher of a medical university. Medical case. 2018;5,6:180-186.

11. Lysachenko O. D., Yeroshenko G. A., Bilash V. P., Pelypenko L. B., Shevchenko K. V. Distance learning at the department of morphological profile under quarantine conditions. Advantages and disadvantages. Herald of problems of biology and medicine. 2020;3(157):188–191.

12. Maslach C, Leiter MP. Understanding the burnout experience: recent research and its implications for psychiatry. World Psychiatry. 2016. 15(2): 103-111.

13. Myronchuk N.M. Professional burnout of a teacher of a higher school: factors, signs, methods of counteraction // Theoretical and methodological principles of development and self-improvement of the personality of an innovative teacher in the context of the modernization of a new Ukrainian school: coll. science and method works / edited by O.A. Dubasenyuk - Zhytomyr: Publishing House Evenok O.O., 2017. - P. 62-67.

14. Pigovska S. Prevention of emotional burnout syndrome // Psychologist. – 2011. - #14-15.

15. Psychological service of the professional technical education. Professional burnout of a teacher [Internet]. Available: https://sites.google.com/site/

16. Rothenberger DA. Physician Burnout and Well-Being: A Systematic Review and Framework for Action. Dis Colon Rectum. 2017. № 60 (6): 567-76. 9. Drummond D. Physician Burnout: Its Origin, Symptoms, and Five Main Causes. Fam Pract Manag. 2015. № 22(5): 42-7.

17. Shepitko V.I., Yeroshenko G.A., Lysachenko O.D., Klymach T.M., Boruta N.V. The cause and prevention of the development of "professional burnout" of a medical university teacher. Mater. International scientific and practical congress; November 2016 30; Geneva: European Association of pedagogues, psychologists and medics "Science"; 2016, p. 85-91.

18. Voloshko L. B., Lapenko T. G. Peculiarities of professional burnout of a teacher of a higher educational institution. Materials of the 8th International Scientific and Practical Internet Conference "Alliance of Sciences: Scholar-Scientist" (March 28-29, 2013). Access mode: http://www.confcontact.com/2013-alyans-nauk/pe5_voloshko.htm.

19. Wiederhold BK, Cipresso P, Pizzioli D, Wiederhold M, Riva G. Intervention for physician burnout: A systematic review. Open Med. 2018. № 13(1): 253-63.

20. Williams D, Tricomi G, Gupta J, Janise A. Efficacy of Burnout Interventions in the Medical Education Pipeline. Acad Psychiatry. 2015. № 39 (1): 47-54.

PEDAGOGICAL SCIENCES

THE ROLE OF IMPLICIT LANGUAGE ACQUISITION IN MULTILINGUALISM

Kostadinov O.
Ph.D., Guest Lecturer
Nikola Vaptsarov Naval Academy
Varna, Bulgaria
ORCID ID: 0000-0002-9183-5243
DOI: 10.5281/zenodo.12060997

Abstract

Multilingualism is a unique and demanding challenge for the human mind, requiring the ability to overcome various side effects. The primary challenges in multilingualism stem from the blending of the vocabularies of the languages under study and the shift from one foreign language to another. Language practice can also present challenges. However, all these negative phenomena are surmountable. The key to solving these problems lies in the method of acquiring vocabulary and grammar. There are two main methods for learning a foreign language: implicit and explicit. The implicit method is natural. There is nothing more sustainable than nature, making the implicit method the most efficient way to learn multilingual foreign languages. It is durable and has the significant advantage of being an easy way to learn. Implicit learning enhances cognitive flexibility and language acquisition.

Keywords: Implicit Learning; Multilingualism; Effortless Language Learning; Immersion in culture; Listening and Reading comprehension; Language Acquisition.

1. Introduction to Implicit Learning and Multilingualism

In today's globalised world, multilingualism is not just an asset but a necessity. The process of acquiring multiple languages often involves various learning methods, among which implicit learning plays a crucial role. This article delves into the cognitive benefits of implicit learning in multilingualism, compares implicit and explicit learning methods, explores ways to overcome challenges in multilingual practice, and suggests strategies to enhance language acquisition through implicit learning.

Implicit learning is often effortless, especially when it involves engaging with interesting content through listening and reading. When language learners enjoy the content, they perceive learning as a pleasure, thus making it seem effortless. Context helps learners understand new vocabulary, and when they encounter a word in different contexts, they learn its precise meaning. Repeated exposure to new words in various texts facilitates memorization. Initially, these words become part of the passive vocabulary, and with frequent repetition and use, they transition into the active vocabulary. This is the essence of the implicit method.

We cannot ignore the value of explicit foreign language learning. Implicit and explicit ways of learning are like both sides of a coin. There are four kinds of language skills: listening and reading, which provide input information, and speaking and writing, which produce output information. We should develop all language skills equally, as they are all important. Because of this, foreign language methodologies should balance all skills.

From a tactical standpoint, for learning two or more foreign languages, it is reasonable to start with implicit methods, which are not as intensive and fast as explicit methods, but they are more stable. Implicit methods preserve acquired knowledge and enhance language proficiency. The biggest advantage of implicit methods is that they are very effective for learning and maintaining several foreign languages at the same time. Implicit learning enables learners to internalise the language rules naturally, making it easier to switch between languages and promoting long-term retention.

It is also recommended to conduct short explicit learning sessions alongside implicit learning to accelerate the learning process. This dual approach ensures a comprehensive understanding of both vocabulary and grammar, fostering overall language development.

2. Definitions and Theoretical Foundations: Implicit Language Acquisition and Multilingualism

2.1. Definition of Implicit Language Acquisition

Implicit language acquisition refers to the subconscious process of learning a language, which is typically achieved through natural exposure rather than formal instruction. This type of learning occurs without the learner's explicit awareness of the language's rules and structures. Implicit learning is often associated with activities such as listening and reading, where the learner absorbs the language in context. It is a gradual process, relying heavily on repetition and the contextual usage of words and phrases. The learner internalises linguistic patterns and vocabulary through repeated exposure, which leads to a natural and often more stable retention of the language.

2.2. Definition of Multilingualism

Multilingualism is the ability to use and understand multiple languages with proficiency. This skill is increasingly valuable in today's interconnected world. Multilingual individuals can switch between languages with ease, often depending on the context and audience. The cognitive benefits of multilingualism include improved problem-solving skills, greater cognitive flexibility, and enhanced memory. Multilingualism is not only beneficial for communication but also for cognitive development and cultural awareness.

2.3.Theoretical Details and Interconnections

The interconnections between implicit language acquisition and multilingualism are profound. Implicit learning methods are particularly effective in fostering multilingualism because they allow for the simultaneous acquisition of multiple languages without the cognitive overload that can accompany explicit learning methods. When learners are exposed to multiple languages in meaningful contexts, they can implicitly learn the similarities and differences between these languages, which aids in better retention and application.

Implicit language acquisition leverages the brain's natural ability to detect patterns and regularities in the input it receives. This method aligns well with the way multilingual individuals often learn languages in diverse environments, such as multicultural families or international settings. By engaging in activities that involve natural language use, such as listening to conversations, watching media, or reading, learners can pick up multiple languages more organically.

Moreover, implicit learning is essential for developing a feel for the language, which is crucial for multilinguals. It helps to understand the nuances and cultural context behind language use, making communication more effective and authentic. The implicit approach also supports long-term retention and fluency, as it mirrors the natural language acquisition process observed in young children.

3. The Role of Implicit Learning in Multilingualism

Table 1 [1]

1. Cognitive Benefits of Implicit Learning

Subject	Detail	Description
Cognitive Flexibility	Benefits	The use of natural and contextual learning helps to improve the ability to transition between languages in a seamless way.
Memory Retention	Benefits	It helps to guarantee that vocabulary and grammar are kept for a longer amount of time by exposing them to them often and putting them to use in meaningful situations.

Table 1: This table presents the advantages of integrating implicit learning into multilingual practice. The conclusion is that intuitive learning is more effective for learning multiple languages simultaneously while simultaneously maintaining and improving them.

Table 2 [2]

2. Comparing Implicit and Explicit Learning Methods

Subject	Detail	Description
Learning Efficiency	Advantages	Implicit learning is more effective and long-lasting than explicit learning, and it requires less mental effort to do. In addition, it is more efficient and maintained than explicit learning.
Effort and Engagement	Characteristics	Via the process of implicit learning, language is absorbed via actions that are cultural in nature and include participation from the learner. Learning in this manner is not only simple but also fascinating.
Natural Acquisition	Properties	A reflection of the acquisition of the first language via exposure and interaction rather than through formal instruction is provided here.

Table 2: Here, the two learning methods - implicit and explicit learning - are compared. In conclusion, implicit learning is more resilient and effective, offering an easier and more sustained approach to multilingual learning.

Table 3 [3]

3. Overcoming Challenges in Multilingual Practice

Subject	Detail	Description
Vocabulary Blending	Strategies	There are a variety of tactics that may be used to prevent and regulate vocabulary mixing. These strategies include context-specific practice and language-specific signals.
Transition Techniques	Methods	There are a variety of strategies that may be used to aid the transition between languages. Two examples of these approaches include code-switching practice and contextual hints.
Practical Application	Instances	The following are some instances of successful multilingual individuals that have used implicit learning strategies, such as living in environments that provide opportunities to acquire many languages.

Table 3: The table presents technical strategies for overcoming challenges in multilingual practice. It outlines techniques for blending vocabulary and methods for facilitating the transition between different languages.

Table 4 [4]

4. Enhancing Language Acquisition Through Implicit Learning

Subject	Detail	Description
Sustained Practice	Activities	Reading, listening to music, and having conversations with native speakers are all examples of activities that provide ongoing and natural exposure to languages.
Contextual Learning	Techniques	Learning vocabulary and grammar via context-based learning, as opposed to acquiring them by rote recall, is the most effective way for expanding one's vocabulary and grammatical knowledge.
Cultural Immersion	Benefits	Immersion in the culture of the language being acquired to facilitate the use of the language in natural settings and to get a more in-depth understanding of the culture.

Table 4: This table provides examples of successful cases of multilingual individuals who have used implicit learning strategies, such as living in environments that provide opportunities to acquire many languages.

Conclusion: Implicit learning is a powerful tool for learning multiple languages, offering significant cognitive benefits and more natural, efficient learning processes. By leveraging implicit learning techniques, individuals can enhance their cognitive flexibility, memory retention, and neural plasticity, making multilingualism a more attainable and enriching experience.

References

1. Reber, A. (1993). Implicit Learning and Tacit Knowledge: An Essay on the Cognitive Unconscious, Oxford University Press, ISBN: 978-0195106589

2. Ellis, R. (2009). Implicit and Explicit Knowledge in Second Language Learning, Testing and Teaching, Multilingual Matters, ISBN: 978-1847691746

3. Bialystok, E. (2007). Cognitive Benefits of Language Learning: Broadening Our Perspectives", Proceedings of the National Academy of Sciences, DOI: 10.1073/pnas.0704309104

4. Aronin, L. & Singleton, D. (2012). Multilingualism: Understanding Linguistic Diversity, Cambridge University Press, ISBN: 978-0521197321

PHILOLOGICAL SCIENCES

МЕТАФОРИЧЕСКОЕ И ЛИНГВОКОНИТИВНОЕ ФОРМИРОВАНИЕ ЗООМОРФИЗМА, ОТНОСЯЩЕГОСЯ К КОНКРЕТНОМУ ЧЕЛОВЕКУ, В ПРОИЗВЕДЕНИЯХ ИСКУССТВА

Норкузиева Д.Ш.
Докторант Самаркандского государственного университета,
Самарканд, Республика Узбекистан

METAPHORICAL AND LINGVOCOGNITIVE FORMATION OF ZOOMORPHISM RELATED TO A SPECIFIC PERSON IN WORKS OF ART

Norkuziyeva D.
Doctoral student of Samarkand state university,
Samarkand, Republic of Uzbekistan
DOI: 10.5281/zenodo.12061328

Аннотация

В данной статье представлено использование зооморфизмов в произведениях искусства и их анализ, а также метафорическое образование зооморфизмов, относящихся к конкретному человеку. Кроме того, излагаются теоретические мнения лингвистов о зооморфизмах, использовании кличок домашних животных в разных ситуациях и в разных значениях, приводятся и подробно анализируются примеры словосочетаний, связанных с названиями животных.

Abstract

This article presents the use of zoomorphisms in works of art and their analysis, as well as the metaphorical formation of zoomorphisms related to a specific person. Moreover, the theoretical opinions of linguists about zoomorphisms, the use of pet names in different situations and in different meanings are expressed, and examples of phrases related to animal names are given and analyzed in detail.

Ключевые слова. Произведение искусства, зооморфизм, метафора, языковой феномен, этнокультурный зооморфизм, дикое животное.

Keywords: Work of art, zoomorphism, metaphor, linguistic phenomenon, ethnocultural zoomorphism, wild animal.

INTRODUCTION. In recent years, despite the fact that sufficient research has been conducted on metaphor in world linguistics, the interest in it is increasing day by day. Because in order to use the words in the language, there is a need to know their figurative meanings as well as their own meaning. This creates the need for a comprehensive study of metaphor in linguistics. Accordingly, as a result of many studies, the basic rules related to the use of metaphor in oral and literary style were developed and the concept of metaphor was defined as a language unit. Because metaphor, as a linguistic phenomenon, accompanies language and speech everywhere, and from this point of view, many linguists consider metaphor from different perspectives and express their opinions about this phenomenon. In many fiction books, zoomorphic images are formed using metaphors. Zoomorphism refers to the metaphorical use of animal images in forming a figurative description of a person or object.

REVIEW OF LITERATURE ON THE SUBJECT. We should pay special attention to the opinions of A.P. Chudinov, a linguist. According to him, metaphor should be interpreted as a basic mental process that unites two conceptual field and allows us to use the power of constructing a source field using a new field. These points of view also affect the study of metaphors in Uzbek linguistics. Due to their linguistic properties, zoomorphisms provide rich and interesting material for researching the problem of the reflection of human life or, in other words, the worldview in language. According to F. Guketlova, the most convenient way to determine the ethnocultural specificity of the zoonymic lexicon describing a person is the traditional term “zoomorphism”, which is understood as a metaphorical name manifested in the image of a specific representative of the fauna in the analysis of the lexicon from the point of view of the emotional-evaluative description of a person.

Kiong, a linguist, studied zoomorphisms from the system-structural aspect. V. Kamenskaya and S. Ogdonova used zoonym and zoomorphism as synonyms for each other in their first studies, and later approved the terms zoocharacteristics and zoomorphism in relation to metaphor, and showed zoomorphisms as language units that create metaphorical meaning. O. Latipov's scientific research in Uzbek linguistics is devoted to the analysis of the semantic structure of pet names in Russian, Uzbek and Tajik languages. B. Zaripov conducted his scientific research on the role of zoonyms used in Navoi’s works in the creation of artistic forms. G. Hakimova studied the structural-semantic aspect of phraseological units with zoonym component in the English language [1]. However, despite so many scientific studies, in linguistics, terms related to the animal world are called by different names, and their terminology has not been unified in terms of content and scope.

METHODOLOGY OF THE RESEARCH. One can imagine concepts in fiction where zoomorphism encourages people to imagine themselves as non-human animals. It can also be defined as art that depicts one type of animal as another animal species, or art that uses animals as a visual motive. Basically, the concept of zoomorphism refers to the use of animal names and characteristics in fiction in terms of human characters, and the description of animals in terms of certain traits and characteristics. This lexicological term is derived from the Greek language, meaning "zoo" - animal, "morphism" - form.

Emphasis was placed on the specifics of the reference to the human image through zoomorphisms, and mainly some animal names were used to reveal the human image and character traits. From the time when the primitive system and its worldview were formed, mankind has been interested and afraid of the world of nature and order. According to totemistic relations, lions, tigers, leopard, falcons, eagles, hawks are depicted as symbols of bravery, boldness, and nobility, while black ravens are depicted as symbols of meanness, bloodthirstiness. Language has several possibilities in revealing the human image through them. The importance of the vocabulary in the language increases even more when reflecting the image of a person through the images of animals and revealing their characters. Language has several possibilities in revealing the human image through them. The importance of the vocabulary in the language increases even more when reflecting the image of a person through the images of animals and revealing their characters. Since ancient times, people have had a very close relationship with animals and other animals in nature. The main goals of this were that animals have been the main helpers in everyday life and work for mankind for several thousand years. In addition, the animal world is the main source of food for mankind. Since the beginning of the development of consciousness in mankind, animals have been the main assistants in the process of hunting. This process caused people to fully master the secrets of the animal world, develop their work ability and increase their interest. As the skills of how to deal with wild animals are formed, the need to train domestic animals has always increased.

In many examples of fiction literature, the impressiveness of the style has led to the use of many animal characters and their names in order to expand the weight of the subjects and attract the reader's attention. For example, people who are cunning, deceitful and liars are depicted foxes, and stupid, greedy, and avaricious people are depicted wolves, and people who live in a carefree life only in pleasure and laughter are depicted to bear-like characteristics and names. Based on this, it can be said that each of these animal forms performed a specific methodological task in the text of the work. It should be noted that people with negative behavior and character are always depicted as beasts and wild animals, while people with positive and virtuous qualities are always depicted as domestic animals. We can find these ideas in the tales and epics of many Uzbek and world nations.

In fiction literature and art, animal characteristics can be depicted based on human behavior and character traits. It is known from history that in ancient countries, some gods were depicted in the form of animals, such views were considered an important factor not only in art, but also in the emergence of religious zoomorphism. Based on the mentality of its culture and history, each nation approaches animals with different beliefs and viewpoints. For example, historically, in the ancient Egyptian state, the god Anubis is usually depicted as a half-man and half-jackal, and in some sources, he is depicted as a dog. The deity known as Bastet is lion-like, or a woman's head is embodied in the form of a lion's head. In other images, she is depicted with kittens by her side, as she is recognized as the goddess of fertility. In ancient Egypt, people believed in cats and worshiped them. If someone's cat died, the owner mourned the cat and shaved its eyebrows. Among many Turkic peoples, the image of a dog is considered a symbol of courage, nobility, loyalty and faithfulness.

ANALYSIS AND RESULTS. A dog is one of the domestic animals that have been living side by side with people for several thousand years, guarding the territory, things, and animals belonging to humanity, showing their loyalty, courage, and selflessness. In historical sources, there are different opinions about the faithful dog and its training for human hands. For example, in many stories of Said Ahmad, one of the Uzbek writers, the image of a dog is depicted with special aesthetic coloring and skill. Even in the epigraph of one story, it is mentioned that *"Jannatga kiradigan o'n nafar hayvondan biri bu* "Ashobi kahf"ning vafodor itidir*"* [8]. In the Explanatory Dictionary of the Uzbek language, the dog is defined as follows. A four-legged mammal pet kept for household guarding, hunting, and other purposes. *Ko'ppak it, ov iti. Katta temir darvoza ostida cho'zilib yotgan hirsday it boshini ko'tarib irillaydi* (A.Qahhor: 1996). Boshsiz odam. Shu hayvonga nisbatlanuvchi haqoratni bildiradi. Azizbek qarshisida qo'l bog'lab turgan darvoza begiga qaradi. - *Nega qarab turasan, darvoza ustiga chiq, kim ekan, u it?* A.Qodiriy. O'tgan kunlar. Xalq tovushi tinimsiz guvullaydi: - *Bu yoqqa chiq, itlar!* (Oybek. Selected works: 18).

One of the most common animal names in Uzbek literature is a dog. There are many zoomorphisms associated with the name of the dog in the literature. Including, - *lekin ustozi hayot vaqtida ipakday muloyim, itday sadoqatli bo'lgan bu bukri savdogar jon taslim qilgan kuni kechasi uning qiziga, eri o'lib tul qolgan qizi Rayhonabonuga tajovuz qilgan, ular shu vajdan qattiq to'qnashgan edi. (Yakubov, Selection: 1-19).* The phrase "loyal as a dog" is used in the above sentence. In this case, it is used in relation to how a dog guards its home, its surroundings, its owner, and its belongings. The zoomorphism presented here serves to strengthen the meaning of the text and to increase its stylistic color.

Here is another zoomorphism related to dogs… - *A'zoyi badani qattiq charchoqdan holdan toygan Martin bu yerda itday ishlab, ijod to'g'risida o'ylash u yoqda tursin, o'zini ham unutib qo'yadi*. *(Language and literature education, 2006: 66).* In the excerpts

from the above works of art, the phrase "*works here like a dog"* is used to describe a hard-working, tireless and very tired person in a brighter and more reliable way. In our daily life, i.e., in our conversational style, the phrase "I'm tired as a dog" is used in the language of tired people who work from morning till night. - *Nega u o'z otam, rahnamomday tuyuladi, nega uni ko'rsam unga qul bo'lgim keladi, etaklarini o'pgim, unga xush yoqish uchun itday hurgim, yaltoqlangim keladi? Nega uni ko'rsam egasini ko'rgan itday ichimda baxtiyorlik, saodat uyg'onadi? (Nazar Eshonqul, The Man Led by the Monkey: 91).* In this passage, an attempt is made to describe the image of a person who is toady and flatters himself in front of others. That is, the dog is always around its owner and responds with various actions to please him. In our language, the phrase "don't flatter like a dog" can also be an explanation for the above example.

