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## СПІВПРАЦЯ МІЖ ВІЛЬНЮСЬКИМ ТЕХНІЧНИМ УНІВЕРСИТЕТОМ ІМ. ГЕДИМІНАСА ТА ЛЬВІВСЬКИМ ДЕРЖАВНИМ УНІВЕРСИТЕТОМ БЕЗПЕКИ ЖИТТЄДІЯЛЬНОСТІ

Ця стаття розглядає важливість написання наукових проектів та співпрацю між університетами в контексті розвитку науки та технологій. У рамках оголошених тендерів відбуваються конкурси на реалізацію білатеральних дослідницьких проектів між Литовською науковою радою та Міністерством освіти і науки України. Автори статті зосереджуються на одному з переможних проектів, який присвячений стічним водам та їх очищенню від азоту, фосфору та поверхнево-активних речовин. У рамках співпраці між Вільнюським технічним університетом Литви та Львівським державним університетом безпеки життєдіяльності України, проводяться дослідження кінетики та динаміки процесу адсорбції на природних сорбентах. Метою проекту є розробка методу третинної очистки стічних вод за допомогою екологічно чистих модифікованих природних сорбентів. Проект передбачає створення багатошарового фільтра з екологічно чистих природних адсорбентів. Стаття також наголошує на значенні міжнародних конференцій та круглих столів для обговорення проблем екологічної безпеки та сприяння обміну досвідом між учасниками. Висновок підкреслює важливість співпраці між університетами в наукових проектах, як засобу сприяння науковому розвитку та вирішення екологічних проблем. У статті також висвітлюється значення міжнародних конференцій та круглих столів у просуванні екологічної безпеки. Ці форуми надають учасникам можливість обмінуватися досвідом та ідеями, сприяючи поширенню знань і сприяючи співпраці. На завершення в статті підкреслюється важливість співпраці університетів у дослідницьких проектах, оскільки це сприяє науковому прогресу та вирішенню екологічних проблем. Співпраця між Вільнюським технічним університетом і Львівським державним університетом безпеки життєдіяльності є прикладом позитивних результатів такого партнерства, сприяючи стійким рішенням і вирішуючи нагальні екологічні проблеми.

**Ключові слова:** міжнародна співпраця, наукові проекти, екологічна інженерія.

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## COOPERATION BETWEEN VILNIUS TECH AND LVIV STATE UNIVERSITY OF LIFE SAFETY

**Abstract.** This article discusses the importance of research projects and university cooperation in the context of science and technology development. The Lithuanian Research Council and the Ministry of Education and Science of Ukraine are currently holding calls for proposals for bilateral research projects. The authors focus on one of the winning projects, dedicated to wastewater and its treatment from nitrogen, phosphorus, and surfactants. Within the framework of the cooperation between Vilnius Technical University of Lithuania and Lviv State University of Life Safety of Ukraine, the kinetics and dynamics of the adsorption process on natural sorbents are being studied. The project aims to develop a method of tertiary wastewater treatment using eco-friendly modified natural sorbents. The project involves the creation of a multilayer filter made of environmentally friendly natural adsorbents. The article also emphasizes the importance of

international conferences and roundtables to discuss environmental safety issues and facilitate participant experience exchange. The conclusion emphasizes the importance of cooperation between universities in research projects to promote scientific development and solve ecological problems. The article also highlights the value of international conferences and roundtable discussions in promoting environmental safety. These forums provide opportunities for participants to exchange experiences and ideas, facilitating knowledge dissemination and fostering collaborations. In conclusion, the article emphasizes the importance of university cooperation in research projects, as it contributes to scientific advancements and the resolution of ecological challenges. The collaboration between Vilnius Technical University and Lviv State University of Life Safety exemplifies the positive outcomes of such partnerships, driving sustainable solutions and addressing pressing environmental issues.