But similes associated with the name of this animal are not always used in a positive sense. In the excerpts from the following works of art, zoomorphisms associated with dogs served to embody the image of negative people. *Bilardim itday o'lib ketishingni itdan farqing yo'q edi! O'ldir, meni ham o'ldir, qotil! - parrixta, sho'rida Ko'k Tursun o'zini Bo'stonga otdi. - Meni ham itday o'ldir. (Aytmatov, The Day Lasts More Than a Hundred Years: 545). Itday akillab o'tdim! Jannat xola. «Itday akillash» ingiz tagida qanchalik mehr borligini bilardim. (Boboyev, Nameless Stars: 254). Kecha jo'ram qanday dam olyapti ekan, deb xabar olgani kelsam, itday qopib berdinga. Sirkang suv ko'tarmaydigan bo'p qopti o'zi. Odatdagidek, ortiqcha mulozamatsiz osongina yarashishadi. (Eastern Star, 1992: 48).*

In the excerpts from the above works of art, the phrase "dying like a dog" is used for people who are constantly speaking words that come to their mouths, who die neglected and humiliated. That is, the phrase "wanderer dog" is also used for homeless and neglected people.

According to the Explanatory Dictionary of the Uzbek language, dog is also used in the sense of insulting this animal [3]. In other words, the word "dog" is used as a derogatory term for people who are incompetent, lazy, greedy, and hypocrite. *For example: Hoy, it! Nechun shariat panohlarini haqorat qilding? G'ofir. Boyota! Men xotinfurushlarni haqorat qildim, xolos! Qozi. Hoy, it fe'l, qadr bilmas! (M.Isroilova, 1981: 80). Mo'min. - Hoy it! Sigaret chekmaysanmi? razvedkachi oyog'i bilan uning iyagidan ko'tardi, - buni qaranglar-a! Bu kishim granatamyot bilan jang qiladilar. (Norkobil, Who Wakes the Sun: 208).* In the above examples, the transfer of meaning is used. That is, the root meaning of the word "dog" includes the meanings of barren, disrespectful and insulting.

Sometimes in literature and in everyday life, the phrase "puppy" is also visible. Puppy: The child of a dog, born of a dog (applies to a young child*). Nuqul itvachcha der emish, astag'firullo, o'z bolasini, o'zi tug'gan bolasini itvachcha desa-ya!. A. Qahhor. The lights of Koshchinar.* With this meaning (mainly in relation to young people) it is used for insult. *Shoshmay tur, hali u izzatni bilmagan itvachchani tutib adabini bermasam, Madumar otimni boshqa qo'yib yuboraman.* The word "puppy" is used in a negative sense in the excerpts from the following works of art. *Xudoning balosi, itvachcha! Maktabda kiming bor? O'liging qola qolsa bo'lmasmidi shu maktabda! - Kennoyim qulog'imni burab ura ketdi, - itvachcha, yetimcha! Bo'rining bolasi o'lganda ham it bo'lmaydi! (Aitmatov, First Teacher:18). Yolg'on aytyapsan, itvachcha! Pora olishni ikki barobar kuchaytirganingdan xabarim bor. Tushgan pullarni shahar tashqarisidagi uyingga berkitib qo'yganingni ham bilaman (Tokhtaboyev, Riding the yellow giant: 290). Sher bo'lsang, kuchingni ko'rsat, itvachcha! G'oyat chaqqonlik ko'rsatib, qattiq zarb bilan Salimning ko'kragiga pichoq urdi. (Oibek, Selected Works of Four Volumes: 2-320).*

The word "puppy" is also usually used in the sense of insulting, derogation, swearing. Often, older people say "puppy" to scold, insult, and touch the ego of younger people. In the fiction literature, there are also expressions related to the name of the dog animal: For example, the phrase "dog sucked" is used to insult, scold, dishallow. - *It emgan Haydarning gapini eshitdingmi, hali? Ha, deydi, shu afandi maktabida o'qib chiqgon bolalar, deydi, ayraplaniga tushub uchar emish, deydi. (Qadiri, Mallavoy in Jirvan, 295)...xudoy haqqi betahorat qiladi, it emganing uzi partiynay ekana, xumsa. - Anuv, Xoshim xezalakni taniysanmi. Ana o'sha lapka ko'targan saki bedumingb ham to'rtta go'dagi bilan xotunini qo'yipti, it emgan, endi bir tatarskasiga. (Qadiri, 1993: 18).*

This phrase is used in the sense of insulting, humiliating and cursing. Often, big and rich officials use this sentence in relation to the disrespect and rudeness of their lower castes.

But often among the Turkic peoples, the image of a dog is embodied as a symbol of loyalty, faithfulness and hard work. Because since ancient times, among many Turkic peoples, the dog has been a constant loyal friend and companion in hunting. But on the contrary, in the culture and art of many European nations, it is the opposite. A dog is primarily a domestic animal adapted for guarding, monitoring its territory through its senses. A dog has a highly developed ability to see, hear, smell, and anticipate danger. The proverb *"Tunda balo kezmasa, it akkillamas"* was created taking into account these characteristics of the dog.

Zoomorphisms are selected based on the nationality, lifestyle and culture of the people in the semantic field of each language. In particular, the image of a sheep is often mentioned in works of art. The well-known translator and scientist G. Salomov in his treatise "On the issue of translating proverbs, matals and idioms from Russian to Uzbek" focused on this topic and wrote "...the symbol of evil, pestilence is a snake, a scorpion; the symbol of savagery is a wolf; a symbol of gentleness are a laughing dove (that's why it is called "carefree like a laughing dove"), a sheep; a symbol of hard work are ants and bees; symbol of size are an elephant, a camel; a symbol of cunning is a fox; a symbol of rudeness is a bear; a symbol of ignorance and recklessness is a donkey, a pig; a symbol of peace is a dove;

a symbol of beauty is a peacock; Nightingale is a symbol of happiness. But in different peoples, objects of analogy may have their own characteristics [1] The scientist also points out that in the works of Homer, the cow is interpreted as a symbol of the beauty of a lover, while a donkey and a fly are embodied as symbols of courage.

In particular, it is embodied in artistic works as a symbol of meekness and calmness. The word "sheep" is used in various figurative meanings for people. In the common language, the names of sheep are still different depending on their gender, age, and color. That is, each of them has its own name in the language. A ram is an unshorn male sheep over two years old. This word has been used in the history of Turkic languages for a long time, and M. Koshgari states that it is an Ugz word used in its chinar and kochbinar forms [2]. Also, in the common language, the term pichma is used for a shorn male sheep, while the term ishshak is used for a two-year-old sheep. In the history of Turkic languages, the term used in the form of qo'zu (lamb) [2] is now used in the form of ship in the common language. *An example of this is that Hazrat Ali, the leader of the saints, said* "Doim mening xotirim bo'ri tekkan qo'ydek tarqab sochiladi, men esam cho'pondek, ularni yig'ish bilan ovoraman, ular esa qochish bilan" *(Donish, Navodirul-waqoe: 2021: 282).* Xuddi bo'yniga arqon solingan qo'ydek ergashganim o'zimga alam qildi. Qo'yvor! - dedim jildni bo'ynimdan olib. *(Hoshimov, Sale of life: 1993, 343).* ...bo'lgan tog'am bu gal o'zini, negadir, qo'ydek yuvosh tutibdi. — Tavba, dedi Bozorvoy amakim ovqatlanib o'tirgan xotini Lutfi xolamga qarab. *(Tokhtabayev, Mungli kozlar: 1991, 197).* Ho'kiz esa, qassob qo'lida pichoqni ko'rib itoatkorlik bilan bo'ynini cho'zgan qo'ydek, boshini tuproqqa qo'yib, olaygan ko'zlarini podachiga tikdi. *(Kholmirzayev, Volumes: 2003, 301).*

The wolf, which is one of the wild animals, has been interpreted as a symbol of strength, bravery and courage among Turkic peoples since ancient times. The wolf was the sacred animal, or totem, of the ancient Turks. Since ancient times, the wolf has been considered as a guide, a giver of wisdom and courage, a symbol of freedom and independence of the Turks. In Chinese sources, the term "wolf" was understood equally with the Turkish khagan, that is, the powerful khagans were assessed as "a person with all the characteristics of a wolf". Shu bo'riday tashlanadi. Ko'rganman-da... O'zi mard odamlar sodda keladi, to'g'rimi? Shu gapingiz to'g'ri...*(Kholmirzayev, Volumes: 2005, 380). For example,* shofyori hozir oldida bo'lsa bo'riday g'ajib tashlardi. Heh, tavba, kambag'alning orqa tomiri tarang bo'ladi, deb bekorga aytishmaskan-da. *(Khazratkulov, Kokkol: 2005, 43).* Bir shisha aroq bilan uni yegandan keyin yana bir shisha aroqni yarim qildi va shundan so'ng och bo'riday uvlab-uvlab uyquga ketdi. *(Cholpon, Works: 1994, 229).* The names of wild animals in the Uzbek language are familiar to many: lion, tiger, wolf, fox, bear, giraffe, leopard. A lion is a large representative of the feline family. Because they do not know fear, our people call brave young men like lions, and brave and strong young men are described as *sherkelbat* (Lion-shaped). In a figurative sense, it refers to a person as a lion (in the sense of majesty, hero, wrestler).

- *Balli., sher, xatni qo'lingizdan kim oldi? –Bir chol. (A. Qadiri, Days gone. 2013, 16).* Lions, tigers, leopards, and husbands are here. It is used in the sense of being in a state and movement like a lion. We can also find different interpretations in other sources. Fig'on qilgan bunda sherlar, Yo'lbars, qoplon, bunda erlar. It is used in the sense of being in a state and movement like a lion. We can also find different interpretations in other sources. *Ali Qushchi o'zini bosishga qancha urinmasin, go'yo qafasga tushgan sherday betoqat bo'lib, hibsxonada gir aylanar, qorong'ida turtinib g'adir - budir devorlarni, temir koplangan og'ir eshikni qayta-qayta paypaslab ko'rardi. (Yakubov, Treasure of Ulugbek: 1978, 203).* Oqibat zanjirband etildi sherdek, lek boshin egmadi bo'ysunmas erdek! Diyonat xo'rlandi, bulg'andi iymon, Insof chavaqlandi, bo'g'ildi vijdon. *(Boyqabilov, Quiet Khorasan: 1992, 250).*

Today, in many historical works, it is noted that "bugra" means a camel with two scythes [5]. In this regard, Muhammedjanov commented that "bugra" means a saddled camel that carries a heavy load [6]. It is known that "bugra" is the totem of the Yagmo tribe. The Yagmo tribe was a herdsman and had a nomadic way of life. The nomadic life was certainly hard, and it was not easy to drive one's livestock from place to place. The existing political, socio-economic conflicts are also difficult for all the nomadic tribes, until they often change the areas where they live, and sometimes they stay in neglected sandy deserts for a long time. The religious beliefs of these tribes were also formed in such a difficult situation. They often chose this animal as a totem, i.e. the beginning of their ancestors. Therefore, the totem of the Yagmo tribe was also considered "bugra" based on these principles. "Bugra" is clearly a camel. But not every camel became a totem. Because in the above-mentioned conditions of life, the heavy load-carrying camels were of great importance. Among such camels can be included male camels that have been slaughtered. Their load-carrying capacity and level of endurance were also higher than that of ordinary unslaughtered and female camels. As we can see, in this matter A.R. Muhammadjanov's opinions can be considered correct.

In fact, "bugra" is a camel that carries a heavy load, and it is considered the largest of the camels. It was not for nothing that the nomadic herdsman Yagmo tribe chose this powerful animal as their totem. Of course, at that time, the camel was also highly valued as a means of transportation on long, difficult roads. Thus, "bugra" is a saddled camel that carries a heavy load and was considered a totem of the Yagmo tribe, which was later used instead of a title in the name of the Khakans. However, the sources do not say exactly when and why the term "bugra" was used instead of a title in the name of the Khagan.

In the following sentences, a camel is described as person that is going without water for a long time, swallowing when it sees water, drinking in a hurry, and cannot get enough even after drinking so much. *Men ham yutoqqan tuyaday ichaveribman. Bir vaqt qarasam,*

boshqa xonada yotibman. (Kholmirzayev, Volumes: 2005, 276). *Oynisa o‘rik shoxiga osiqlik ketmonni olib ariqdan gulzorga suv ochib yubordi, qatqaloq yer namni chanqoq tuyaday simira boshladi.* (H. Ghulam, People of Tashkent: 1975, 125).

Sometimes the phrase “like a drunken camel” is used in the works of art: *Havoning qovog‘i soliq, dengiz notinch, katta - katta to‘lqinlar mast tuyaday ko‘pirib, kemani u yoqdan - bu yoqqa uloqtirar edi. (Kadyrov, Pass of Generations: 1994, 187).* Mast tuyaday o’kirgan Davronning endi hech narsadan qaytmasligini sezadi. O‘lim xavfidan o‘zini yo‘qotib qo‘yadi va qo‘rqib orqaga tisariladi. *(Kadyrov, Meros: 1975, 327).*

CONCLUSIONS AND SUGGESTIONS. It can be concluded from the above-mentioned points that we can find many zoomorphisms related to the name of the animal in the works of art. There are especially many zoomorphisms related to the name of a dog. Each animal acquires a different color from the point of view of the situation, that is, sometimes it is positive, and sometimes it is negative. In particular, dog-related zoomorphisms are interpreted more in a positive way. But most of the related phraseology is distinguished by having a negative connotation. It can be said separately that the image of a dog in folklore serves to illuminate almost all aspects of the daily life of the Uzbek people.

Regardless of the nationality and language of the people they are used, they create positive skills such as enriching the folk art, being able to evaluate positive and negative situations in people, understanding the happenings and the right approach to every work. If we observe the use of animal names in folklore, we can see that each animal name has its own seminal development. Because their manifestation in speech is different, and each zoonym acquires a figurative meaning according to its different characteristics, natural living conditions, and people's attitude.

References

1. Bakhronova D.K. Semantic and linguocultural characteristics of anthropozoomorphisms (in the material of Uzbek and Spanish languages). Abstract. p.3.

3. Madvaliyev A and others. An explanatory dictionary of the Uzbek language. “Publishing Office of Uzbekistan”. Tashkent - 2021.

4. Ismaili M. Fergana until dawn. 1995. p.476.

5. Latipov O. Analysis of the semantic structure of the thematic space pets in different system languages (and the material of the Russian Uzbek and Tajik languages) Abstract, p.3.

6. Norkuziyeva D.Sh. Ethnolinguistic characteristics of zoomorphisms. INTEGRATION OF SCIENCE, EDUCATION AND PRACTICE. pp.327-331.

7. Jumanazarova G. Lingupoetics of the language of the sagas of Fozil Yoldosh’s son (lexical-semantic, linguostylistic and linguostatistical analysis). - Tashkent, 2012. - P.15-16.

8. Zaripov B. The participation of zoonims in the creation of art forms (based on the works of Alisher Navoi). Abstract. p.3.

9. Marufova Z. Expressing beauty through zoonyms in Uzbek classical poetry. Oriental Renaissance: Innovative, educational, natural and social sciences. Scientific journal. p.309.

10. https://tafakkur.net/qorakoz-majnun/said-ahmad.uz

PHYSICAL SCIENCES

IT FOLLOWS FROM THE SPECIAL THEORY OF RELATIVITY THAT THE INVISIBLE AFTERLIFE WORLD PREDICTED BY ALL RELIGIONS IS IN FACT PHYSICALLY REAL[1]

Antonov A.
PhD, HonDSc, H.Prof.Sci
Independent researcher, Kiev, Ukraine
DOI: 10.5281/zenodo.12061500

Abstract

The article proves that the generally accepted version of special theory relativity (SRT), which states that imaginary numbers are physically unreal, is incorrect. Experimental evidence is given of the general scientific principle of the physical reality of imaginary numbers, with the use of which a corrected version of the SRT was created. She argues that in addition to our visible universe, there are many other mutually invisible universes in nature. And they form the actually physically existing afterlife invisible world, predicted by all religions.

Keywords: imaginary numbers, special theory of relativity, invisible universes, afterlife invisible world.

1. Introduction

Imaginary numbers, discovered about 500 years ago by Scipione Del Ferro, Niccolò Fontana Tartaglia, Gerolamo Cardano, Lodovico Ferrari and Raphael Bombelli [1], are known to everyone and are currently used in all exact sciences. They are even studied in school mathematics courses. But unlike other numbers that are understandable to everyone - integers and fractions, positive and negative, scalar and vector, etc. - their physical essence has not yet been explained. Indeed, what 2 kg., 3 m., 4 sec. is clear to everyone, but what is 2*i* kg., 3*i* m., 4*i* sec., where $i = \sqrt{-1}$, no one can explain. Nevertheless, no one cared about this, just as, for example, now no one can explain. Nevertheless, no one cared about this, just as, for example, now no one cares that the phenomenon of ball lightning is not explained.

But at the beginning of the 20th century Joseph Larmor [2], Nobel Prize winner Hendrik Anton Lorenz [3], Jules Henri Poincaré [4], Nobel Prize winner Albert Einstein [5] and other outstanding scientists created the special theory of relativity, which rightly accepted to be considered an outstanding scientific achievement of physics of the 20th century, because it proposed the principle of relativity. And which is therefore now studied in all physics textbooks used in the educational process even at the most prestigious universities. However, in this theory, calculations using relativistic formulas, which were the final result of all reasoning, in some cases led to a result measured by imaginary numbers. And this result already needed to be explained. After all, no one would need a theory that even its creators could not explain. But the authors of SRT did not know how to do this. And the fate of the service station hung in the balance. But it was saved by the fact that an additional postulate was introduced into the SRT, called the principle of not exceeding the speed of light, from which it followed that quantities measured by imaginary numbers do not exist in nature. And therefore, there is no need to explain them.

This is the form in which SRT is still taught.

2. The physical reality of imaginary numbers.

But besides STR there are other sciences. Including the theory of electrical circuits, which is used in radio engineering, electrical engineering and computer science. Fundamental to this theory is Ohm's law [6], [7], discovered in 1826 for DC electrical circuits, which is now studied even in school physics textbooks. And in 1893, Charles Proteus Steinmetz proposed its interpretation of Ohm's law for alternating current electrical circuits [8], which is now used daily by millions of engineers around the world in their work. In this theory of electrical circuits, the imaginary resistances of capacitors and inductors, which can be measured by instruments, were recognized as actually physically existing. And if these imaginary resistances were recognized as physically unreal, as follows from SRT, then neither radio engineering, nor electrical engineering, nor computers, nor radio measuring instruments should exist.

[1] This is reprint of the article "Antonov A. A. From the physical reality of imaginary numbers it follows that the invisible afterlife world predicted by all religions actually exits. Norwegian Journal of development of the International Science. 130. 36-41.
https://doi.org/10.5281/zenodo.10975059".

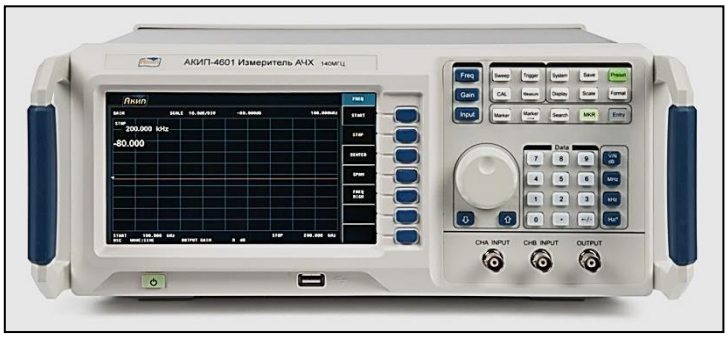

Fig. 1. In any radio-technical laboratory there are devices called frequency response meters, which prove the physical reality of imaginary and complex numbers by their mere existence

But they do exist. And thereby they prove the physical reality of imaginary numbers [9]-[33]. Consequently, by the existence of radio- and electrical engineering, the generally accepted version of SRT was refuted even before its creation. Other proofs of the physical reality of imaginary numbers have been published in [34]-[46]. Therefore, the logical conclusion is that the version of SRT currently presented in all physics textbooks is incorrect [47]-[66]

3. Physical reality of invisible parallel universes

In the existing generally recognized version of SRT from its relativistic formulas and the principle of non-exceeding the speed of light also follows that in nature there is only our visible universe in which everything is measured only by real numbers. However, in the corrected version of SRT [67]-[74], from its relativistic formulas it follows that in our Multiverse [75]-[85], in addition to our visible universe, there are also about twenty other mutually invisible parallel universes

And one can be convinced of their existence [86]-[91]. as a result of astronomical observations of the starry sky in portals [92]-[94], since the constellations in them will differ - and the further into the portal one penetrates, the greater the differences will be - from the constellations observed at the same time in the same region outside the portals. And since there are a lot of anomalous zones [95]-[98] on Earth,

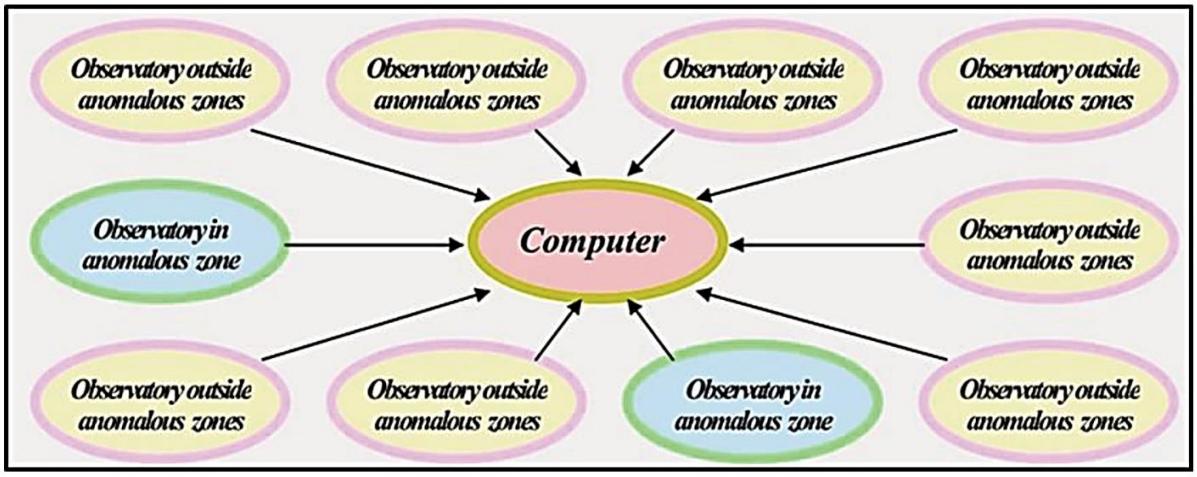

Fig. 2. Scheme of an astronomical experiment to detect invisible universes

such anomalous zones. Like, for example, the main astronomical observatory of the National Academy of Sciences of Ukraine, located in Goloseyevsky forest 12 km from the center of Kyiv. Therefore, in order to verify the existence of neighboring invisible universes adjacent to our visible universe, it is enough to compare on a computer the observations of this observatory with the observations of neighboring observatories located outside the anomalous zones.

4. Why, despite all the refutations of the generally accepted version of SRT, set out in all physics textbooks, it continues to be taught.

But this simple and low-cost experiment, which in the most indisputable way will allow us to answer the question of whether there are invisible universes neighboring our visible universe, no one has done or is going to do. Obviously, because physicists do not need such an answer, since it will refute the version of SRT studied in textbooks.

The corrected version of SRT states that imaginary numbers are physically real and invisible universes exist. Therefore, having become convinced of the existence of invisible universes, we will have to admit that the corrected version of SRT is correct and once again be convinced that imaginary numbers actually physically exist. And then it will inevitably be necessary to explain their physical meaning of imaginary numbers. And it is obvious - in addition to our visible world, there is an invisible world.

5. The existence of a physically real invisible world

However, the usefulness for science of the above experimental evidence of the physical reality of imaginary numbers goes beyond problems of correcting the

version of SRT given in physics textbooks. From experimentally proven principle of the physical reality of imaginary numbers, one will inevitably have to conclude that the results of all studies described by imaginary numbers in all other exact sciences also are physically real.

Then many difficult questions will arise. For example, what exists in the looking glass when we see ourselves in the mirror? And therefore, in the end, we will have to admit that in addition to our visible world, there is also a huge (most likely even much larger than our visible world) invisible world [99]-[107]. Indeed, in addition to the room in which we are now and which we see, there are a large number of other invisible to us rooms in other apartments, houses, cities and countries. The same situation is in space – in addition to our visible universe, in other dimensions there are about twenty other parallel universes of the hidden Multiverse that are invisible to us. And outside of our hidden Multiverse in the Hyperverse, there are many other Multiverses.

And the existence of such a world invisible to us, in which Gods and the souls of the dead live, was long predicted by all world religions. Consequently, what these religions say about the world order, about the afterlife, is true. And therefore, all of us, the inhabitants of planet Earth, will now have to believe in this.

6. Conclusion

The author hopes that the information presented in the article will be an incentive to unite the efforts of science and religions in their activities for the benefit of people.

Acknowledgments

The author is cordially grateful for the understanding, comments and help of his wife Olga Ilyinichna Antonova.

References

1. Weinstein E.W. (2005). The CRC Concise Encyclopedia of Mathematics. 3-rd ed. CRS Press. Roca Raton. FL.

2. Ohm G. S. (2014). Die galvanische Kette. Verlag Der Wissenschaften. Göttingen.

3. Ohm G. S. (2015). Gesammelte Abhandlungen. Severus Verlag, Hamburg.

4. Steinmetz C. P. (2010). Theory and Calculation of Electric Circuit. Nabu Press. Charlstone.

5. Larmor J.J. (1897). A Dynamical Theory of the Electric and Luminiferous Medium. Part III. Relations with Material Media. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences. 190, 205-300.

6. Lorentz H.A. (1899). Simplified Theory of Electrical and Optical Phenomena in Moving Systems. Proceedings of the Netherlands Academy of Arts and Science. Amsterdam. 1, 427-442.

7. Poincaré H. (1905). On the Dynamics of the Electron. Comptes Rendus. 140. 1504-1508.

8. Einstein A. (1905). Zur Elektrodynamik bewegter Korper. Annals of Physic. 17. 891-921.

9. Antonov A. A. (2021). The version of STR stated in physics textbooks is incorrect because it denies the existence of radio engineering. 82nd International Scientific Conference of the Eurasian Scientific Association "Scientific result in theory and practice". Moscow. ESA. 11-15. https://esa-conference.ru/sborniki/?y=2021

10. Antonov A. A. (2022). The version of STR presented in physics textbooks is incorrect, since it follows from it that radio engineering should not exist. European Journal of Applied Sciences. Services for Science and Education. UK. 10(1). 440-445. DOI://doi.org/10.14738/aivp.101.2022

11. Antonov A. A. (2022). The existence of radio engineering refutes the physics text-books version of STR. The scientific heritage. (Budapest, Hungary). 83(1). 19-22. DOI: 10.24412/9215-0365-2022-83-1-19-22

12. Antonov A.A. (2022). The fundamental Ohm's law in radio engineering as interpreted by Steinmetz, which proves the physical reality on imaginary capacitive and inductive reactances, refuted the version of the STR presented in physics textbooks even before its creation. German International Journal of Modern Science. 26. 50-53. DOI: 10.24412/2701-8369-2022-26-50-63

13. Antonov A.A. (2022). The version of STR stated in physics textbooks is refuted by the existence of radio engineering. Danish Scientific Journal. 56. 56-59. http://www.danish-journal.com

14. Antonov A.A. (2022). The version of STR presented in physics textbooks is in correct because it denies the possibility of the existence of Ohm's law as intepreted by Steinmetz and, consequently, the existence of radio engineering. Annali d'Italia. 28(1), 43-47. https://www.anditalia.com/

15. Antonov A.A. (2022). The version of STR stated in physics textbooks is refuted by the existence of radio engineering. Norwegian Journal of development of the International Science. 78(1). 63-67. DOI: 10.24412/3453-9875-2022-78-63-66.

16. Antonov A.A. (2022). If the physics textbook version of STR were true, then Ohm's law should not exist in nature, and therefore all radio engineering would not exist. International independent scientific journal. 36. 16-19. http://www.iis-journal.com

17. Antonov A.A. (2022). If the version of STR in physics textbooks were true, then there would be no radar, no television, no radio navigation, no telecommunication and many other things. Journal of science. Lyon. 28. 76-79. https://www.joslyon.com/

18. Antonov A.A. (2022). The version of STR set out in physics textbooks is incorrect because it states that Ohm's law as interpreted by Steinmetz does not really exist, and therefore radio engineering does not exist either. Sciences of Europe (Praha, Czech Republic). 87(1). 54-57. DOI: 10.24412/3162-2364-2022-1-54-57

19. Antonov A.A. (2022). Why the physics textbooks teach an incorrect version of the special theory of relativity which denies the existence of radio- and electrical engineering. III international scientific conference "Challenges and problems of modern science". London. Great Britain. 78-86. DOI: https://doi/org/10.528/zenodo.7486814

20. Antonov A. A. (2023). Why is the incorrect version of the special theory of relativity being studied in physics textbooks, refuted the existence of radio- and electrical engineering even before its creation? The scientific heritage. (Budapest, Hungary). 105. 83-89. DOI: 10.5281/zenodo.7560145

21. Antonov A.A. (2023). Why is an incorrect version of the special theory of relativity that denies the possibility of the existence radio and electrical engineering being studied in physics textbooks? German International Journal of Modern Science. 48. 23-29. DOI: https://doi.org/10.5281/zenodo.7541137

22. Antonov A.A. (2023). Who needs the incorrect version of special relativity taught in physics textbooks despite all its experimental refutations? Annali d'Italia. 39, 64-70. DOI: 10.5281/zenodo.7568916

23. Antonov A.A. (2023). Why is incorrect version of the special theory of relativity that denies the possibility of the existence of radio and electrical engineering being studied in textbooks of physics? Norwegian Journal of development of the International Science. 100. 27-33. https://doi.org/10.5281/zenodo.7528512

24. Antonov A.A. (2023). Why is incorrect version of the special theory of relativity, refuted by the existence of radio and electrical engineering, is still studies in all university physics textbooks? Danish Scientific Journal. 69. 66-72. https://doi.org/10.5281/zenodo.7692053

25. Antonov A.A. (2023). Why is incorrect version of the special relativity still being studied in physics textbooks, which denies Ohm's law for alternating current used worldwide by millions of radio- and electrical engineers? International independent scientific journal. 46. 38-44. https://doi.org/10.5281/zenodo.7525751.

26. Antonov A.A. (2023). Why is the generally accepted version of STR, which denies the possibility of the existence of radio engineering and electrical engineering, tsunamis and bell ringing, the physical phenomenon of resonance and Ohm's physical law for alternating current, music created by the piano and even swing swings on the playground, nevertheless is still considered correct and studied in physics textbooks? Sciences of Europe (Praha, Czech Republic). 112. 44-50. DOI: 10.5281/zenodo.7708515

27. Antonov A.A. (2023). Why is the incorrect version of the special theory of relativity still being studied in physics textbooks, despite all its experimental refutations. European Journal of Applied Sciences. Services for Science and Education. UK. 11(2). 61-71. DOI: https://doi.org/10.14738/aivp.112.14128

28. Antonov A.A. (2023). Why the incorrect version of the special theory of relativity, which denies the possibility of the existence of radio engineering and electrical engineering, has not yet been refuted. Journal of science. Lyon. 40. 19-25. https://doi.org/10.5281/zenodo.7704392

29. Antonov A. A. (2008). Physical Reality of Resonance on Complex Frequencies. European Journal of Scientific Research. 21(4). 627-641. http://www.eurojournals.com/ejsr.htm

30. Antonov A. A. (2009). Resonance on Real and Complex Frequencies. European Journal of Scientific Research. 28(2). 193-204. http://www.eurojournals.com/ejsr.htm

31. Antonov A. A. (2010). New Interpretation of Resonance. International Journal of Pure and Applied Sciences and Technology. 1(2). 1-12. http://doi.org/10.17686/sced_rusnauka_ 2010-888

32. Antonov A. A. (2010). Oscillation processes as a tool of physics cognition. American Journal of Scientific and Industrial Research. 1(2). 342-349. doi:10.5251/ajsir.2010.1.2.342.349

33. Antonov A. A. (2010). Solution of algebraic quadratic equations taking into account transitional processes in oscillation systems. General Mathematics Notes. 1(9). 11-16. http://doi.org/10.17686/sced_rusnauka_2010-887

34. Antonov A. A. (2013). Physical Reality of Complex Numbers. International Journal of Management, IT and Engineering. 3(4). 219-230 http://doi.org/10.17686/sced_rusnauka_2013-898

35. Antonov A. A. (2014). Correction of the special theory of relativity: physical reality and nature of imaginary and complex numbers. American Journal of Scientific and Indus-trial Research. 5(2). 40-52. doi:10.5251/ajsir.2014.5.2.40.52

36. Antonov A. A. (2015). Physical reality of complex numbers is proved by research of resonance. General Mathematics Notes. 31(2). 34-53. http://www.emis.de/journals/GMN/yahoo_site_admin/asets/docs/4_GMN9212-V31N2.129701.pdf

37. Antonov A.A. (2015). Principle of physical reality of imaginary and complex numbers in modern cosmology: the nature of dark matter and dark energy. Journal of the Russian physico-chemical society. 87(1). 328-355. (In Russian). http://doi.org/10.17686/sced_rusnauka_2015-1119

38. Antonov A. A. (2016). Physical Reality and Nature of Imaginary, Complex and Hypercomplex Numbers. General Mathematics Notes. 35(2). 40-63. http://www.geman.in/yahoo_site_admin/assets/docs/4_GMN-10932-V35N2.31895146. pdf

39. Antonov A. A. (2015). Ohm's law explains astrophysical phenomenon of dark matter and dark energy. Global Journal of Physics. 2(2). 145-149. http://gpcpublishing.com/index.php?journal=gjp&page=article&op=view&path%5B%5D=294&path%5B%5D=pdf_14

40. Antonov A. A. (2015). Adjustment of the special theory of relativity according to the Ohm's law. American Journal of Electrical and Electronics Engineering. 3(5). 124-129. doi: 10.12691/ajeee-3-5-3

41. Antonov A. A. (2016). Ohm's Law is the general law of exact sciences. PONTE. 72(7) 131-142. doi: 10.21506/j.ponte.2016.7/9

42. Antonov A. A. (2016). Ohm's Law explains phenomenon of dark matter and dark energy. International Review of Physics. 10(2). 31-35. https://www.praiseworthyprize.org/jsm/index.php?journal=irephy&page=article&op=view&path%5B%5D=18615

43. Antonov A. A. (2016). Ohm's law refutes current version of the special theory of relativity. Journal of Modern Physics. 7. 2299-2313. http://dx.doi.org/10.4236/jmp.2016.716198

44. Antonov A.A. (2021). The special theory of relativity stated in physics textbooks is incorrect. 77th International Scientific Conference of the Eurasian Scientific Association "Theoretical and practical issues of modern science". Moscow. ESA. 11-15

45. Antonov A. A. (2021). Version of the special theory of relativity that is studied in all physics textbooks is incorrect. Österreichisches Multiscience Journal (Insbruck, Austria). 43(1). 17-22. http://osterr-science.com

46. Antonov A. A. (2021). Generally accepted version of the special theory of relativity contained in physics textbooks is incorrect. The scientific heritage. (Budapest, Hungary). 73(2). 39-43. DOI: 19.24412/9215-0365-2021-73-2-39-43

47. Antonov A. A. (2021). Special theory of relativity, which is studied in physics textbooks, is incorrect. German International Journal of Modern Science. 16, 49-53. DOI: 10.24412/2701-8369-2021-16-49-53

48. Antonov A. A. (2021). Special theory of relativity, which is studied in all physics textbooks, is incorrect. Danish Scientific Journal. 51(1). 31-35. http://www.danish-journal.com

49. Antonov A. A. (2021). Special theory of relativity taught in all physics textbooks is incorrect. Annali d'Italia. 22(1). 39-44. https://www.anditalia.com/

50. Antonov A. A. (2021). Special theory of relativity presented in physics textbooks is wrong. Norwegian Journal of development of the International Science 68(1). 3-7. DOI: 10.24412/3453-9875-2021-68-3-7.

51. Antonov A. A. (2021). In all physics textbooks an erroneous version of special theory of relativity is given. International independent scientific journal. 31.34-39. http://www.iis-journal.com

52. Antonov A. A. (2021). Special theory of relativity taught in physics textbooks is wrong. Journal of science. Lyon. 23. 47-52. https://www.joslyon.com/

53. Antonov A. A. (2021). All physics textbooks study incorrect special theory of relativity. Sciences of Europe. (Praha, Czech Republic) 79(1). 30-35. DOI: 10/24412/3162-2364-2021-79-30-35

54. Antonov A. A. (2021). Experimental proofs of infidelity of the version of the special theory of relativity studied in physics textbooks and the truth of its alternative version. 80th International Scientific Conference of the Eurasian Scientific Association "Development of science and education in the conditions of global instability". Moscow. ESA. 8-17. https://esa-conference.ru/sborniki/?y=2021

55. Antonov A. A. (2021). The fallacy of the STR version studied in physics text- books proved experimentally. Österreichisches Multiscience Journal (Innsbruck, Austria). 45(1). 17-26. http://osterr-science.com

56. Antonov A. A. (2021). Experimental evidences for the fallacy of the STR version in the physics textbooks. European Journal of Applied Sciences. Services for Science and Education. UK. 9(6). 349-364. DOI:10.14738/aivp.96.11304.

57. Antonov A. A. (2021). If the STR version in physics textbooks were true, we would never have heard the music of the piano and the bell ringing, there would be no television, no cellular telephony, no radar or GPS navigation, we would not even be aware of the existence of resonance and Ohm's law as interpreted by Steinmetz, and our children could not swing on the swings. The scientific heritage (Budapest, Hungary). 78(2). 41-50. DOI: 10.24412/9215-0365-2021-78-2-41-50

58. Antonov A. A. (2021). Experimental refutations of the STR version contained in physics textbooks and confirmations of the truth of its alternative version. German International Journal of Modern Science. 22. 52-61. DOI: 10.24412/2701-8369-2021-22-52-61

59. Antonov A. A. (2021). The STR version in physics textbooks must be corrected, be-cause if it were true, there would be no tsunamis or indian summer in nature, we would be never have heard piano music, engineers would be not have been able to create television, cell phones, GPS trackers, and even children would not be able to swing on swings. Danish Scientific Journal. 54(1). 29-38. http://www.danish-journal.com

60. Antonov A. A. (2021). Experimental evidence of the incorrectness of the STR version studied in physics textbooks. Annali d'Italia. 25(1). 32-41. https://www.anditalia.com/

61. Antonov A. A. (2021). The incorrectness of the STR version presented in physics textbooks proven experimentally. Norwegian Journal of development of the International Science. 74(1). 3-7. DOI: 10.24412/2453-9875-2021-74-53-62.

62. Antonov A. A. (2021). Experimental refutations of the generally accepted version of the SRT studied in physics textbooks. International independent scientific journal. 34(1). 23-32. http://www.iis-journal.com

63. Antonov A. A. (2021). Experimental refutations of the SRT version in the physics textbooks. Journal of science. Lyon. 26(1). 29-37. https://www.joslyon.com/

64. Antonov A. A. (2021). Experimental evidences for the fallacy of the STR version in physics textbooks. Sciences of Europe (Praha, Czech Republic). 82(2). 19-28. DOI: 10.24412/3162-2364-2021-82-2-19-28

65. Antonov A.A. (2023). The Corrected Version of the Special Theory of Relativity. European Journal of Applied Sciences. Services for Science and Education. UK. 11(5). 68-83. DOI:10.14738/aivp.115.15474

66. Antonov A. A. (2023). Corrected special theory of relativity. Journal of science. Lyon. 48. 27-36. https://doi.org/10.5281/zenodo.10277156

67. Antonov A. A. (2023). Corrected special theory of relativity. Annali d'Italia. 49, 25-35. DOI: 10.5281/zenodo.10214679

68. Antonov A. A. (2023). The Corrected Version of the Special Theory of Relativity. The scientific heritage. (Budapest, Hungary). 123. 72-81,

69. Antonov A. A. (2023). The Corrected Version of the Special Theory of Relativity. Norwegian Journal of development of the International Science. 118. 40-49. https://doi.org/10.5281/zenodo.10009500

70. Antonov A. A. (2023). Alternative Version of the Special Theory of Relativity. Sciences of Europe. (Praha, Czech Republic). 128. 62-71.

71. Antonov A. A. (2023). Special Theory of Relativity. German International Journal of Modern Science. 67. 64-73. DOI: 10.5281/ zenodo.10966458

72. Antonov A. A. (2023). Corrected Version of the Special Theory of Relativity. Danish Scientific Journal. 77. 88-97. https://doi.org/10.5281/zenodo.10054677

73. Antonov A. A. (2011), Structure of the Multiverse. British Journal of Science. 2(2). 51-60. http://doi.org/10.17686/sced_rusnauka_2011892

74. Antonov A. A. (2012). Multiverse. Time Travels. International Journal of Pure and Applied Sciences and Technology. 12(2). 43-56. http://doi.org/10.17686/sced_rusnauka_2012-896

75. Antonov A. A. (2012). Discovery of the real multiverse. Encyclopedia of Russian thought, Reports to the Russian Physical Society. 16(3). 3-20. (In Russian). http://doi.org/10.17686/sced_rusnauka_2012-1115

76. Antonov A. A. (2013). Cognition of the multiverse as a factor in accelerating the development of human civilization. Journal of Russian physical thought. 1-12, 6-77. (In Russian). http://doi.org/10.17686/sced_rusnauka_2011-1117

77. Antonov A. A. (2015). Hidden Multiverse. International Journal of Advanced Research in Physical Science. 2(1). 25-32. http://doi.org/10.17686/sced_rusnauka_2015-903.

78. Antonov A.A. (2015). The astrophysical phenomenon of dark matter and dark energy proves the existence of the hidden Multiverse. American Journal of Modern Physics. 4(4). 180-188. DOI: 10.11648/j.jamp.20150404.14

79. Antonov A. A. (2015). Hidden Multiverse: explanation of dark matter and dark energy phenomena. International Journal of Physics. 3(2). 84-87. doi:10.12691/ijp-3-2-6

80. Antonov A. A. (2015). Principles and structure of the real Multiverse: explanation of dark matter and dark energy phenomena. American Journal of Modern Physics. 4(1). 1-9. doi: 10.11648/j.ajmp.20150401.11

81. Antonov A. A. (2016). Hypothesis of the Hidden Multiverse: Explains Dark Matter and Dark Energy. Journal of Modern Physics. 7(10), 1228-1246. doi: 10.4236/jmp.2016.710111

82. Antonov A. A. (2015). Quaternion structure of the hidden Multiverse: explanation of dark matter and dark energy. Global Journal of Science. Frontier Research A: Physics and Space Science. 15(8). 8-15. https://globaljournals.org/GJSFR_Volume15/2-Quaternion-Structure-of-the-Hidden.pdf

83. Antonov A. A. (2016). Verifiable Multiverse. Global Journal of Science Frontier Research: A Physics and Space Science. 16(4) 4-12. doi: 10.17406/GJSFR

84. Antonov A. A. (2020). How to See Invisible Universes. Journal of Modern Physics. 11(05), 593-607. DOI: 10.4236/jmp.2020.115039

85. Antonov A. A. (2020). Can invisible universes be seen? International independent scientific journal. 21(2). 51-60. http://www.iis-journal.com

86. Antonov A. A. (2020), How to discover invisible universes. Norwegian Journal of development of the International Science. 42(1). 36-48. http://www.njd-iscience.com

87. Antonov A. A. (2020). Universes Being Invisible on Earth outside the Portals Are Visible in Portals. Natural Science. 12(8). 569-587. https://doi.org/10.4236/ns.2020.128044

88. Antonov A. A. (2020). Invisible universes can be seen in anomalous zones. Danish Scientific Journal. 43(1). 9-24. http://www.danish-journal.com

89. Antonov A. A. (2021). Invisible universes can be seen in anomalous zones. International independent scientific journal. 23(1). 28-44.