**Keywords:** international cooperation, scientific projects, environmental engineering.

**Formulation of the problem:** The collaboration between Vilnius Gediminas Technical University and Lviv State University of Life Safety in the field of sustainable wastewater treatment reflects the significance of international cooperation in addressing environmental challenges. This joint project focuses on the development of a method for tertiary wastewater treatment using environmentally friendly modified natural sorbents. By combining expertise and resources from both institutions, they aim to create a multilayer filter system that effectively removes nitrogen, phosphorus, and surfactants from wastewater. This collaborative effort highlights the importance of knowledge exchange, scientific research, and innovative solutions in tackling ecological issues.

**Analysis of recent research and publications:** Vilnius Gediminas Technical University of Lithuania (VILNIUS TECH) currently has bilateral cooperation agreements with scientific institutions of 35 countries, including 13 agreements with Ukrainian universities [1]. VILNIUS TECH includes the Faculties of Environmental Engineering, Architecture, Electronics, Fundamental Sciences, Mechanics, Transport Engineering, Construction, Creative Industries, Business Management, and the Antanas Gustaitis Aviation Institute. It is an innovative Lithuanian university that educates creative highly qualified specialists. The number of VILNIUS TECH students is almost 9 thousand, the university is a leader in the field of technical sciences and provides modern, labor market-oriented studies [2]. The university publishes fifteen peer-reviewed scientific journals, all published using the Open Access model, allowing free access and use of scientific production. From 2018 all articles are published under the CC-BY 4.0 license [3]. VILNIUS TECH journals are referenced in various databases, of which ten journals are indexed in the Web of Science (WoS) database (7 journals have the Journal Impact Factor (JIF) citation index and 3 journals are in the WoS Emerging Sources Citation Index database), thirteen journals are indexed in the SCOPUS database. The university organizes international conferences, 8 of which are planned for 2023.

Lviv State University of Life Safety is a leading institution of higher education in Ukraine in the field of human safety, recognized as a leader in national education and the consolidated All-Ukrainian rating

of higher educational institutions of Ukraine. The university is a member of the Association of Higher Education Institutions of the European Union in the field of human security (EFSCA).

Lviv State University of Life Safety, an educational and research institution, is working on mitigating the man-made impact on the environment and preventing emergencies, training specialists in human safety. Therefore, the proactive nature of education is at the core of the institution's activities. The university is a kind of training and research centre ensuring the principles of multi-level, continuous education [4,5].

The university has 6 scientific journals such as: Fire Safety, Bulletin of Lviv State University of Life Safety, Pedagogic and Psychology of Professional Education, Lviv Philological Journal, Scientific Notes of Lviv State University of Life Safety. Pedagogy and Psychology and Public Administration and Social Work [6].

Lviv State University of Life Safety carries out educational activities related to the provision of higher education in 22 educational and professional programs of bachelor's, specialist's, and master's degrees in full-time and part-time education. To increase the level of professional training of the firefighter rescuer, a psychological-training center for the training of firefighters and rescue teams, and a computer laboratory for psychological training of the emergency response manager were created at the University, which makes it possible to bring the rescuer closer to the real ones in real life fires and during emergency management. The educational process at the University is provided by highly qualified scientific and pedagogical staff, including 25 – Doctors of Sciences, Professors; 108 – Candidates of Sciences, Associate Professors.

The University has a scientific-research institute of fire and technogenic safety, an educational-scientific institute of civil protection, an educational-scientific institute of psychology and social protection, an institute of postgraduate education, a Higher vocational school of Lviv State University of Life Safety (in Vinnytsia) [7,5].

**The purpose of the article and the selection of previously unsolved parts of the general problem:** The purpose of this article is to shed light on the

significance of research projects and university cooperation in the realm of science and technology development. It aims to emphasize the importance of collaborative efforts between Lithuania and Ukraine in tackling shared challenges and advancing scientific knowledge.