90. Antonov A. A. (2012), Earth, portals, parallel universes. American Journal of Scientific and Industrial Research. 3(6). 464-473. doi:10.5251/ajsir.2012.3.6.464.473

91. Antonov A. A. (13 January 2016). How Portals of the Invisible Multiverse Operate. Science PG Frontiers. http://www.sciencepublishinggroup.com/news/sciencepgfrontiersinfo?artic leid=7

92. Antonov, A. A. (2016). Star gates of the hidden multiverse. Philosophy and cosmology. 6. 11-27. (In Russian). http://ispcjournal.org/journals/2016-16/Antonov16.pdf

93. Chernobrov, V. (2000). Encyclopedia of mysterious places of the Earth. Veche Publishing House. Moscow. (In Russian).

94. Chernobrov, V. (2004). Encyclopedia of mysterious places of Russia. Veche Publishing House. Moscow. (In Russian).

95. Chernobrov, V. (2007). Encyclopedia of mysterious places of the Earth and space. Veche Publishing House. Moscow. (In Russian).

96. Chernobrov, V. (2009). Encyclopedia of mysterious places of Moscow and Moscow region. Helios ARV Publishing House. Moscow. (In Russian).

97. Antonov A. A. (2017). The physical reality and essence of imaginary numbers. Norwegian Journal of development of the International Science. 6. 50-63. http://www.njd-iscience.com

98. Antonov A. A. (2018). Physical Reality and Essence of Imaginary Numbers in Astrophysics: Dark Matter, Dark Energy, Dark Space. Natural Science. 10(1). 11-30. doi:10.4236/ns.2018.101002

99. Antonov A. A. (2023). Proving physical reality and explaining the physical essence of imaginary numbers. Norwegian Journal of development of the International Science. 123. 26-36. https://doi.org/10.5281/zenodo.10451085

100. Antonov A. A. (2024). Physical reality of imaginary numbers and their physical essence. Danish Scientific Journal. 80. 25-35/ https://doi.org/10.5281/zenodo.10594282

101. Antonov A. A. (2024). Proof of physical reality of imaginary numbers and explanation of their physical essence. German International Journal of Modern Science. 72. 17-27.

102. Antonov A. A. (2024). Physical reality of imaginary numbers and their physical essence. Sciences of Europe. (Praha, Czech Republic). 133(1). 79-90. DOI: 10.5281/zenodo.10575590

103. Antonov A. A. (2024). Physical reality of imaginary numbers and their physical essence. The scientific heritage. (Budapest, Hungary). 129. 43-53. DOI: 10.5281/zenodo.10558263

104. Antonov A. A. (2024). Proving Physical Reality and Explaining Physical Essence of Imaginary Numbers. Journal of science. Lyon. 50. 25-35. https://doi.org/10.5281/zenodo.10609816

105. Antonov A. A. (2024). Physical reality of complex numbers and their physical essence. International independent scientific journal. 58. 3-13. https://doi.org/10.5281/zenodo.10491923

106. Antonov A. A. (2024). Proof of physical reality of imaginary numbers and explanation of their physical essence. Annali d'Italia. 51, 25-35. DOI: 10.5281/zenodo.10573831

POLITICAL SCIENCES

RUSSIA'S ON GOING HYBRID WAR IN GEORGIA'S AND ITS INFLUENCE ON PROTECTED CONFLICT

Tamazashvili M.
Doctoral Student
The Faculty of Conflict analyses and Management
Ivane Javakhishvili Tbilisi State University
DOI: 10.5281/zenodo.12061690

Abstract
The article will analyze a new generation war, Hybrid warfare, what is the powerful weapon of the Russian Federation. It Examines Russia's Hybrid war tools, techniques and their impact on protracted conflict in Georgia.
Keywords: Hybrid war, protracted conflicts, Russia's aggression.

Introduction:

In the wake of globalization and the development of information technology, a new type of war "Hybrid war" became the utmost important technique, used by the Russian Federation against Georgia in every possible direction.

In recent decades, the universe has been under threat – the widespread concept of hybrid war, which is a critical and ongoing challenge around the world, as it is a fight where borders and time do not matter and can be conducted openly and may pose a more devastating threat to countries in the future, than military confrontation between countries.

Furthermore, this war causes physical and material damage and controls people's psychology, emotions, and thoughts, so they may not even be aware of it. Consequently, the damage caused by the war and its subsequent compensation will be tricky for the world to overcome. Unfortunately, the new war strategy had a significant impact and still posed a great threat to Georgia's national security and the resolution of the protracted conflict. The damage and the results caused by this non-military war will be more prolonged and deep. Russia is using hybrid war elements, which are, as never, critically damageable to global security. Moscow's aggressive policy's main elements are exactly Hybrid war elements. It derives from the Conflict in Georgia, then broader in Crimea. Through the Hybrid War, the Russian Federation managed the bloodless annexation of Crimea, and now we have in the face of ongoing Russian aggression against the independence of Ukraine.

The Russian Federation uses all internal and external Hybrid War tools to destabilize these regions' situations and put political pressure on the governments. Therefore, non-military elements, with military elements, are weighty in Russian military thought. By using hybrid war, the basic, the Russian Federation can leverage and manipulate post-soviet space, especially in conflict and occupied zones.

*****

To feed its empire, the Russian Federation, which constantly plays with the world by its own rules and never shies away from satisfying its imperial desires by military means, has crossed many red lines in front of the international community. It conquered the territories of neighboring countries using hybrid warfare, the technologies he refined over time. 2008 Russo-Georgian War and the 2014 War in Ukraine are vivid examples of those above. Russia had created all the grounds for winning the war just before the start of the military intervention. Before the war, the Kremlin used its new war technologies to do major essential work before hostilities started.

The Russian military defines a "**hybrid war**" as a strategic-level effort to shape a target state's governance and geostrategic orientation in which all actions, up to and including the use of conventional military forces in regional conflicts, are subordinate to an information campaign.

It is worth mentioning, that Russian officials started calling for a comprehensive security doctrine around decades ago. In the political and strategic documents from 2010, the Kremlin deals more with the characteristics of modern conflicts, than directly with the armed forces. Its approach emphasizes the possibility of integrating military and non-military capabilities to enable Russia to maintain its role as a world center and remain an agent of influence in global space. Military doctrines of 2010 and 2014 also referred to the integrated use of military and non-military resources and means. By using the hybrid war techniques, protracted conflict in Georgia is becoming more complex, prolonged and intractable.

The importance of using elements of hybrid warfare in Russian military circles is being actively discussed. For example, in his 2013 report "The Methods of Conducting a New Generation War," the Chief of the General Staff of Russia, Valery Gerasimov, analyzed the events of the "Arab spring." He concluded that military force would be used secretly in a "new generation war" without an official statement. It emphasizes the importance of using information and economic and political forces. He also says it would be perfect if Russia started cooperating closely with the protest segment in the opposing country. Russia uses exactly mentioned methods in Georgia. The main goal of which is to spread an anti-Western narrative in society ad finance non-governmental organizations or opposition political parties. He is trying to influence the foreign policy course of Georgia by using disinformation and propaganda methods.

On the other hand, it uses economic forces as one of the crucial hybrid war elements in the occupied regions of Georgia. According to the 2023 report of the State Security Service of Georgia, in 2023, the budget of the occupied region Abkhazia, Georgia was about 159 million dollars, of which about 41% (about 65 million dollars) was the Russian tranche. As for the occupied Tskhinvali region, the so-called budget was about 107 million dollars, of which about 78% (about 83.2 million dollars) was financed by the Russian Federation.[2]

Gerasimov's article is striking proof that Russia has developed a new combat strategy that significantly differs from the classical rules of war and has acquired a completely new hybrid character. Russia uses the information space as an essential tool in the theory of hybrid warfare. Russian T**V channels "Russia Today" and "Sputnik"** are powerful tools to spread information throughout the world that is beneficial to it and harmful to the West.

According to Valery Gerasimov, information and psychology play a significant role in modern conflicts. The author notes, that the significance of outdated military means is gradually diminishing, and states have to comprehend the role of non-military methods in achieving their goals, which are aimed at shaking the foundations of the state so that military means do not become necessary to defeat the enemy. Gerasimov thinks that the line of war can pass in all areas simultaneously in such wars. In concordance with his basic idea, the main target in modern warfare is the mind. Therefore, the dominant place in modern military operations is devoted to information and psychological wars. The Kremlin uses the mentioned the most often in the occupied territories of Georgia. Such actions create more obstacles in the way of solving or transformation of the conflict.

The author presented the second report in March 2019. According to Gerasimov, nowadays, to win the war, it is still necessary to use both military and non-military methods to ensure the success of the armed forces. It was especially noted that Russia developed its counter-strategy against any forms and strategies, which implies the so-called "active defense" and unites various active measures to ensure the state's security. It is noteworthy that Gerasimov directly refers to modern information technologies as weapons and views them as a means to achieve military and political objectives. He states that the information field, which has no clear national borders, is a tool that can have a hidden impact not only on critically important information infrastructure but also on the population of a country and, consequently, on the security of the country (Gerasimov, 2019).

After the military intervention in Georgia in 2008, Russia used only hybrid war methods to maintain and strengthen its influence over the territory of Georgia. Which until now is sufficient to achieve his goal, of making the conflict in Georgia even more protracted. As I mentioned above, the more continuous the conflict, the more difficult it is to resolve it using traditional methods. The hybrid warfare idea is two-fold: to jeopardize the Euro-Atlantic integration process of Georgia, harm strategic cooperation with the Western world, and drift Georgia into the Kremlin's orbit.

Kremlin sees Tbilisi's pro-Western foreign policy agenda and aspirations to join the European and Euro-Atlantic space as a significant security threat. Moreover, the Kremlin understands that consolidating a Western-style democratic system with transparent and robust institutions in Georgia would represent a direct and visible contrast to the Russian authoritarian system, incentivizing other states to follow the Georgian example. Should also be mentioned Georgia's growing relations with NATO allies, caused significant dissatisfaction in the Kremlin. If Georgia becomes a member of the mentioned alliance, its territorial integrity and sovereignty will depend on its members, Herewith, after Georgia's integration into the EU, there is a huge chance, that Georgia's occupied territories may rethink their connections with Russia, who can offer them less, then Georgia, as one of the EU member countries. Considering the above-mentioned Russia uses a strong Hybrid war against Georgia in this direction. , create each possible obstacle in the way of Georgia's Western aspiration. The vivid proof of all this is its current efforts, to use the ongoing political situation in Georgia, regarding the low of foreign influence for its own best interests.

Russia perfectly used this momentum, and its official statements exaggerated current demonstrations. For more visibility, the Georgian Parliament's decision to pass a law on foreign influence has triggered widespread protests in the capital. Critics warn that it mirrors a foreign agents law already passed in Russia. Russia would not miss that chance definitely, its officials made just "simple" statements, that they are standing on the side of parliamentarians, and support the adoption of the mentioned law. It is doubtless, that Russia's official discourse has used information warfare as a "peacetime weapon" [3]for destabilizing a target society, poured fuel on the fire, and increased uproar among the people. It is worth noting that the de-facto rulers of the occupied territories of Georgia and the "opposition" persons also made statements. For example, Akhra Bjania, head of the Akhyatsa public movement, said that this law is Russian, which is why the Georgian government can take back Abkhazia from Russia as a "compromise". [4]This cooperation is called mutual beneficial cooperation. „To me, the Georgian "foreign agents" bill is a kind of maturity test. When you have to choose one thing: either nostalgic past or life-affirming future".

After the mentioned statements made in Russia, Even those people who had not read the law at all,

[2] https://bm.ge/news/rogoria-okupirebuli-afkhazetisa-da-tskhinvalis-finansuri-damokidebuleba-rusetze-sus-is-angarishi)

[3] https://oc-media.org/abkhazian-opposition-figures-express-support-for-georgias-HYPERLINK "https://oc-media.org/abkhazian-opposition-figures-express-support-for-georgias-foreign-agent-law-protesters/" HYPERLINK https://oc-media.org/abkhazian-opposition-figures-express-support-for-georgias-foreign-agent-law-protesters/

[4] (https://jam-news.net/abkhazia-georgia-and-foreign-agents-bill/

started chanting, that the bill initiated by the Parliament of Georgia was Russian because it was supported by Moscow. Because of protracted conflict, Georgians feel deep hostility toward the Kremlin and any statement or action is perceived by the masses as much more painful and aggressive. It is one of the important characteristics of a protracted conflict. The goal of such a kind of disinformation is to convince the audience with not only one message but also many directions. To change their overall mind. After all, of this, we have the face the statements by the Western governments, Matthew Miller, Spokesperson of the US Department of State mentioned, that the Kremli supports the text proposal. [5]

Based on above example, vivid conclusion is that the main beneficial part of created processes in the capital of Georgia is the Russia Federation. Russia perfectly used the current events to its advantage and created a turbulent environment between Georgia and its strategic partners.

Another method to make Georgia far from the Western universe and Nato is the method of Borderization. Strikes the fear into that part of the society, if Georgia does not change its foreign policy vector and realizes the processes of integration in the Euro-Atlantic space, Russia will completely annex the occupied territories of Georgia. At the same time, tries to show that the West, which is "so kind to Georgia, does nothing in favor of Georgia to stop the steps towards this illegal annexation.

The impact of a hybrid war on a protracted conflict:

According to the scientist Peter Coleman,[6] the longer protracted conflicts last, the fewer opportunities are for its resolution with traditional methods. Coleman considers protracted conflicts in the context of a dynamic model and argues that internal factors are becoming more and more resistant to external interference. Conflicts go through escalation and de-escalation phases, change forms, spread in new groups, and, possibly, will be passed down from generation to generation, in which, of course, **the media plays an important role**. When a conflict drowns for a long time, the parties to the Conflict make an effort to keep the existence of the Conflict and its intense sensations from drowsing in society and from being forgotten. That is why the best tool for that is the media and the social space, which the Kremlin fruitfully uses to undermine Georgia. Digital and social media are breeding grounds for disinformation, and Russia brings that into its strategic calculus. Disinformation peddled by Russia is sometimes very effective.

The Russian media in the occupied regions of Georgia (Abkhazia and Tskhinvali) play a significant role in recalling and interpreting wartime facts. Providing information to the population through such formations continuously serves the only purpose of the Kremlin - to further aggravate the syndrome of a broken bridge between Georgia and the occupied territories by constantly raising a sensitive issue. It also tries to pass on from generation to generation the enemy image of Georgia as a terrible legacy, which, of course, makes it even more challenging to resolve a protracted conflict in any situation, not just during a conflict.

According to Edward Azar's theory, emotional aspects are activated during a protracted conflict, which becomes even more vital as the Conflict continues. At this time, it is not easy to make a rational decision. The Russian propaganda machine is actively working to strengthen these emotions. According to Edward Azayr 's [7] theory, another characteristic feature of protracted Conflict is that it lasts longer and is more complicated due to external interference; this or that side of the Conflict always considers the third party as an enemy. That is why the second element of Russia's information war is to present the West as an enemy both occupied regions of Georgia. Inhabitants believe, that West support Georgia and want to resolve the Conflict in favor of the Georgian side.

Putin's Moscow actively uses almost every element of the hybrid war – informational, economic, and political. Moscow controls all media and prints media on the territory of occupied Abkhazia. The population has almost no access to other international channels. The local media sector is dominated by the government, which operates the Abkhaz State Television and Radio Company (AGTRK), a newspaper, and a news agency. Russian TV and Abkhazian state TV are the main sources of news. State-run one – Apsua TV, which broadcasts up to 6 hours a day, with 15-minute news in Abkhaz and Russian, and is the only local channel available all over the territory Major Russian stations are relayed in the territory. The only private TV, Abaza TV, is licensed to cover the entire region. There is little or no access to Georgian TV, other than by satellite.[8] The second problem, which even complicates the issue, is the population's education level and the language barrier. Most of them know only Russian as a foreign language. Therefore, they will not be able to read anything except Russian information broadcast or published in other languages. Herewith, kremlin actively use social media as one of the strong hybrid war component. In 2021, CNN Business reported Russia and Iran as the top two sources of coordinated fake activity on Facebook. As for the occupied Tskhinvali region, the situation is even worse here. The language spoken by the vast majority of the population is Ossetia, reported only by Russian media outlets. The state news agency https://cominf.org/ is top-rated and publishes the information that Kremlin agents want.

[5] https://1tv.ge/lang/en/news/matthew-miller-fara-is-for-people-who-act-on-behalf-of-foreign-governments-not-for-people-who-do-legitimate-non-governmental-organization-work/

[6] Characteristics of Protracted, Intractable Conflict: Toward the Development of a Metaframework Peter T. Coleman PEACE AND CONFLICT: JOURNAL OF PEACE PSYCHOLOGY, 9(1), 1–37

Copyright © 2003, Lawrence Erlbaum Associates, Inc

[7] EDWARD AZAR'S PROTRACTED SOCIAL CONFLICT THEORY AND DRIVERS OF SELF-DETERMINATION: THE CASE OF NIGERIA. Centre for International Peace and Stability – NUST University Islamabad. http://studiastrategiczne.amu.edu.pl/wp-content/uploads/2021/12/ps-2021-17.pdf

[8] https://www.bbc.com/news/world-europe-18175030

According to the Freedom House 2020 research, local media, including the television channel and newspapers - Yuzhnaya Osetiya and Respublika, and the online portals are almost entirely controlled by the authorities. As a result, self-censorship is pervasive, and defamation charges are often employed against critical media. Nevertheless, the local version of the Russian news portal Sputnik, accessible in both Russian and Ossetia, is increasingly popular. [9] Consequently, in such a situation, Russia does not even make much effort to create an information vacuum in the occupied Abkhazia and Tskhinvali regions for the local population and to keep their jingoistic sentiments constantly awake.

Russia's information war and propaganda in the occupied territories of Georgia mainly takes place in two directions: the first is to **constantly portray Georgia as an enemy**, the new generation to remember forever "**how bad the Georgians were"** and how they tried to seize their homeland, which led to the ruthless **extermination of the Abkhazians**. **The second** is to show how bad the West is, which is constantly biased, supports Georgia, and acts subjectively. Special attention is paid to the constant recollections of the past in the Russian interpretation to preserve and deepen the roots of hatred towards Georgia among the population.

For example, March 15-16, 1993, in occupied Abkhazia, is celebrated as the day of the liberation of Sukhumi from Georgia. Consequently, *various events are constantly held in honor of the Abkhazian heroes who were "killed by Georgian troops,"* as well as the so-called historical and patriotic actions. "**along the roads of heroes, the way to glory**". "***March 15-16 is a day of mourning in the country's history. Twenty-eight years ago, during an offensive operation to liberate Sukhumi from the invaders, Abkhazia lost 250 brave defenders of the homeland. A pain will always be with us. The young boys started attacking though they realized that they would die. Everything was done for our future, our homeland's future. They had the purest thoughts; they thought of a free Abkhazia where everyone would live peacefully". [10]*** . Looking through the information covered in 2024 concerning this day, we can see how propaganda machines try to enhance the enemy image of Georgia by spreading disinformation, which in the event of a protracted conflict, makes it much more challenging to resolve in any way. The primary purpose ***is to awaken the hostile attitude towards Georgia again and call on the next generation never to forget how Georgians killed young heroes fighting for the homeland***. Statements of the so-called president of the occupied region of Abkhazia, Georgia also worse to mention Aslan Bzhania - "Dear compatriots! Today we celebrate one of the most tragic and at the same time heroic dates in the history of the Abkhazian Patriotic War. 28 years ago, on March 15, 1993, in battles, over 200 soldiers of the Abkhazian army died, hundreds of people were wounded, and over 20 were lost. We honor the memory of our heroes who sacrificed themselves for the freedom of Abkhazia. ***Our main task is to protect the independence of Abkhazia and make it a successful country because thousands of sons and daughters died for its freedom"***. I ***dreamed of seeing it. Eternal glory to the heroes!***"[11] The same narrative is spread in the occupied region of Tskhinvali, Georgia. [12]"***We have not forgotten anything: in South Ossetia are commemorating the Tsinagar tragedy".*** The article also states that these individuals fought for the independence of Ossetia and against the Georgians, "**who started our genocide in 1920 and ended it in 2008**. They were killing old people, mothers, and children. They wanted Ossetia without Ossetia's." [13]

Conclusion

As a result, in both stages situation is concerning, Central government of Georgia with its western strategic partners should intensify and unify all integrity efforts to counter hybrid campaign. Otherwise, as time passes, the chance of protracted conflict resolution will decrease.

One set of explanations is that the Russia Federation uses economic, military and information hybrid warfare elements to maintain its control over the occupied regions of Abkhazia and Tskhinvali, Georgia. Without any military intervention, it manages to prolong conflict. Meanwhile, protracted conflicts are not resolvable with ordinary methods. Shortly, as protracted it is, the harder is to resolve with simple theory in the foreseeable future. Kremlin perceives well, that during protracted conflict emotional experience of humiliation contribute to the enduring nature of intractable conflicts. Seizing this, the main objective is to make deeper people's physical, psychological and emotional traumas.

On another stage, while Georgia's Euro-Atlantic aspiration is alarming for Russia, as a set of hybrid warfare activities it creates instability in Georgia, to distance it from the Western world. Russia uses all the information sources at its disposal to enhance and intensify people's aggression towards to the Government. Georgia without western allies will be less attractive for the occupied Abkhazia and Tskhinvali regions. What is a guarantee of keeping the occupied territories of Georgia permanently under the Kremlin's control.

References

1. В Грузии у здания парламента собрались противники закона об иоиогенах. Я. Тимофеев15.04.2024 12:48 https://rg.ru/2024/04/15/v-gruzii-u-zdaniia-parlamenta-sobralis-protivniki-zakona-ob-inoagentah.html

2. C.R. Mitchel "Conflict, Social Change and Conflict Resolution. An Enquiry"

3. Protracted Social Conflict; Theory and Practice in the Middle EastEdward E. Azar, Paul Jureidini and Ronald McLaurin

[9] https://freedomhouse.org/country/south-ossetia/freedom-world/2021

[10] https://www.apsnypress.info/ru/item/2666-beslan-eshba-molodye-rebyata-shli-na-smert-radi-budushchego-nashej-rodiny

[11] https://www.apsnypress.info/ru/item/2661-prezident-aslan-bzhaniya-obratilsya-k-narodu-abkhazii-v-svyazi-s-28-oj-godovshchinoj-martovskogo-nastupleniya

[12] http://cominf.org/en/node/1166535356; https://www.kavkaz-uzel.eu/articles/353097/

[13] http://cominf.org/en/node/1166529595

4. Journal of Palestine StudiesVol. 8, No. 1 (Autumn, 1978), pp. 41-60 (20 pages) Published By: University of California Press)

5. P. Collaman Robin. R“Protracted conflicts as dynamical systems” P.62-65lr_29.08.16.pdf protracted conflict and humanitarian action ICRC

6. https://www.icrc.org/sites/default/files/document/file_list/protracted_conflict_and_humanitarian_action_icrc_report_https://www.researchgate.net/publication/236007848_Protracted_Conflicts_as_Dynamical_Systems

7. Abkhazian opposition figures express support for Georgia’s foreign agent law protesters. Oc Media. 09.05.2024 https://oc-media.org/abkhazian-opposition-figures-express-support-for-georgias-foreign-agent-law-protesters/.

8. What will Georgians choose: their past embodied by Abkhazia or a European future? I. Khashig. 16.05.2024 https://jam-news.net/abkhazia-georgia-and-foreign-agents-bill/

9. Matthew Miller: FARA is for people who act on behalf of foreign gov'ts not for people who do legitimate NGO work 07.05.2024

10. https://1tv.ge/lang/en/news/matthew-miller-fara-is-for-people-who-act-on-behalf-of-foreign-governments-not-for-people-who-do-legitimate-non-governmental-organization-work/

11. Russia’s hybrid war against the West. A. Bilal. 26.04.2024

12. https://www.nato.int/docu/review/articles/2024/04/26/russias-hybrid-war-against-the-west/

13. RUSSIAN HYBRID WARFARE. MILITARY LEARNING AND THE FUTURE OF WAR SERIES09.2020

14. https://www.understandingwar.org/report/russian-hybrid-warfare

15. Сложно понять». Как Запад и Россия отреагировали на грузинский закон об иноагентах 16.05.2024

16. https://rtvi.com/news/slozhno-ponyat-kak-zapad-i-rossiya-otreagirovali-na-gruzinskij-zakon-ob-inoagentah/

17. https://www.bbc.com/news/world-europe-18175030

18. https://freedomhouse.org/country/abkhazia/freedom-world/2023

19. https://www.apsnypress.info/ru/item/2660-segodnya-v-abkhazii-otmechayut-28-yu-godovshchinu-martovskoj-nastupatelnoj-operatsii

TECHNICAL SCIENCES

INVESTIGATION INTO THE MECHANICAL PROPERTIES OF CONCRETE USING PEBBLES FROM BIDA ENVIRON AS COARSE AGGREGATE IN CONCRETE PRODUCTION

Abbas B.A.,
Abdullahi M.,
Sadiku S.,
Aguwa J.I.,
Department of Civil Engineering, Federal University of Technology, Minna, Nigeria
Abubakar J.,
Department of Civil Engineering, Joseph Sarwuan Tarka University, Makurdi, Nigeria
Kolo D.N.
Department of Civil Engineering, Federal University of Technology, Minna, Nigeria
DOI: 10.5281/zenodo.12061918

Abstract

Strength performance remains the most important property of structural concrete, from engineering point of view. This paper investigates the mechanical properties of concrete made from Bida natural stones, extensive experimental work was con-ducted using 1,600 specimens for compressive strength, flexural strength, splitting tensile strength and elastic modulus (four hundred specimens for each property). Central composite design was used for the factor setting with the following range of values; W/C= 0.4, 0.5, 0.6, CA/TA= 0.55, 0.615, 0.68, TA/C= 3.0, 4.5 and 6.0. The specimens were produced and cured for 7, 14, 21 and 28days. The highest strength was achieved using low W/C, low TA/C and high level of CA/TA corre-sponding to 0.4, 3.0 and 0.68 respectively.

Keywords: Bida natural stones, mechanical properties, curing, response surface methodology.

1.0 Introduction

Attention has been seriously placed on provision of comfortable and affordable housing for human habitation right from the beginning of civilization, because shel-ter is one of the basic needs of man. Thus, problem of providing adequate housing has been a major concern, not only to individuals but to government at all levels. However, common building materials such as cement, sand, crushed granite and steel etc. have invariably become expensive and unaffordable especially by the ma-jority of the Nigerian population (Aguwa and Amadi, 2010). In addition to the is-sue of cost, extraction of crushed granite involves high energy demand, increased dust, noise and vibration, loss of forest, blasting and pollution hazard. Hence, the necessity to research for alternative naturally occurring, local and affordable con-struction materials is pertinent. Crushed stones are available in some part of Nigeria, like Abuja and its environment and are transported to Bida for production of concrete at high cost. This is because there is no quarry in Bida and its environs thereby increasing the haulage distance. Bida natural coarse aggregate are abundantly available in Bida area. This aggregate is cheaper than the crushed granite. This aggregate has been used for concrete produc-tion, but extensive research work has not been conducted on it as compared with the crushed granite. It is therefore appropriate to study the engineering properties of Bida natural coarse aggregate and the concrete produced using Bida natural coarse aggregate to provide detailed technical information that can be used in the mix proportioning, and also to design mixes for specified compressive strength of concrete and subsequent estimation of optimal quantity of aggregate material to reduce the overall concrete production cost.

This study therefore sought to proffer answers to the following question;

1. Does Bida natural stones (BNS) possess the required properties to be used in concrete Production?

2. What effect will Bida natural stones (BNS) shape have on the mechanical proper-ties of concrete?

2.0 Materials and methods

2.1 Materials

Ordinary Portland cement produced in accordance with BS EN 197-1(2000): Part 1 and classified as CEM 1 of the standard was used for this research. The cement was purchased at cement deport located at Kpakungu, Minna, Niger state. The sand was collected from Gidan Mangoro, Minna, Niger state, the sand used was clean, sharp, free from clay, loam, dirt's or organic matters (NIS 87: 2004) and also conforms to the standard requirement of BS EN 12620 (2008). Potable drinking water from Civ-il Engineering laboratory, Federal University of Technology Minna was used throughout this work, the water was clean, free from deleterious materials and fit for drinking as recommended by BS EN 1008 (2002). The coarse aggregate (natural stones in plate I.) used for this work were taken from Bida, Niger state in the mid-dle belt region of Nigeria located about 250Km North-East of Bida inland from the Federal capital city of Abuja. The deposits aggregates lie in zone 31, which fall within the latitude N 90 55′E and longitude N 50 52′ E (Salihu, 2011). The Bida natural deposits aggregates in character occur in middle Niger basin of Nigeria in several million metric tons. This aggregate is characterized with round and smooth surface,

and reddish-brown in colour. The aggregate used consist of maximum size of 19mm. It also conforms to the standard requirement of BS EN 12620 (2008).

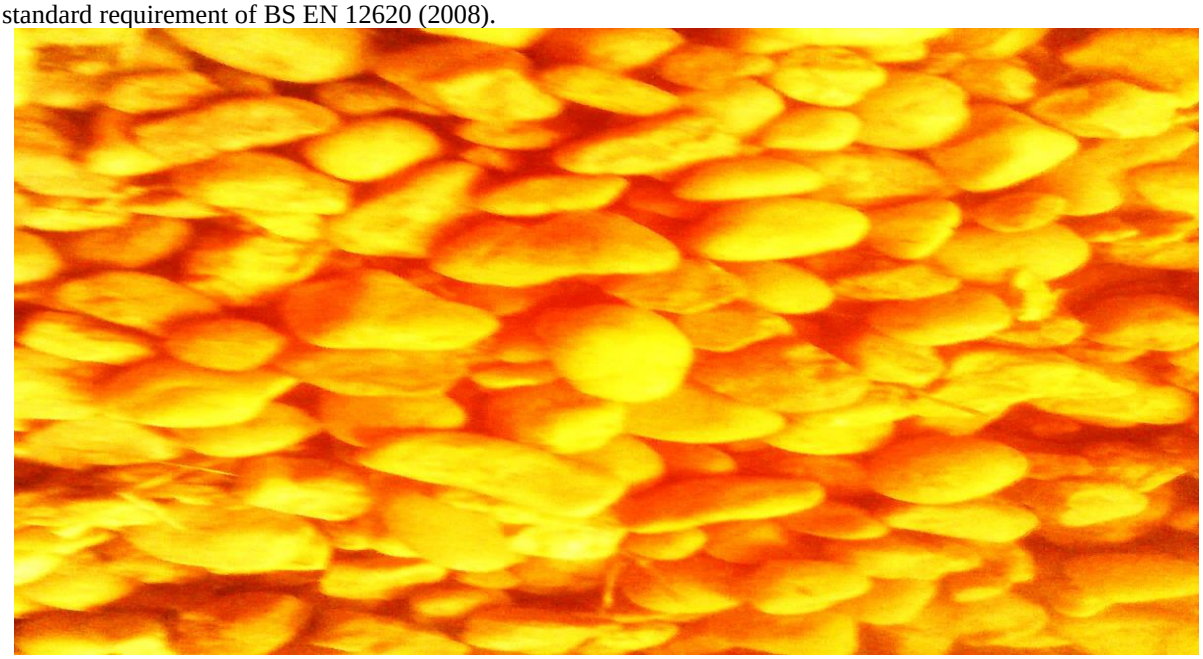

Plate I: Cluster of Bida natural stones

2.2 Methods

The concrete specimens that were tested are 150mmx150mmx150mm (cube), 100mmx100mmx500mm (prism), 300mmx150mm (cylinder) and also 300mmx150mm (cylinder) for compressive strength, flexural strength, splitting tensile strength and elastic modulus test respectively in accordance to specifications of BS 12390 (2002).

Laboratory tests that were conducted on the sample of Bida natural coarse aggre-gate and fine aggregate to determine their physical properties include the following: moisture content, specific gravity, sieve analysis, aggregate impact value, aggregate crushing value, bulk density (compacted and uncompacted), water absorption and silt test in accordance with BS EN 12620 (2008). Also, the laboratory test con-ducted on the fresh and hardened concrete are: slump test and compacting factor test (compacted and uncompacted) in accordance to BS EN 12350-1(2000), and compressive strength, splitting tensile strength, flexural strength and elastic modu-lus test in accordance to BS EN 12390 (2002) respectively.

a) Factor setting

Central Composite Design (CCD), an augmented factorial design was employed for the factor settings. In the factorial approach, the q components of a mixture are re-duced to q-1 independent variables. Factor setting involves changing one or more factor at a time to study the effect of the variable on the response, this operation is randomized by the software such that experimental result from the laboratory will yield the best mixes. In this study, four (4) concrete components of water, cement, coarse aggregate and fine aggregate were used with three (3) corresponding inde-pendent variables/factors of water-cement ratio (W/C), coarse aggregate-total ag-gregate (CA/TA) and total aggregate-cement (TA/C). The independent variable ware represented by x1, x2 and x3 respectively. The ranges of the independent varia-bles chosen are as stated below:

$$\frac{W}{C} = 0.4, 0.5, 0.6 \quad (1)$$

$$\frac{CA}{TA} = 0.55, 0.615, 0.68 \quad (2)$$

$$\frac{TA}{C} = 3.0\ 4.5, 6.0 \quad (3)$$

Absolute volume method was used for mix proportioning.

b) Production of Concrete for Compressive strength

The sample was thoroughly mixed manually until the required homogeneity was achieved; the standard iron moulds of (150×150×150) mm3 were used. The moulds were lubricated with engine oil in order to reduce friction and to enhance removal of cubes from the moulds, they were then filled with fresh concrete in three layers and each layer was tamped 25 times. The same procedure was carried out for other concrete specimen (that is prism and cylinder for flexural strength, and splitting tensile and elastic modulus respectively). Table 1 shows a breakdown of the num-ber of samples produced for the experiment.

Table 1

Breakdown of the number of samples produced for the experiment

Concrete Specimen	Curing days				
	7days	14days	21days	28days	Total sample
Compressive strength (150x150x150) mm (Cubes)	100	100	100	100	400
Flexural strength (100x100x300) mm (prism)	100	100	100	100	400
Splitting tensile strength (100x300) mm (cylinder)	100	100	100	100	400
Elastic modulus (100x300) mm (cylinder)	100	100	100	100	400
Total number of samples cast			1600		

c) Curing and crushing of the concrete

The curing method used was total immersion, the hardened concrete samples were removed after 24 hours, cured and crushed for 7, 14, 21 and 28 days respectively, the mechanical properties that were determine include compressive strength, split-ting tensile strength, flexural strength and elastic modulus.

d) Compressive Strength Test

Compressive strength test on concrete cubes (Compressive strength test on concrete cubes (four hundred specimens) were determined using an electrically operated Seidner compressive machine using standard procedure for concrete curing age of 7, 14, 21, and 28days re-spectively at Civil Engineering laboratory, Federal University of technology, Minna (destructive test) in accordance with BS EN 12390 (2002). The weight of each cube was always taken before the compressive strength test was conducted. During crushing care was taken to ensure that the cubes were properly positioned and aligned with the axis of the thrust of the compres-sive machine to ensure uniform loading on the cubes (Neville, 2002).

The compressive strength was calculated using Equation (5)

$$f_{cu} = \frac{\text{Average load}}{\text{Area}} \text{ (N/mm}^2\text{)} \quad (5)$$

The result of compressive strength is presented in Table 2. Each result is an average of five test conducted on each mix

e) Flexural Strength Test

Flexural strength test on concrete made from Bida natural stones was carried out in accordance with BS EN 12390-5:2009 on rectangular beams measuring 100mm x 100mm x 500mm. The concrete mixes were labeled M1-M20. Four hundred (400) specimens were produced and cured for 7, 14, 21 and 28 days using one point load-ing arrangement.

While test was conducted, the development of crack and the cracking up to the fail-ure was closely observed. The flexural strength was calculated using Equation (6)

$$f_{cr} = \frac{FL}{d_1 d_2^2} \text{ (N/mm}^2\text{)} \quad (6)$$

Were

F = The applied load

L =Supported length of the beam

d_1 = Average width of the specimen

d_2 = Average depth of the specimen

The result of flexural strength is given in Figure 3. Each result is an average of five test conducted on each mix.

f) Splitting Tensile Strength Test

Splitting tensile strength test on concrete made from Bida natural stones were car-ried out in accordance with BS EN 12390-6:2009 on cylindrical specimen measur-ing 150mm diameter and 300mm height. The concrete mixes were labeled M1-M20. Four hundred (400) specimens were produced and cured for 7, 14, 21 and 28 days. During the test, the specimens were placed with its horizontal between the plates of a testing machine. And the load was increased until failure by vertical in-direct tension in the form of splitting along the diameter took place. The rate of loading was as prescribed by BS EN 12390-6:2009. The Splitting Tensile Strength fct in N/mm2 was calculated using Equation (7)

$$f_{ct} = \frac{2F}{\pi Ld} \text{ (N/mm}^2\text{)} \quad (7)$$

Where

f_{ct} = Splitting tensile strength

F = Maximum load

L = Length of line of contact of the specimen

d = Diameter of the specimen

The result of splitting tensile strength is given in Figure 4. Each result is an average of five test conducted on each mix.

g) Elastic modulus (young's modulus)

Elastic modulus test on concrete made from Bida natural stones was carried out in accordance with BS EN 1352:1997 on cylindrical specimen measuring 150mm diameter and 300mm height. The concrete mixes were labeled M1-M20. Four hundred (400) specimens were produced and cured for 7, 14, 21 and 28 days.

The modulus of elasticity measured in this case was chord modulus of elasticity. This is the slope of a straight line originating at a point on the curve corresponding to 50μ in/ in strain and extending to the stress at 40% of the ultimate strength. The elastic modulus E in N/mm2 was calculated using Equation (8)

$$E = \frac{S_2 - S_1}{\varepsilon_2 - \varepsilon_1} \text{ (N/mm}^2\text{)} \quad (8)$$

Where

E= Chord modulus of elasticity

S_2= Stress corresponding to 40% ultimate load

S_1= Stress corresponding to a longitudinal strain at 0.000005

$^{TM}_2$= Longitudinal strain produced by stress, S_2

$^{TM}_1$= Strain at 0.000005

The result of elastic modulus is given in Figure 5. Each result is an average of five test conducted on each mix.

3.0 Result and Discussion

3.1 Measured Responses at 7, 14, 21 and 28days Curing

The summary of experimental results of concrete crushed at 7, 14, 21 and 28days curing for compressive strength, flexural strength, splitting tensile strength and elastic modulus are respectively presented in Figures 2 - 5. The range of values obtained for compressive strength at 7, 14, 21 and 28days curing are 5.85N/mm2 - 22.90N/mm2, 6.34N/mm2 - 27.2N/mm2, 6.38N/mm2 - 29.91N/mm2, and 7.91N/mm2 - 33.42 N/mm2 respectively. Those of flexural strength at 7, 14, 21 and 28days curing are 1.0N/mm2 - 6.1N/mm2, 1.2N/mm2 - 7.45N/mm2, 1.4N/mm2 - 7.65N/mm2 and 1.6N/mm2 - 7.9N/mm2 respectively. And for splitting tensile strength for 7, 14, 21 and 28days curing are 0.36N/mm2 -2.03N/mm2, 0.51N/mm2 - 2.23N/mm2, 0.52N/mm2 - 2.53N/mm2 and 0.72N/mm2 - 2.62N/mm2 respectively. The range of value for elastic modulus for 7, 14, 21 and 28days curing are 3560N/mm2-1500N/mm2, 3630N/mm2-17782N/mm2, 5150N/mm2-2273N/mm2 and 7210N/mm2 - 25090N/mm2 re-spectively.

The strength increases as the curing age increases for all cases tested, this is primarily due to the fact that concrete hardening is caused by chemical reaction between cement and water which continues for a long period of time and consequently concrete get stronger with age (Gambhir, 2004). The tensile and flexural strength of a concrete is much lower than the compressive strength, tensile strength is usually not considered directly in design (normally assumed to be zero), though its value is still needed because cracking in concrete tends to be a tensile behaviour (Zain et al., 2002). Figures 2-5 also shows that, tensile strength, flexural strength and elastic modulus increase in the same manner with compressive strength, simi-lar trend of strength development were obtained by (Zain et al., 2002).

The highest strengths were obtained with Mix M19 with the corresponding W/C=0.4, CA/TA=0.68 and TA/C=3 for the all curing age and the properties tested. This can be at-tributed to the high amount of coarse aggregate, lower water content and high amount of cement employed for the mix. Hence, these results obtained are in lined with that of Med-dah et al. (2010) who also stipulated that the compressive strength of concrete increases with increase in coarse aggregate content. In addition, concrete should be examined as a three-phase material consisting of aggregate skeleton, hardened cement paste and transition zone. The strength property (compressive strength) of such composite material is intimately related to the property of each phase. The predominant of properties of such a phase on the compressive strength of composite material is mainly influenced by the type of concrete (normal strength concrete and high strength concrete). Considering the normal strength concrete, the weakest phases are the cement phase and the transition zone between cement paste and the aggregate.

Increasing the aggregate surface area leads to an increase in the percentage of transition zone in the concrete material and thus, increasing the volume of the weakest phase. It can be con-cluded that the granular skeleton system plays a predominant role within the concrete mix-ture regarding the development of mechanical properties. Therefore, since high amounts of coarse aggregates were used, higher mechanical properties were obtained. In addition, high amount of water/cement ratio produces concrete with less cement paste consistency (highly watery) and offers lesser adhesion to the aggregate, leading to an increase in slump value, thus resulting in a weaker strength, but as the cement content is increased, paste of stiffer consistency are produced with greater binding capability. Thus, holding the aggregate to-gether and produce concrete of lower slump value but with greater strength (Abdullahi, 2009).