Furthermore, the article focuses on highlighting the selection of previously unsolved aspects within the broader problem at hand. Specifically, it examines the joint research project between Vilnius Technical University and Lviv State University of Life Safety, which addresses the treatment of wastewater by utilizing modified natural sorbents. By exploring the kinetics and dynamics of adsorption on natural sorbents, the project aims to develop an innovative method for tertiary wastewater treatment.

The selection of this particular research area underscores the authors' recognition of the existing gaps and the need for novel solutions in environmental engineering. By tackling the removal of nitrogen, phosphorus, and surfactants from wastewater, the project contributes to the development of sustainable technologies and fosters ecological preservation.

In summary, this article not only highlights the importance of research projects and university cooperation but also underscores the deliberate selection of previously unsolved components within the larger problem. By focusing on wastewater treatment and the utilization of modified natural sorbents, the project aims to address pressing environmental challenges and advance the field of environmental engineering.

**Presenting main material:** The Science Council of Lithuania, together with the Ministry of Education and Science of Ukraine, in order to develop and promote bilateral cooperation in the field of science and technology, announces tenders for applications to carry out bilateral research projects of researchers. Application competitions are published once every 2 years. The following expenses are provided by the scientific projects: expenses for visits (up to 14 days) by the project implementers to the partner institution in Ukraine; costs for organizing joint seminars, conferences, and meetings in Lithuania; joint articles (publications), joint event materials and publishing costs [8, 9]. In December 2021, the results of the competition were announced. Our project "Sustainable technology of wastewater treatment by environmentally friendly modified natural sorbents for removal of nitrogen, phosphorus and surfactants" was on the list of winners. [10]. The partners of this project are: Vilnius Gediminas Technical University of Lithuania and Lviv State University of Life Safety of Ukraine.

From November 21 to 27, Adjunct of the Department of Environmental Safety, Captain of the Civil Defense Service, Iryna Fediv was on a business

trip to Gežeminas Vilnius Technical University (Republic of Lithuania) within the framework of the Ukrainian-Lithuanian project and the scientific-research work "Sustainable technology of wastewater treatment by environmentally friendly modified natural sorbents for removal of nitrogen, phosphorus and surfactants".

During her visit, she investigated the kinetics and dynamics of adsorption on bentonite, glauconite, and clinoptilolite in the university's laboratories. This project is aimed at developing a method for tertiary (deep) wastewater treatment from phosphorus, nitrogen and surfactant compounds. Natural minerals such as bentonite, glauconite, and clinoptilolite were chosen as environmentally friendly and inexpensive absorbents. Three different modification methods are proposed to increase their sorption capacity and selectivity, including thermal (heating in order to release pores from excess moisture), chemical (treatment by solutions increasing the sorption capacity and selectivity of sorbents for the above pollutants), and microwave irradiation. As a result of the project, it is planned to develop a multilayer filter with a backfill of environmentally friendly natural sorbents. Iryna Fediv got acquainted with the research areas of the University's Department of Environmental Protection. Together with the partners, they planned research and joint activities in the future and discussed the possibility of signing a cooperation agreement [11].

On March 17, the Lviv State University of Life Safety hosted a roundtable discussion on "Restoration of the Ukrainian environment due to Russia's armed aggression" to discuss the negative impact on the environment caused by Russia's armed aggression and its restoration based on the best international practices, as well as the tasks of environmentalists to address these issues.

The roundtable included a presentation by the Ukrainian-Lithuanian partners on "Cleaning contaminated water from phosphorus, negatively impacted by hostilities in Ukraine".

The following issues were discussed at the meeting: challenges and prospects for the development of Ukraine's environmental security strategy; humanitarian aspects and international participation in the reconstruction of Ukraine; negative impact on soils as a result of military operations and their reclamation; legal liability for environmental offenses during military operations; ecosystems negatively affected by military operations and assessment of their condition; problems of overcoming the impact of military operations on the environment; pollution of ground and surface water, as well as negative impact on the environment.