The weakest strengths were obtained with mix 17 containing W/C=0.4, CA/TA=0.55 and TA/C=6. This weak strength result was expected because right from the laboratory the mix-ture provided a harsh fresh concrete, and it is a well-known fact that when low W/C ratio is employed in conjunction with low CA/TA and a high TA/C ratio, the end product will re-sult in a weaker concrete. In order words, lower coarse aggregate to total aggregate (CA/TA) means a high amount of fine aggregate leading to high value of specific surface which require much quantity of water to produce concrete of reasonable strength. Also, a high total aggregate to cement (TA/C) means the quantity of cement is low but total aggre-gate which contained high amount of sand was used (that is low CA/TA), hence leading to weak strength.

More so, all mixes for 28days compressive strength satisfied the specified recommendation for the normal strength (compressive strength) concrete whereas mixes M6, M12, M13 and M17 do not satisfy the requirement therefore such mixes should be avoided when normal strength concrete is needed. Also, for flexural strength, only mix M17 fall below the range for normal strength concrete (flexural strength), hence this mix proportion should be discouraged. However, M13 should also be discouraged because it lies slightly above the low-er limit. In case of splitting tensile strength M1, M2, M3, M5, M8, M10, M11, M14, M19, M20 fall within the required limit for the normal strength concrete (tensile strength), but the rest of the mixes fall below the range and therefore should be discouraged for production of normal strength concrete (tensile strength). For the elastic modulus, only mixes M6, M13 and M17 fall below the specified range for the normal strength concrete (elastic modulus), hence all other mixes satisfied the requirement.

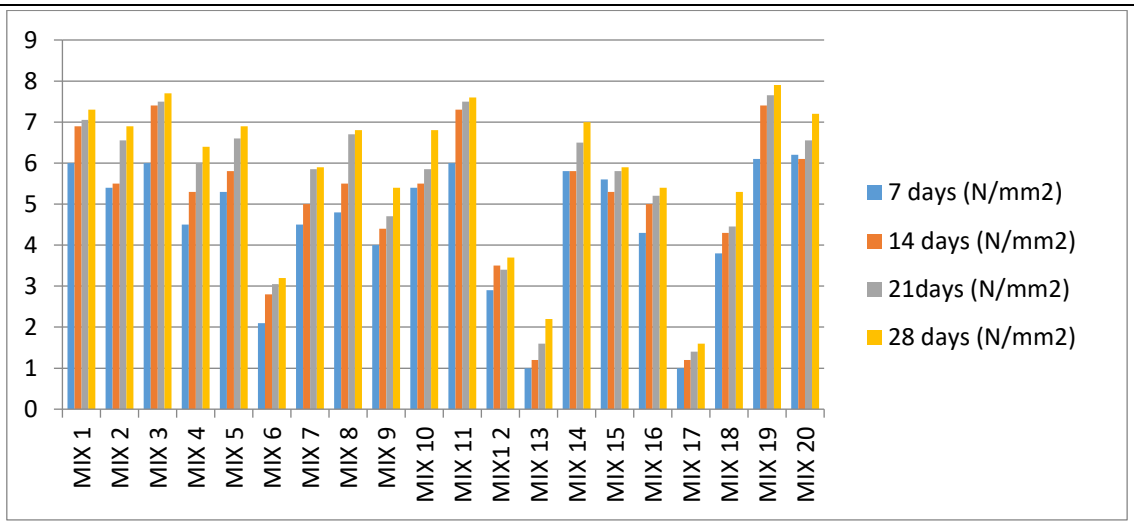

Fig 1: Summary of the Results of Compressive Strength for 7, 14, 21 and 28days Curing

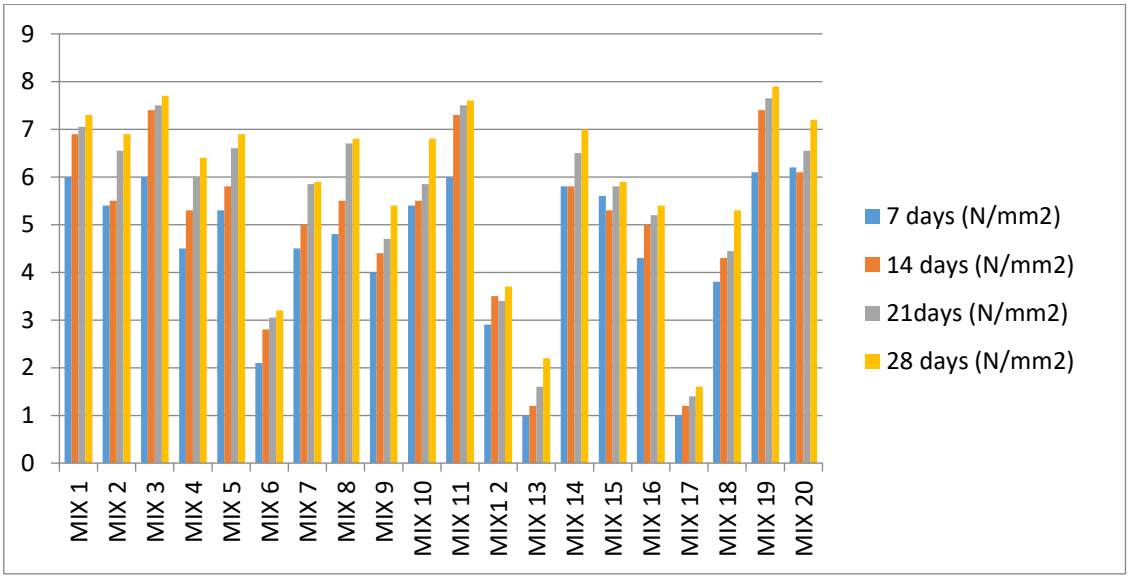

Fig 2: Summary of the Results of Flexural Strength for 7, 14, 21 and 28days Curing

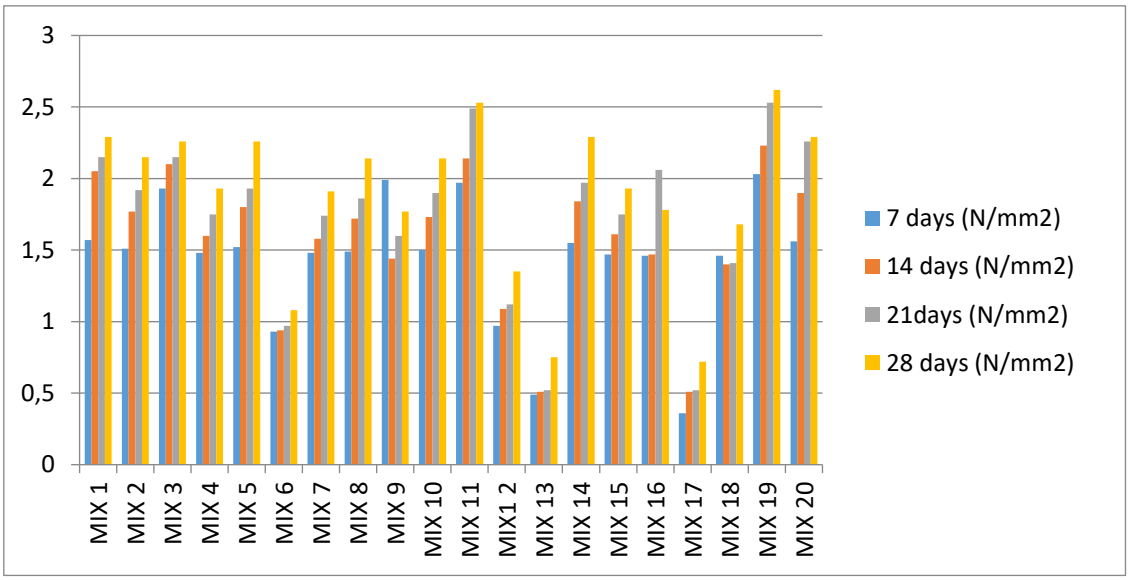

Fig 4: Summary of the Results of Splitting Tensile Strength for 7, 14, 21 and 28days Curing

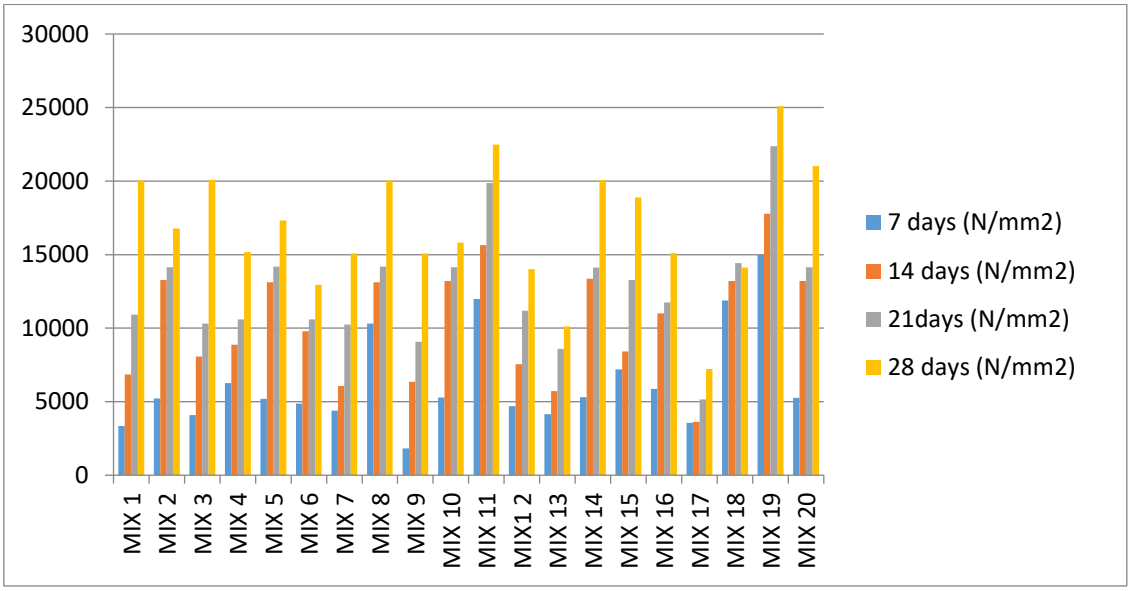

Fig 5: Summary of the Results of Elastic Modulus for 7, 14, 21 and 28days Curing

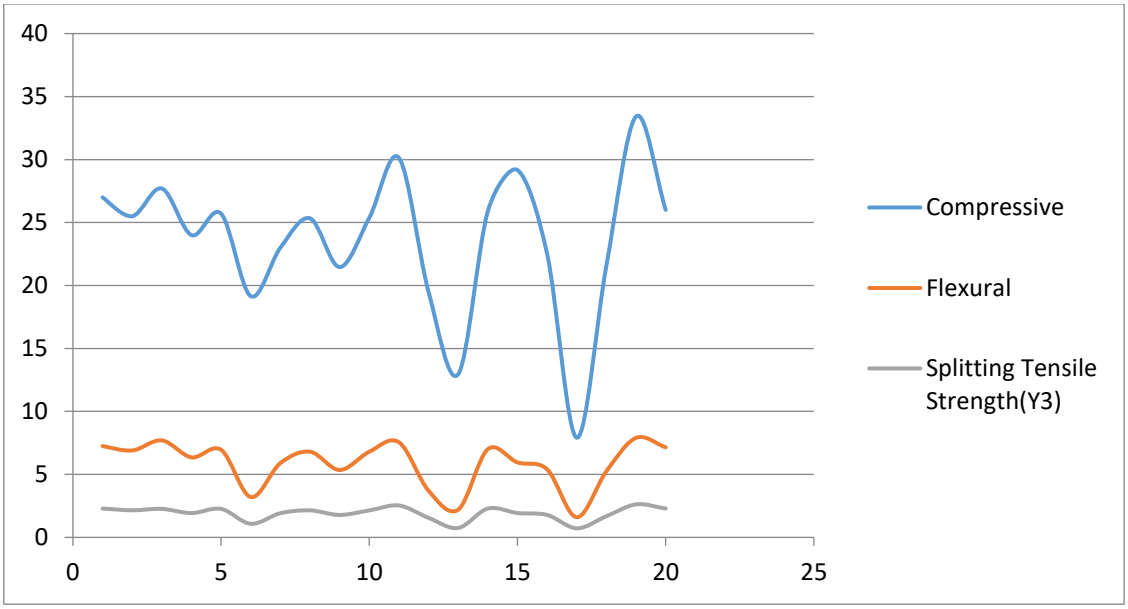

Fig. 6 Measured Responses at 28days

4.0 CONCLUSION

Based on the result of this research the following conclusions were drawn;

The strength of the concrete increases with the curing age in all cases.

The highest mechanical properties were obtained using low water/cement ratio (W/C), high coarse aggregate/total aggregate ratio (CA/TA) and low total aggregate/cement ratio (TA/C) as 0.4, 0.68 and 3.0 respectively.

4.1 Recommendations

1. Based on the result of the mechanical properties, it is recommended that the ranges of values for concrete made using washed Bida natural stones of 19mm maximum aggregate size are as follows: W/C= 0.4, 0.5, 0.6, CA/TA= 0.55, 0.615, 0.68, TA/C= 3.0 4.5, 6.0 respectively.
2. Further studies should include the development of models for compressive strength, flexural strength, splitting tensile strength, elastic modulus and slump of concrete made from BNS.

References

1. Abdullahi, M. (2009). Development of an expert system for light weight concrete mix design. PhD thesis submitted to College of Graduate Studies University Tenaga National, Malaysia.

2. Aguwa, J. I. and Amadi, A. A. (2010). Performance of coconut shell as coarse aggregate for production of lightweight concrete. Global Journal of Engineering and Technology, 3(4), Pp, 695-701.

3. BS EN 12620 (2008). Specification for aggregates from natural sources for concrete. London, British Standard Institution.

4. BS EN 1008 (2002). Mixing water for concrete: Specification for sampling, testing and assessing the suitability of water, including water recovered from concrete industry as mixing water for concrete. London, British Standard Institution.

5. BS EN 197-1 (2000). Composition, specification and conformity criteria for common cement. London, British Standard Institution.

6. BS EN 12390-3 (2009). Testing harden concrete. Compressive strength of test specimens. London W4 4AL UK, British Standard Institution.

7. BS EN 12350-1 (2009). Testing fresh concrete: London W4 4AL UK, British Standard Institution.

8. Gambhir, M. L. (2004). Concrete Technology-Second Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi. London Madrid Mexico.

9. Neville, A. M. and Brooks, J. J. (2002). Concrete Technology, 3rd edition. Pearson Education Publisher pte. Limited New Delhi India, Pp, 623.

10. Salihu, A. T. (2011). Compressive Strength of Concrete made from Bida Natural Deposits Stone and Crushed Rock as a Coarse Aggregates. Unpublished M. Eng. thesis submitted to the department of civil engineering, FUT Minna.

11. Zain, M. F. M, Mahmud, H. B., Ade I., and Faizal, M. (2002). Prediction of splitting tensile strength of high performance concrete, Journal of Cement and Concrete Research, 32, Pp, 1251-1258.

12. Meddah, M. S. Salim, Z., Said, B. (2010). Effect of content and particle size distribution of coarse aggregate on the compressive strength of concrete. Journal of Construction and BuildingMmaterial. Elsevier, 24, Pp, 505-512.

ОПТИМИЗАЦИЯ БИЗНЕС-ПРОЦЕССОВ НА ПРЕДПРИЯТИИ: МЕТОДЫ И СРЕДСТВА

Багитова Л.
Магистрант
Атырауский университет им. Х. Досмухамедова

OPTIMIZATION OF BUSINESS PROCESSES IN THE ENTERPRISE: METHODS AND TOOLS

Bagitova L.
Master's student
Atyrau University named after H. Dosmukhamedov
DOI: 10.5281/zenodo.12062292

Аннотация

Оптимизация бизнес-процессов является критически важным элементом для повышения эффективности и конкурентоспособности современных предприятий. В статье рассматриваются основные методы оптимизации, включая анализ текущих процессов (AS-IS), моделирование и проектирование будущих процессов (TO-BE), реинжиниринг бизнес-процессов (BPR), а также методы Lean и Six Sigma. Приводятся преимущества оптимизации, среди которых повышение эффективности, снижение затрат, улучшение качества продукции и услуг, повышение удовлетворенности клиентов и гибкость в адаптации к изменениям рынка. Статья подчеркивает важность систематического подхода к улучшению бизнес-процессов и использования современных технологий для достижения устойчивого развития и успеха предприятия.

Abstract

Business process optimization is a critically important element for enhancing the efficiency and competitiveness of modern enterprises. This article examines the main optimization methods, including the analysis of current processes (AS-IS), the modeling and design of future processes (TO-BE), business process reengineering (BPR), as well as Lean and Six Sigma methodologies. The advantages of optimization are highlighted, including increased efficiency, cost reduction, improved product and service quality, higher customer satisfaction, and flexibility in adapting to market changes. The article emphasizes the importance of a systematic approach to improving business processes and the use of modern technologies to achieve sustainable development and enterprise success.

Ключевые слова: Оптимизация бизнес-процессов, эффективность предприятия, AS-IS анализ, TO-BE моделирование, реинжиниринг бизнес-процессов (BPR), Lean методология, информационные системы, ERP, BPM, системы управления качеством (QMS), аналитика данных, конкурентоспособность, гибкость предприятия, удовлетворенность клиентов.

Keywords: Business process optimization, enterprise efficiency, AS-IS analysis, TO-BE modeling, business process reengineering (BPR), Lean methodology, information systems, ERP, BPM, quality management systems (QMS), data analytics, competitiveness, enterprise flexibility, customer satisfaction.

Введение. Оптимизация бизнес-процессов является ключевым фактором повышения эффективности и конкурентоспособности предприятия. Она направлена на улучшение рабочих процессов, сокращение затрат и увеличение прибыли. В данной статье рассмотрим основные методы и средства оптимизации бизнес-процессов, которые могут быть применены на предприятии.

Современная экономика Казахстана полностью функционирует на рыночных принципах. Более того, казахстанские предприятия все активнее интегрируются в мировую экономику. Эти условия требуют повышения их конкурентоспособности и эффективности управленческой деятельности.

Актуальность исследования бизнес-процессов особенно важна, поскольку современные предприятия Казахстана должны постоянно совершенствовать свою деятельность. Это требует разработки новых технологий и методов ведения бизнеса, улучшения качества конечных продуктов и внедрения более эффективных способов управления и организации работы предприятий.

Понятие бизнес-процесса можно определить различными способами[2]:

1. Бизнес-процесс представляет собой устойчивую и целеустремленную совокупность взаимосвязанных видов деятельности (последовательность работ), которая преобразует входные ресурсы в выходные продукты или услуги, представляющие ценность для клиента по определенной технологии [1, с. 17].

2. Бизнес-процесс – это совокупность разнородных видов деятельности, направленных на производство продукции или услуг, имеющих ценность для клиента.

3. Бизнес-процесс состоит из различных видов деятельности, где на входе используются один или несколько видов ресурсов, а на выходе создается продукт, представляющий ценность для потребителя.

4. Бизнес-процесс включает несколько связанных работ или процедур, которые совместно реализуют конкретную цель текущей деятельности компании в рамках существующей организационной структуры.

5. Бизнес-процесс представляет собой систему последовательных, целенаправленных и регламентированных видов деятельности, в которой входы

процесса преобразуются в выходы, представляющие ценность для потребителей, с помощью управляющего воздействия и ресурсов.

6. Бизнес-процесс – это цепь логически связанных, повторяющихся действий, при которых используются ресурсы предприятия для переработки объекта (физически или виртуально) с целью достижения определенных измеримых результатов или продукции для удовлетворения внутренних или внешних потребителей.

Средства оптимизации бизнес-процессов. Главная идея заключается в том, что любой бизнес-процесс ориентирован на потребителя, будь то внутренний или внешний. Исходя из этого определения, все действия внутри организации (компании) можно рассматривать либо как самостоятельный бизнес-процесс, либо как его составную часть.

1. Стратегическая роль процесса для предприятия

2. Финансовая важность процесса для компании

3. Значение процесса в системе управления

4. Частота выполнения процесса

5. Ожидания внутренних и внешних потребителей

Основываясь на некоторых практических рекомендациях, оптимальность внутренних бизнес-процессов промышленных предприятий следует оценивать по следующим критериям:

- Время выполнения бизнес-процесса или его отдельных процедур;
- Затраты на весь процесс и его процедуры;
- Основные показатели эффективности процессов;
- Полнота, адекватность и своевременность поступающей и передаваемой информации;
- Эффективность управления информационными потоками;
- Наличие дублирующих функций;
- Избыточность согласующих звеньев;
- Логические ошибки или «узкие места»;
- Участие ключевых сотрудников в принятии решений;
- Распределение ответственности за результаты выполнения бизнес-процесса.

Преимущества оптимизации бизнес-процессов. Результаты оптимизации бизнес-процессов включают сокращение времени на решение типовых задач, снижение производственных затрат, улучшение качества и ускорение выпуска продукции, оптимизацию методов взаимодействия с клиентами, снижение затрат на обучение персонала, высвобождение рабочего времени и ресурсов для решения стратегических или нестандартных задач. Часто оптимизацию бизнес-процессов путают с реинжинирингом бизнес-процессов. Однако реинжиниринг представляет собой радикальную перестройку ключевых бизнес-процессов предприятия. Это означает полный отказ от существующих принципов организации ключевых процессов и их замену на принципиально новые. Цель реинжиниринга - значительное снижение стоимости бизнес-процессов, времени их выполнения и числа задействованных сотрудников. При реинжиниринге обычно происходит изменение организационной структуры компании и задач ее подразделений.

Реинжиниринг бизнес-процессов следует проводить в следующих случаях[1]:

1. Предприятие теряет (или скоро начнет терять) клиентов.

2. Внутренние проблемы и сбои нарастают и начинают угрожать успешной деятельности предприятия.

В контексте данной проблематики важно помнить, что кардинальные изменения в второстепенных процессах, как правило, не приводят к значительным изменениям в производственно-хозяйственной деятельности. Однако небольшие изменения в ключевых процессах могут привести к значительным положительным результатам, как это происходит при оптимизации бизнес-процессов.

Методы оптимизации бизнес-процессов.

- первым шагом в оптимизации является детальный анализ существующих процессов, что позволяет выявить узкие места и определить области для улучшения. Для этого используются такие инструменты, как:
- диаграммы потоков (Flowcharts): Визуализация последовательности действий помогает лучше понять процесс и выявить неэффективности.
- карты потоков создания ценности (Value Stream Mapping): Метод позволяет увидеть, где создается ценность для клиента и где происходят потери.

На основании анализа текущих процессов разрабатывается модель будущих процессов (TO-BE). Этот этап включает:

- Разработка новой архитектуры процессов: Определение новых последовательностей действий и распределение ресурсов.
- Имитационное моделирование: Использование компьютерных моделей для тестирования и оценки новых процессов до их внедрения.

Реинжиниринг бизнес-процессов предполагает радикальное пересмотрение и переосмысление существующих процессов для достижения значительных улучшений. Основные принципы BPR:

- Фокус на клиента: Процессы ориентируются на удовлетворение потребностей клиента.
- Автоматизация процессов: Внедрение ИТ-решений для автоматизации рутинных задач.
- Сокращение ненужных звеньев: Устранение лишних этапов и согласований.

Методы Lean и Six Sigma направлены на минимизацию потерь и улучшение качества процессов соответственно.

- Lean: Сосредоточен на устранении всех видов потерь (например, перепроизводство, излишние запасы, ожидание).
- Six Sigma: Использует статистические методы для уменьшения вариабельности и дефектов в процессах.

Средства оптимизации бизнес-процессов[3]:

1. Информационные системы и программное обеспечение

- ERP-системы (Enterprise Resource Planning): Интеграция всех аспектов бизнеса, включая планирование, закупки, производство, продажи и финансы.
- BPM-системы (Business Process Management): Автоматизация управления бизнес-процессами, что позволяет моделировать, анализировать и оптимизировать процессы.

2. Инструменты для анализа данных

- BI-системы (Business Intelligence): Анализ данных для принятия обоснованных управленческих решений.
- Big Data и аналитика: Обработка больших объемов данных для выявления тенденций и принятия решений на их основе.

3. Инструменты для совместной работы и управления проектами

- Системы управления проектами (например, Asana, Trello): Обеспечение прозрачности и координации действий команд.
- Платформы для совместной работы (например, Slack, Microsoft Teams): Улучшение коммуникации и сотрудничества между сотрудниками.

Оптимизация бизнес-процессов приводит к ряду значительных преимуществ для предприятия:

- Повышение эффективности: Сокращение времени и ресурсов, затрачиваемых на выполнение процессов.
- Снижение затрат: Уменьшение операционных расходов за счет устранения излишних действий и автоматизации.
- Улучшение качества: Снижение количества ошибок и дефектов в продукции или услугах.
- Повышение удовлетворенности клиентов: Быстрое и качественное удовлетворение потребностей клиентов.
- Гибкость и адаптивность: Способность быстро реагировать на изменения рынка и требований клиентов.

Заключение

Оптимизация бизнес-процессов является неотъемлемой частью управления современным предприятием. Внедрение эффективных методов и средств оптимизации позволяет не только повысить производительность и качество работы, но и обеспечить устойчивое развитие и конкурентоспособность на рынке. Систематический подход к анализу, моделированию и улучшению процессов, а также использование современных технологий и инструментов, являются ключевыми факторами успеха в данной области.

Список литературы

1. Давенпорт, Т. Х. (2010). Инновации в бизнесе: Реинжиниринг работы через информационные технологии. Вильямс.

2. Елиферов В. Г. Бизнес-процессы: регламентация и управление: учебник. М.: Инфра-М, 2005. 319 с. (Учебники для программы МВА).

3. Саксена, В., Сринивасан, А. (2013). Управление бизнес-процессами: Практическое руководство. Вильямс.

ИССЛЕДОВАНИЕ АЛМАЗНОГО ПОРОДОРАЗРУШАЮЩЕГО ИНСТРУМЕНТА

Киткин Д.А.,
Магистрант 1 курса Нефтегазового факультета
Смашов Н.Ж.
Кандидат технических науч, доктор PhD, ассац. профессор
Казахский Национальный Исследовательский Технический университет имени К.И. Сатпаева Казахстан, г. Алматы

RESEARCH ON DIAMOND ROCK BREAKING TOOLS

Kitkin D.,
1st year Master's degree of the Faculty of Oil and Gas
Smashov N.
Candidate of Technical Sciences, PhD, Associate Professor
Kazakh National Research Technical University named after K.I. Satpaev, Kazakhstan, Almaty
DOI: 10.5281/zenodo.12062575

Аннотация

Данная научная статья фокусируется на важности алмазного бурения в горнопромышленном комплексе и его влиянии на эффективность процессов разрушения горных пород. Работа предоставляет обзор классификации породоразрушающих инструментов (ПРИ) в зависимости от типов бурения и принципов разрушения пород, обеспечивая широкий выбор инструментов для различных геологических условий.

Основное внимание уделено алмазным коронкам и расширителям, выделяя их значимую роль в процессе бурения скважин. Исследования позволяют выделить ключевые аспекты, влияющие на эффективность алмазного бурения, такие как оптимизация конструкции коронок, контроль размера шлама в реальном времени и использование акустической диагностики для интегрального контроля процесса бурения.

В данной статье проведён анализ изменений в акустическом спектре при бурении, выявив диагностические признаки смены геологического разреза. Отмечено формирование частиц шлама определённого размера в процессе алмазного бурения, подчёркнута необходимость дополнительных исследований фануломатрического состава шлама. Статья предоставляет ценные данные для улучшения конструкции инструментов и оптимизации процессов бурения. Отмечается, что дополнительные исследования в области фануломатрического состава шлама могут привести к более глубокому пониманию влияния параметров горных пород на формирование частиц шлама, что способствует повышению эффективности алмазного бурения в различных геологических условиях.

Abstract

This scientific article focuses on the importance of diamond drilling in the mining industry and its impact on the efficiency of rock breaking processes. The work provides an overview of the classification of rock-breaking tools (RBT) depending on drilling types and rock-breaking principles, offering a wide range of tools for various geological conditions.

The main attention is given to diamond crowns and expanders, highlighting their significant role in the well drilling process. The research allows identifying key aspects influencing the efficiency of diamond drilling, such as the optimization of crown designs, real-time slurry size control, and the use of acoustic diagnostics for integral control of the drilling process.

In this article, an analysis of changes in the acoustic spectrum during drilling is conducted, revealing diagnostic features of geological strata changes. The formation of slurry particles of a certain size during diamond drilling is noted, emphasizing the need for additional research on the fanulomatric composition of the slurry. The article provides valuable data for improving tool designs and optimizing drilling processes. It is highlighted that additional research in the field of fanulomatric composition of the slurry may lead to a deeper understanding of the impact of rock parameters on slurry particle formation, contributing to the increased efficiency of diamond drilling in various geological conditions.

Ключевые слова: коронки, процесс алмазного бурения, породоразрушающий инстумент, конструкция бурового инструмента, акустический спектр.

Keywords: crowns, diamond drilling process, rock-breaking tool, drill tool design, acoustic spectrum.

Введение

Породоразрушающий инструмент (ПРИ) представляет собой буровой инструмент, прямо взаимодействующий с грунтом при процессе бурения скважины. Его целью является формирование ствола скважины путём разрушения горных пород.

Эффективность применения породоразрушающего инструмента зависит от характеристик конкретной породы, метода бурения и целей задачи. Следовательно, выбор подходящего инструмента требует анализа того, какие типы грунтов будут

преодолеваться в процессе бурения скважины, а также определение оптимального метода бурения.

Алмазное бурение, являясь важной технологией в современном горнопромышленном комплексе, сталкивается с разнообразием геологических условий, которые охватывают как твёрдые абразивные породы, так и менее прочные по механическим свойствам. Эффективность бурения в значительной степени зависит от выбора и применения различных видов породоразрушающих инструментов [1].

Классификация породоразрушающего инструмента (ПРИ) производится по нескольким критериям. По назначению ПРИ делится на три основных типа: инструменты для бурения сплошным забоем (например, долота шарошечные, лопастные), для бурения кольцевым забоем (как, например, коронки твёрдосплавные/алмазные и бурголовки), и инструменты специального назначения, такие как расширители скважинные, фрезеры, калибраторы и центраторы.

Ещё одним критерием классификации ПРИ является принцип разрушения породы. В данном случае выделяют режуще-скалывающее действие, которое применяется для вязких, пластичных и малоабразивных пород; дробяще-скалывающее действие, применяемое для разбуривания пород любой абразивности и твёрдости; и истирающе-режущее действие, используемое для бурения в породах средней твёрдости.

Важной частью комплекта алмазного ПРИ при бурении скважин являются алмазные коронки и расширители. Алмазная коронка, являясь породоразрушающим наконечником, играет ключевую роль в процессе бурения. Расширитель, снабжённый алмазами, предназначен для удержания диаметра скважины и стабилизации работы коронки на забое.

Методология бурения алмазными коронками предполагает использование различных размеров коронок в зависимости от условий бурения и свойств разбуриваемых пород. При этом, тщательно подобранный тип и размер алмазных коронок становятся решающими факторами для достижения высокой производительности и оптимизации стоимости буровых работ.

Таким образом, в рамках данного исследования представляется важным рассмотрение особенностей алмазного бурения, включая классификацию и характеристики породоразрушающего инструмента, с целью изучения процесса бурения скважин.

Методы

Одной из особенностей алмазного бурения на современном этапе является разнообразие геологических условий, которые включают в себя как очень твёрдые абразивные породы, так и породы с невысокой прочностью. При этом в геологических разрезах скважин могут присутствовать зоны осложнений, такие как нарушение устойчивости стенок скважин, поглощение промывочной жидкости, водопроявления и другие.

Эффективность бурения в значительной степени зависит от выбора алмазных коронок, что в свою очередь определяется конструктивными особенностями инструментов. Современные зарубежные компании выработали определённые общие правила, которые помогают выбирать оптимальные конструкции алмазных инструментов для конкретных условий. Эти конструктивные элементы включают в себя различные параметры, такие как сорт и размер алмазов, насыщенность, количество выпускаемых зёрен из-под торца матрицы, износостойкость и форма торца.

Процесс разрушения горных пород при бурении сопровождается появлением различных физических явлений, таких как акустическое, электрическое, электромагнитное и тепловое поля. Эти физические явления представляют собой важный источник информации о процессе разрушения горной породы, который традиционными методами сложно измерить. [1, 2, 3, 4, 5]

Для дальнейших исследований было выбрано акустическое поле, так как оно является легко измеряемым и информативным. Характерные отличия акустических исследований при бурении на нефть и газ алмазным бурением на твёрдые полезные ископаемые заключаются в использовании различных систем измерений и разном частотном диапазоне. При бурении на нефть и газ используется наземная система измерений, а информативный частотный диапазон акустических сигналов ограничивается до 1 кГц. В случае алмазного бурения, приёмник размещается в призабойной зоне, и информативный частотный диапазон достигает 20 кГц. Эти различия объясняются физикой разрушения горных пород, где высокочастотные колебания возникают при алмазном бурении в прочных горных породах. [6, 7]

С содействием экспериментальных исследований на стендовых установках, проведённых с целью выяснения воздействия типа и индивидуальных конструктивных параметров коронки на механизм бурения в режимах, не сопровождающихся вибрациями снаряда, был получен комплекс данных. Для осуществления данных исследований были задействованы алмазные коронки различных типов: БС, ИС, ИЖ, ИЧДП, И6ДХ, 02ИЗ, И4ГС, А4ДП с диаметрами от 46 до 93 мм. В ходе экспериментов конструктивные параметры коронок были изменены в значительном диапазоне, включая размер алмазов (от 250/200 до 2000/1600 мкм), количество алмазов на торце (от 10 до 150 шт/см^2), выступ алмазов из матрицы (от 0 до 50 мкм), качество алмазов (синтетические и природные разных марок), свойства матрицы (различные матрицы с твёрдостью от 10 до 55 HRC) и геометрию режущей части (коронки с плоскими и ступенчатыми торцами).

Результаты исследований подтвердили, что механизм бурения с использованием алмазных коронок обусловлен их конструктивными особенностями и проявляется через определённые параметры, такие как акустический шум разрушения и коэффициент Кр.

Примером рассмотрения являются результаты бурения биотитового гранита алмазными коронками типа БС, ИС, ИЖ, ИЧДП, И6ДХ, 02ИЗ, И4ГС и А4ДП диаметром 59 мм при параметрах Р=1000 даН, n=400 мин$^{-1}$ и Q=20 дм^3/мин. В ходе бурения отбирались образцы шлама, подвергнутые микроскопическим исследованиям и ситовому анализу.

В таблицах 1 и 2 показаны конструктивные параметры алмазных коронок и результаты бурения алмазными коронками соответственно. Число алмазов на торце коронки определяли прямым подсчётом зёрен при помощи микроскопа с 17-кратным увеличением. Максимальный выступ алмазов на торце коронки измерялся с использованием профилометра ПИК-1 по окружностям диаметром 44, 48, 51, 54 и 57 мм.

Методика исследований включала бурение скважин (каждой из приведённых коронок) глубиной 0,3 м при осевой нагрузке 1000 даН, частоте вращения снаряда 400 мин$^{-1}$ и расходе промывочной жидкости 12 дм^3/мин. В процессе бурения одновременно регистрировались механическая скорость бурения, мощность, реализуемая в процессе бурения, и звуковое давление в горной породе на расстоянии 0,3 м от забоя бурящейся скважины. Измерения акустических сигналов и сбор данных с датчика механической скорости и киловаттметра осуществлялись каждые 5 см по глубине скважины. По завершении бурения проводился отбор пробы шлама объёмом 3 см^3 с поверхности блока горной породы. После этого поверхность блока промывалась водой, и проводилось бурение новой скважины другой коронкой. Накопление шлама на поверхности блока происходило из-за неровного рельефа поверхности и низкой скорости истечения промывочной жидкости.

Таблица 1.

Конструктивные параметры алмазных коронок используемых в исследовании.

Тип коронки	Качество алмазов		Размер алмазов, мкм		Средний диаметр объём алмазов, мкм	Максимальный выступ алмазов, мкм	Число алмазов на 1 см^2 торца, штук
	объёмных	подрезных	объёмных	подрезных			
БС	АС-80	Твесал	250/200	--	230	20	139
ИС	АС-125	АРС-3	250/200	1600/1250	230	20	134
ИЖ	ХХХУгр.	ХХХ1У гр. «б»	650/500	1600/1250	570	50	87
И4ДП	А-80	ХХХ1У гр. «б»	800/630	1600/1250	700	80	34
И6ДХ	ХХХУгр.	ХХХ1У гр. «б»	630/500	1600/1250	570	90	38
02ИЗ	ХУ гр.«а»	ХУ гр.«а»	800/700	1600/1500	750	160	21
И4ГС	АСПК	ХХХ1У	800/630	1600/1250	700	170	10
А4ДП	ХХХУ1 гр. «б»	ХХХ1У гр. «б»	2000/1600	2000/1600	1700	250	11

Таблица 2.

Результаты бурения алмазными коронками.

Тип коронки	Показатели бурения			Характеристики шлама		Параметры механического бурения			
	$V_{МЕХ}$ х 10^{-7} м^3/с	$N_З$, кВт	W_V х 10^9, Дж/м^3	$d_ш$, мкм	Fs на 1 м^3 объёма х10^4, м^2	p, Па	fa, кГц	W_{AV} х 10^7, Па*с/м^3	$К_р$ ч 10^{-3} Па/Вт
БС	4,19	4,0	10,2	205	6,076	7,4	14,29	1,77	1,85
ИС	5,40	5,5	10,2	208	6,084	7,7	15,19	1,43	1,40
ИЖ	8,50	3,8	4,6	237	5,161	11,7	13,70	1,38	3,08
И4ДП	7,83	3,5	4,5	244	5,037	14,8	14,15	1,89	4,43
И6ДХ	9,32	3,0	3,2	268	4,729	15,9	12,33	1,71	5,30
02ИЗ	9,32	2,5	2,7	298	4,735	12,4	10,77	1,33	4,96
И4ГС	11,21	2,8	2,5	345	4,552	17,2	12,09	1,53	6,14
А4ДП	11,88	2,1	2,1	356	4,076	18,2	9,87	1,53	8,67

Спектры звукового давления, зафиксированные в области призабойной зоны, демонстрируют выраженные отличия, проявляющиеся в величине амплитуды, положении пиков на частотной оси и распределении энергии в спектре (рис. 1).

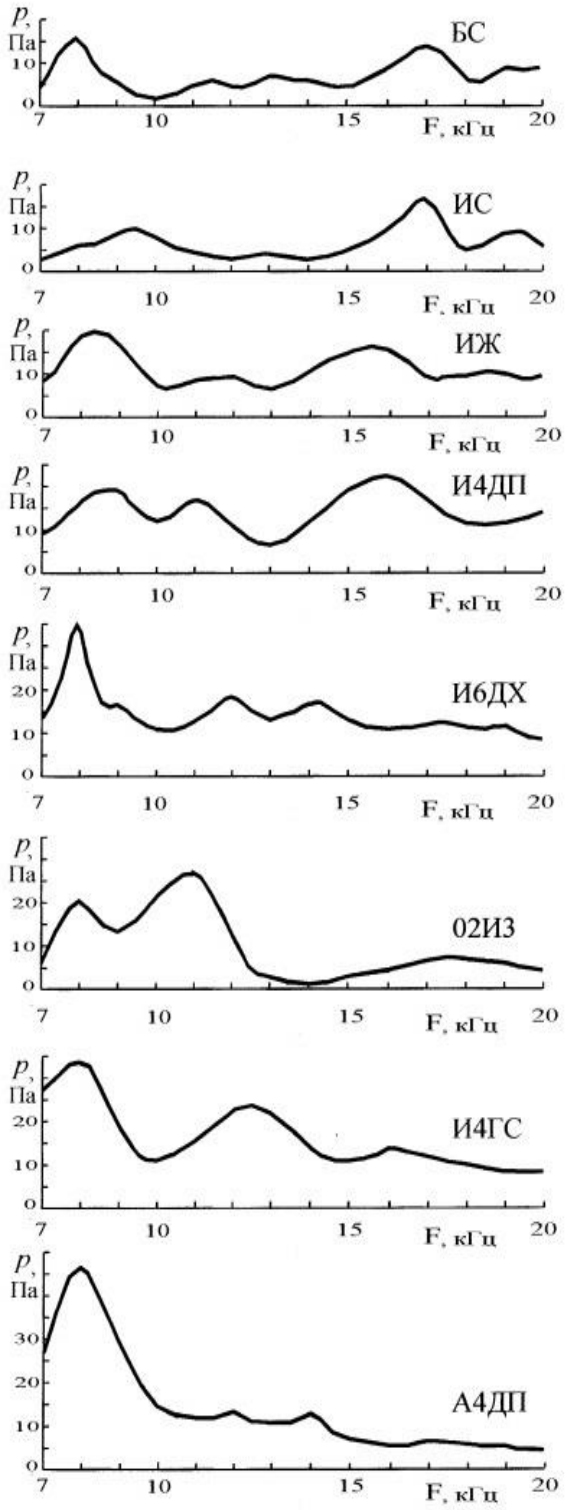

Рис.1 - Спектры звукового давления в процессе бурения биотитового гранита коронками БС, ИС, ИЖ, И4ДП, И6ДХ, 02И3, И4ГС и А4ДП

Из образца керна были изготовлены шлифы для проведения петрографического анализа, в результате которого были определены тип, текстурно-структурные особенности и минеральный состав горной породы. Рассматриваемая горная порода представляет собой средне-кристаллический биотитовый гранит, содержащий калиевый полевой шпат (микроклин) в объёме 35-40%, плагиоклаз – 25-30%, кварц – 25-30%, и биотит – 13-15%.

Вторичные минералы включают хлорит по биотиту и серицит по плагиоклазу. Кристаллы кварца формируют изометричные зерна, с размерами в диапазоне от 0,13 до 2,55 мм в поперечнике, кристаллы полевых шпатов имеют средний размер 2-3 мм. Структура гранита описывается как порфировидная, хотя не резко выраженная, и текстура – массивная.

Физико-механические свойства биотитового гранита, определённые по данным керна, включают

плотность 2810 кг/м^3, предел прочности на одноосное сжатие – 139 МПа, предел упругости – 110 МПа, и скорость распространения продольных упругих волн – 4990 м/с.

Гранулометрический состав шлама был выявлен путем проведения ситового анализа. Для этого применялся набор сит с диаметром отверстий 50, 100, 200, 315, 450, 630, 800, 1000, 1250 и 16000 микрометров. Пробы шлама подвергались сухому рассеиванию, при этом сита устанавливались от крупных размеров отверстий к мельчайшим сверху вниз. Шлам засыпали на верхнее сито, и весь набор сит регулярно встряхивали в течение 10 минут. Масса остатка (фракции) на каждом сите определялась путем взвешивания на весах модели АДВ-200М. Процедура очистки сит осуществлялась с использованием пылесоса.

Для определения содержания фракции С использовалась формула, в которой отношение массы фракции (m) к массе общей навески шлама (М), взятой для анализа, было рассчитано следующим образом:

$$C = \frac{m}{м} * 100\% \quad (1)$$

Гранулометрический состав шлама представлен в виде зависимости процентного содержания фракции от размеров отверстий сита (рис. 2).