The preservation, restoration and post-war restoration of the main components of the environment, based on the ideas of the UN Sustainable Development Goals and the Law of Ukraine "On the Basic Principles



(Strategies) of the State Environmental Policy of Ukraine for the Period up to 2030", will be the key to improving the level of environmental safety in Ukraine. A report will be published based on the results of the Roundtable meeting. [12].

The 12th International Conference "Environmental Engineering" took place on April 27-28 this year. There were speakers from 7 countries: Italy, Latvia, Poland, Austria, Ukraine, Germany, and Malaysia. During the plenary meeting of the conference, VILNIUS TECH Rector gave a speech about the importance of environmental engineering science in modern society, drawing attention to the current situation due to hostilities in Ukraine and the need to solve environmental problems [13]. Due to its versatility, complexity, and applied nature, environmental engineering is one of the most complex areas of engineering, covering various areas of life, combining the knowledge and experience of different sciences. The main objectives of the conference were:

- create conditions for scientists, engineers, representatives of industry and municipalities from Lithuanian and foreign scientific and study institutions to have direct discussions and develop multifaceted cooperation;
- gather potential partners for possible successful, long-term, and continuous cooperation in environmental engineering issues;
- to discuss further directions for the development of applied science and the implementation of the most advanced scientific research in practice.

Before the conference, the international scientific committee selected 66 of the submitted reports. All of them were peer-reviewed by Lithuanian and foreign scientists and will be placed in an electronic set of conference reports, which is planned to be sent to the ISI Proceedings database. The Lithuanian-Ukrainian environmental science project "Sustainable technology of wastewater treatment by environmentally friendly modified natural sorbents for removal of nitrogen, phosphorus and surfactants" correspond to the priority direction of scientific research "Ecology and rational use of nature". The goal of the project is to obtain effective and affordable sorbents made on the basis of natural minerals, suitable for cleaning wastewater from eutrophicators and detergents. As part of the project, it is planned to create a multi-layer filter filled with environmentally friendly natural adsorbents. The Ukrainian partner participating in this project has experience in the fields of extraction of natural sorbents (various clays), investigation of their sorption properties, and preliminary testing. The Lithuanian partner has experience in the application of plant sorbents and sand-based sorbents for wastewater treatment. By combining the common

knowledge, it is expected to obtain and test new modified sorbents. During the implementation of the project, an agreement was concluded on the joint management of the doctoral students' work. The universities of Lithuania and Ukraine are interested in continuing cooperation at the institutional level by implementing cooperation programs and exchanging experience both in the field of education and scientific activities. Based on the results of the project, general scientific articles are published. A new device was purchased from the project funds - a portable X-ray fluorescence analyzer (XRF), X-200 Alloy Analyzer. This device will be used in scientific research by Vilnius Tech Department of Environmental Protection and Water Engineering master's students, doctoral students, lecturers, and scientists of the Vilnius Tech Environmental Protection Institute.

**Conclusions:** To conclude, we can say that applying for scientific projects and collaborating between universities are crucial aspects of scientific and technological development. In particular, joint research projects between Lithuania and Ukraine contribute to the establishment and advancement of bilateral cooperation in the field of science and technology.

These projects provide opportunities for researchers to exchange knowledge, research methods, and technologies, as well as expand international connections. They stimulate the exchange of expertise and experience between universities and research institutions, promote the development of innovative solutions, and disseminate new knowledge within the scientific community.

Within such projects, expenses for mutual visits of researchers, the organization of joint seminars, conferences, and meetings, as well as the publication of joint scientific papers and materials, are funded. This facilitates active interaction among researchers from different countries, fosters idea exchange, and deepens knowledge in various fields of science.

The universities of Vilnius Gediminas Technical University in Lithuania and Lviv State University of Life Safety in Ukraine play an important role in stimulating scientific research and educating creative and highly skilled professionals. They actively collaborate with other universities and research institutions, organize international conferences, and foster scientific cooperation between the two countries.

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