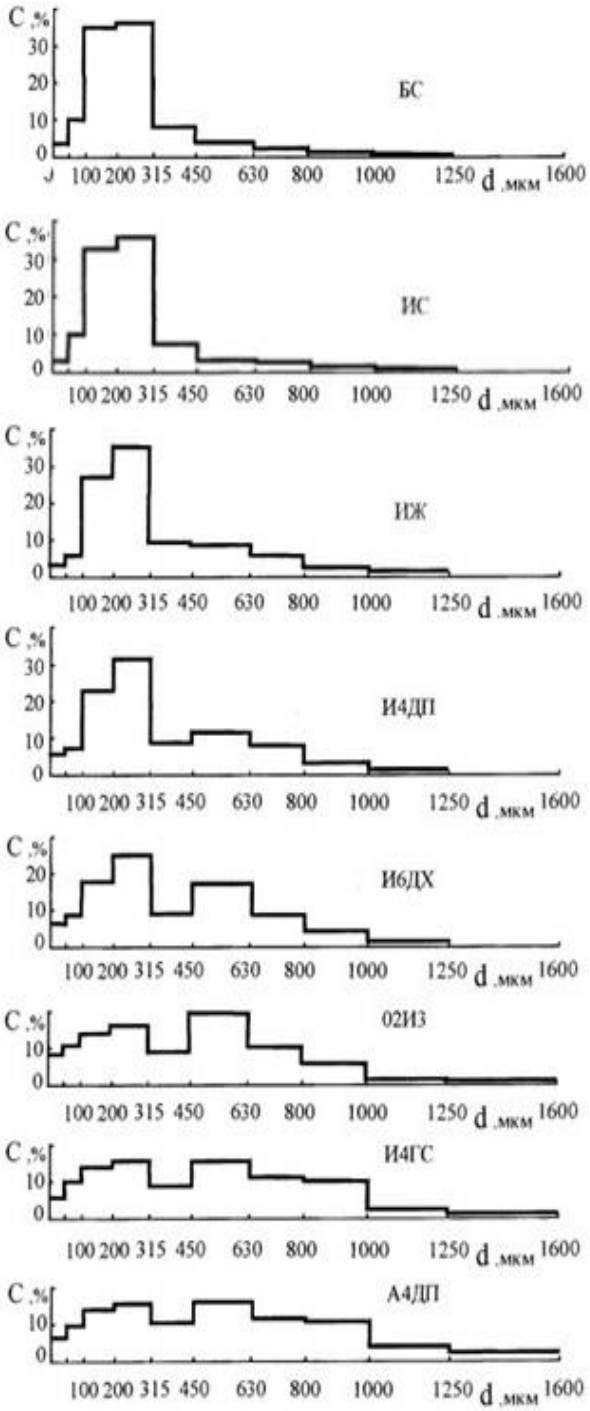

Рис.2 - Гранулометрический состав проб шлама, отобранных при бурении коронками БС, ИС, ИЖ, И4ДП, И6ДХ, 02И3, И4ГС и А4ДП биотитового гранита

Микроскопические исследования шлама выявили, что преобладающей формой частиц (примерно 60%) являются чешуйчатые, у которых высота в 2 и более раза меньше длины и ширины. Остальные частицы имеют неправильную форму и представляют собой сколы с острыми краями.

Для определения площади вновь образованной поверхности горной породы использовалась пластинчатая форма частицы с соотношением сторон 4:3:1.

Размеры средней частицы в каждом ситовом диапазоне были рассчитаны следующим образом: длина (L) – 75% от верхней границы диапазона, высота (h) – 25% от длины, ширина (S) – 75% от длины. Объем частицы (Vч) определялся согласно формуле:

$$\mathbf{Vч} = \mathbf{L} * \mathbf{h} * \mathbf{S} \quad (2)$$

Масса средней частицы шлама (mч) определялась путём умножения плотности гранита (ρ), равной 2810 кг/м3, на объем частицы:

$$\mathbf{mч} = \boldsymbol{p} * \mathbf{Vч} \quad (3)$$

Число частиц (Nч) в каждой фракции рассчитывалось делением массы фракции (m) на массу средней частицы (mч):

$$\mathbf{Nч} = \mathbf{m}/\mathbf{mч} \quad (4)$$

Площадь поверхности вновь образованных частиц (Fф) в каждой фракции определялась перемножением площади поверхности средней частицы (Fч) на число частиц (Nч) в фракции:

$$\mathbf{Fф} = \mathbf{Fч} * \mathbf{Nч} \quad (5)$$

Суммарная площадь вновь образованной поверхности (F_s) вычислялась путём сложения площадей вновь образованной поверхности в каждой фракции. Проведённые исследования подтвердили уже известный характер взаимосвязи между площадью вновь образованной поверхности (F_s) и удельной энергоёмкостью разрушения (W_v): увеличение удельной энергоёмкости разрушения сопровождается увеличением площади вновь образованной поверхности [73].

Представленная зависимость F_s=f (W_v) была аппроксимирована степенной функцией с высоким коэффициентом корреляции r = 0,98.

$$\mathbf{Fs} = \mathbf{3.61} * \mathbf{10^2} * \mathbf{Wv^{0.223}} \quad (5)$$

Исследования механизмов бурения с применением однотипных коронок выявили, что они проявляют практически одинаковые информативные характеристики, при условии совпадения геометрических размеров, торцевого и радиального боя, а также состояния и максимального выступа алмазов из тела матрицы, включая параметры матрицы. Бурение биотитового гранита выполнялось с использованием двух коронок И6КС-59 при осевой нагрузке 750 даН, частоте вращения 700 мин$^{-1}$ и расходе промывочной жидкости 20 дм^3/мин. Геометрические размеры, торцевой и радиальный бой, количество алмазов на торце, состояние и максимальный выступ алмазов из тела матрицы не различались у обеих коронок.

Спектры звукового давления, зафиксированные на расстоянии 0,3 м от забоя при бурении коронками И6КС, обладают характерным обликом (рис. 3). Пиковые амплитуды в спектре отмечены в диапазонах от 2 до 3, от 3 до 4, от 5 до 6, от 8 до 9 и от 11 до 12 кГц. По информативным параметрам отклонения у коронок минимальны и составляют: по СКЗ звукового давления - 9 %, по средней частоте f_A - 2 %, коэффициенту Кр - 9 %.

Это свидетельствует о том, что особенности распределения энергии при разрушении, а также параметры низкочастотных вибраций и акустического шума разрушения при бурении коронками И6КС совпадают.

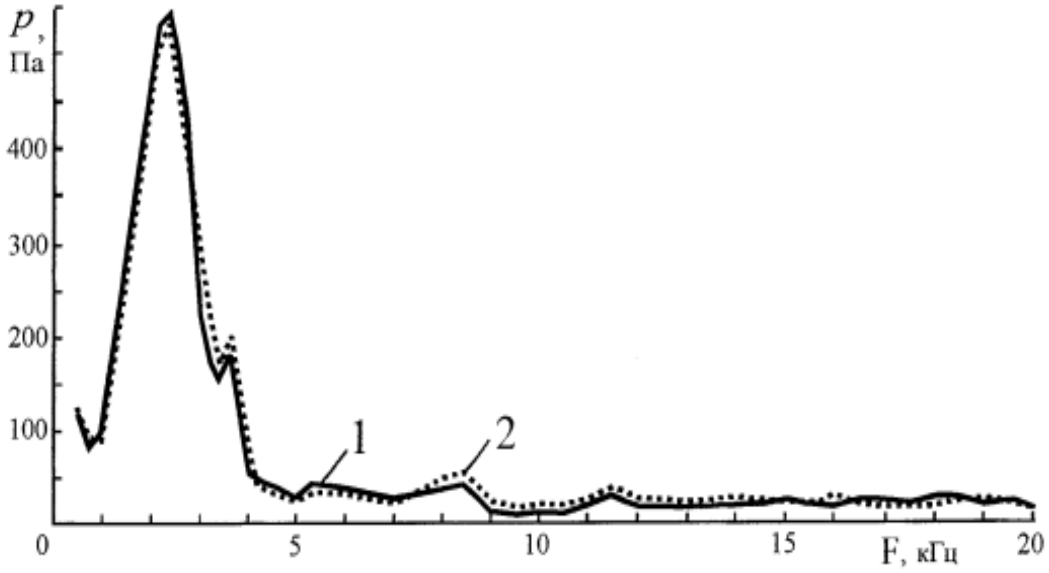

Рис.3 - Спектры звукового давления в призабойной зоне при бурении биотитового гранита алмазными коронками типа И6КС №2 (1) и №251 (2)

Сравнительный анализ изменений средней частоты f_A при бурении коронками одного типа в различных горных породах показал, что общий характер распределения энергии в спектре сохраняется в определённых пределах. Это позволяет провести классификацию механизмов бурения, осуществляемых алмазными коронками, на основе параметров акустического шума разрушения. По величине частоты f_A, зафиксированной при бурении гранита Каменогорского месторождения, механизмы разрушения разделяются на три типа: низкочастотный (НЧ) с f_A менее 10,5 кГц, среднечастотный (СЧ) с f_A в пределах 10-12 кГц и высокочастотный (ВЧ) с f_A более 12 кГц. Физически это означает, что с увеличением средней частоты f_A коронка реализует механизм с более высокой частотой взаимодействия алмазов с забоем.

Механизм бурения также зависит от степени приработки алмазной коронки. Неприработанная коронка проявляет механизм бурения, отличный от механизма разрушения приработанной коронки. Рассмотрим результаты бурения гранита с использованием семи коронок типа 02ИЗ-59, армированных объемными алмазами XV гр"а" 2Т1 размером 800/700 мкм и подрезными алмазами XV гр"а" 4Т4 размером 1600/1500 мкм (табл. 3). Масса алмазов в объёмном слое составляла 8,8 карат у всех коронок. Бурение производилось на постоянном режиме при Р=1000 даН, п=400 мин$^{-1}$ и Q=20 дм^3/мин.

Таблица 3.

Конструктивные параметры алмазных коронок 02ИЗ-59 и результаты бурения биотитового гранита

Номер коронки	Число алмазов на 1см^2 торца, штук	Максимальный выступ алмазов, мкм	$V_{МЕХ}$, м/ч	$N_З$, кВт	WV x10^9, Дж/м^3	Параметры акустического спектра		W_{AV} x 10^6, Па*с/м^3	Кр x 10^{-4}, Па/Вт
						Р, Па	f_A, кГц		
17891	38	160	4,1	2,0	1,3	1,4	13,6	0,91	7,0
17897	20	90	3,0	2,0	1,9	1,3	12,7	1,16	6,2
17896	21	80	2,8	2,1	2,0	1,2	11,5	1,14	5,7
17898	19	70	2,8	2,3	2,2	1,1	11,2	1,04	4,8
17892	18	70	2,6	2,3	2,4	0,9	11,3	0,93	3,9
17895	17	60	2,6	2,5	2,6	1,0	10,5	1,03	4,0
17890	15	60	2,4	2,5	2,8	0,9	10,4	1,00	3,6

С постепенной приработкой коронки на её рабочей поверхности отмечается увеличение числа алмазов и их выступа из матрицы, что сопровождается повышением СКЗ звукового давления, средней частоты fA акустического шума разрушения и коэффициента Кр (табл. 3). Спектры звукового давления в области призабойной зоны подвергаются закономерным изменениям (рис. 3). Полностью приработанная коронка №17891 обладает максимумами амплитуды на частотах от 8 до 8,3, от 10,4 до 10,7 и от 18,4 до 19,2 кГц. Удельная акустическая энергия на всех этапах приработки коронок примерно одинакова, что указывает на более сильное влияние свойств горной породы на W_{AV}, чем на тип коронки.

Изменение механизма бурения в процессе приработки коронки может быть объяснено следующим образом. В начальный период на рабочей поверхности коронки находится ограниченное количество алмазов с невеликим выступом из матрицы, и матрица коронки имеет значительную площадь контакта с забоем. Это приводит к повышенным затратам энергии на трение и тепловыделение, а также к низким затратам на динамическое взаимодействие алмазов с забоем. Это подтверждается низким коэффициентом распределения энергии при разрушении. С течением времени коронка постепенно переходит к механизму разрушения горной породы, характерному для полностью приработанных коронок. С появлением новых алмазов меняется характер распределения энергии на забое. Все больше энергии направляется на динамическое взаимодействие алмазов с забоем и разрушение горной породы, при этом доля энергии, расходуемой на трение матрицы о забой, уменьшается. Перераспределение энергии прекращается только после завершения процесса приработки коронки [7].

Характерные особенности бурения, осуществляемого данным породоразрушающим инструментом, позволяют использовать изменение параметров акустического шума разрушения в качестве диагностических признаков наличия конструктивных дефектов или изменения состояния инструмента.

Результаты и обсуждения

На основе энергетического подхода к процессу разрушения мы предлагаем физическое объяснение зависимости между силой бурения (Fs) и подачей промывочной жидкости (Wv). При увеличении размера алмазов и их выступа из тела матрицы (с уменьшением числа алмазов на торце коронки) отмечается увеличение мощности и уменьшение средней частоты акустического шума разрушения, а также рост коэффициента распределения энергии при разрушении. Характер распределения энергии при разрушении изменяется: акустическая энергия, излучаемая при этом, увеличивается, в то время как энергия, затрачиваемая на трение и преобразование в тепло, уменьшается. Эти изменения сопровождаются повышением эффективности механизма бурения. Оптимизация распределения энергии при разрушении сопровождается увеличением механической скорости бурения, снижением забойной мощности и уменьшением удельной энергоёмкости (табл. 3).

Результаты исследования впервые выявили возможность контроля селективности разрушения

с использованием параметров акустического шума разрушения. Под селективным разрушением понимается процесс управляемого воздействия на горную породу, в результате которого энергия поступает к требуемым межфазным контактам, вызывая разрушение в определённых направлениях и отделение частиц требуемых размеров от забоя. Ранее идея селективного разрушения горных пород рассматривалась в области обогащения полезных ископаемых [8]. Очевидно, что селективное разрушение позволит снизить энергоёмкость бурения и, в некоторых случаях, перейти к опробованию по шламу, избегая разрушения зёрен рудных минералов.

Для анализа изменений в размерах частиц шлама была использована характеристика dч, представляющая собой средний диаметр частиц. Этот параметр определяется как условный размер отверстия сита (диаметр частицы шлама), разделяющего образец на две весовые части. Определение значения dч производилось на основе графика, отображающего зависимость размера ячейки сита от процентного содержания фракции в образце (рис. 2). Метод заключался в поиске условного значения размера ячейки сита, при котором слева и справа от него находилось примерно по 50% веса образца.

Для параметров стандартного коэффициента звукового давления (СКЗ) и средней частоты (fA) в диапазоне 7-20 кГц были построены линейные аппроксимации в зависимости от среднего диаметра dч частиц шлама, и были вычислены коэффициенты корреляции r для каждой из этих функций.

$$\mathbf{fa} = \mathbf{20,46} - \mathbf{0,0284} * \mathbf{d}\text{ч}, \quad \mathbf{r} = -\mathbf{0,89} \tag{6}$$

$$\mathbf{p} = -\mathbf{3,15} + \mathbf{0,0604} * \mathbf{d}\text{ч}, \quad \mathbf{r} = \mathbf{0,86} \tag{7}$$

Отсюда можно сделать вывод, что одновременное уменьшение мощности акустического шума при разрушении и насыщение спектра высокочастотными компонентами является индикатором уменьшения размеров частиц горной породы, отделяемых от забоя. Спектр акустического шума при разрушении в зоне призабойной зоны, вызванной бурением алмазными коронками, содержит информацию о степени масштабности разрушения. На основе такой информации в будущем можно будет проводить разрушение горных пород с желаемой степенью селективности.

В проведённых исследованиях, посвящённых забойным процессам при алмазном бурении, были выведены ключевые аспекты, оказывающие влияние на эффективность и характер разрушения горных пород. Полученные результаты позволяют сделать следующие основные выводы:

- Изученный оригинальный механизм бурения горных пород алмазной коронкой зависит от конструктивных параметров коронки. Спектр акустического шума разрушения и коэффициент распределения энергии при разрушении (Кр) служат ключевыми характеристиками этого механизма. Размер алмазов и их выступ из матрицы прямо влияют на звуковое давление, среднюю частоту и спектр, а также на коэффициент Кр, что представляет интерес для оптимизации конструкции алмазных коронок.
- Снижение звукового давления и насыщение спектра акустического шума разрушения высокочастотными составляющими оказываются диагностическими признаками уменьшения размера частиц шлама. Это открывает перспективы для контроля размера шлама и селективности разрушения горной породы в реальном времени при бурении [8].
- Изменения в акустическом спектре при бурении на постоянном режиме, выражающиеся в смещении максимумов амплитуды и изменении звукового давления, являются диагностическим признаком смены геологического разреза, что делает акустическую диагностику полезной в интегральном контроле процесса бурения.
- В ходе исследований выявлено, что в процессе алмазного бурения формируются преимущественно частицы шлама размером 0 - 250 мкм. Однако объёмы исследований фануломатрического состава шлама оказываются недостаточными для установления зависимостей размеров частиц шлама от свойств горной породы, режима бурения и типа алмазного инструмента.

В целом, результаты исследований предоставляют ценные данные для дальнейшей оптимизации конструкции алмазных коронок, контроля процессов бурения и эффективного использования алмазного инструмента в различных геологических условиях. Дополнительные исследования в области фануломатрического состава шлама могут внести вклад в более глубокое понимание влияния параметров горных пород на формирование частиц шлама.

Заключение

В заключении данного исследования подчёркивается важность алмазного бурения в горнопромышленном комплексе, где эффективность процесса напрямую зависит от правильного выбора и применения породоразрушающих инструментов (ПРИ). Классификация ПРИ по типам бурения и принципу разрушения пород предоставляет широкий арсенал инструментов для различных геологических условий.

Особое внимание уделено алмазным коронкам и расширителям, выделяя их ключевую роль в процессе бурения скважин. Исследования позволили вывести ключевые аспекты, влияющие на эффективность разрушения горных пород алмазными коронками. Важными результатами являются оптимизация конструкции коронок, контроль размера шлама в реальном времени и использование акустической диагностики для интегрального контроля процесса бурения.

Проанализированы изменения в акустическом спектре при бурении, выявлены диагностические признаки смены геологического разреза. Отмечено формирование частиц шлама определённого раз-

мера в процессе алмазного бурения, но также отмечена необходимость дополнительных исследований фануломатрического состава шлама.

Обобщая, результаты исследований предоставляют ценные данные для улучшения конструкции инструментов и оптимизации процессов бурения, а дополнительные исследования могут привести к более глубокому пониманию влияния параметров горных пород на формирование частиц шлама, повышая эффективность алмазного бурения в различных геологических условиях.

Список литературы

1. Исаев М.И., Пономарев П.В. «Основы прогрессивной технологии алмазного бурения геологоразведочных скважин» М., Недра,1975.

2. Исаев М.И., Голодец Л.С. «Исследование напряженного состояния алмазных коронок» - В сб. "Методика и техника разведки". Л., ВИТР, 1972.

3. Исаев М.И., Ширко Г.И., Быченков Е.И. «Заполирование алмазов в буровых коронках и пути его предупреждения (рекомендации)». Л., ВИТР,1972.

4. Курочкин П.Н., Исаев М.И. «Исследование температурного режима работы алмазной коронки на забое скважины» - В кн.: Методика и техника разведки. Л., ВИТР, 1967.

5. Любимов Н.И. Классификация горных пород и рациональное применение буровой техники. М., Недра, 1977.

6. Курочкин П.Н. О динамике работы алмазов в буровых коронках и долотах. Изв. вузов. Геология и разведка, 1974.

7. Мухин М.Е. и др. Прочностные свойства алмазов марки различной прочности - Науч. труды. рег. совещ. «Алмазы и сверхтвердые материалы», 1974.

8. Ревнивцев В.И., Гапонов Г.В., Зарогатский Л.П. и др. Селективное разрушение минералов. М., Недра, 1988.

POLISH JOURNAL OF SCIENCE
№75 (2024)

ISSN 3353-2389

Polish journal of science:

- has been founded by a council of scientists, with the aim of helping the knowledge and scientific achievements to contribute to the world.
- articles published in the journal are placed additionally within the journal in international indexes and libraries.
- is a free access to the electronic archive of the journal, as well as to published articles.
- before publication, the articles pass through a rigorous selection and peer review, in order to preserve the scientific foundation of information.

Editor in chief –J an Kamiński, Kozminski University
Secretary – Mateusz Kowalczyk

Agata Żurawska – University of Warsaw, Poland
Jakub Walisiewicz – University of Lodz, Poland
Paula Bronisz – University of Wrocław, Poland
Barbara Lewczuk – Poznan University of Technology, Poland
Andrzej Janowiak – AGH University of Science and Technology, Poland
Frankie Imbriano – University of Milan, Italy
Taylor Jonson – Indiana University Bloomington, USA
Remi Tognetti – Ecole Normale Superieure de Cachan, France
Bjørn Evertsen – Harstad University College, Norway
Nathalie Westerlund – Umea University, Sweden
Thea Huszti – Aalborg University, Denmark
Aubergine Cloez – Universite de Montpellier, France
Eva Maria Bates – University of Navarra, Spain
Enda Baciu – Vienna University of Technology, Austria

Also in the work of the editorial board are involved independent experts

1000 copies
POLISH JOURNAL OF SCIENCE
Wojciecha Górskiego 9, Warszawa, Poland, 00-033
email: editor@poljs.com
site: http://www.poljs.com