UDC 338.48-043.2:504](045)

https://doi.org/10.52058/2786-6025-2024-4(32)-802-814

Dzhoha Olha Valentynivna PhD, associate professor at the Department of Technologies and Organization of Tourism and Hotel and Restaurant Business, Pavlo Tychyna Uman State Pedagogical University, Sadova St., 2, Uman, 20301, tel.: (04744) 4-06-44, https://orcid.org/0000-0003-2574-4906

ENVIRONMENTAL CHARACTERISTICS OF HUMAN LIFE ACTIVITIES

Abstract. Humanity increasingly feels the consequences of its influence on the environment. Today, the world community not only actively discusses the issue of environmental protection in all spheres of human activity, but also implements measures to improve the ecosystem, turning them into eco-trends. Ukraine is located in the central part of Europe and is also concerned with environmental issues. The issue of life safety is very painful for our country, because Ukrainians have already felt the consequences of the Chernobyl disaster, the explosion of the Kakhovskaya HPP dam, the destruction of the ecosystem in the southern and eastern regions due to Russia's military aggression. The coasts of Odesa, Koblevo, Zalizny Port and other popular resort towns have become unsuitable for swimming due to water pollution, the danger of mines and the destruction of buildings. However, even in such difficult conditions, the country's business is trying to maintain and develop. Hotel owners strive to improve the quality of services in accordance with European standards. Hoteliers of Ukraine face global challenges in terms of creating safe conditions for the operation of their establishments in relation to the environment, creating safe conditions for the stay of guests in hotels and the work of staff.

In the article, the author analyzes the impact of the activities of the hotel and restaurant industry on water and land resources as a result of the use of personal hygiene products, tools for cleaning and processing equipment, equipment, premises. The problem of littering the ecosystem with plastic and its negative impact on the human body will be raised. The author makes an attempt to investigate the legislative framework that regulates the accounting and use of detergents and plastics in hospitality industry establishments. Pays attention to new legislation and eco-standards. Alternative ways of using plastic waste and innovative developments to reduce the negative impact of harmful components on the environment are considered.

Keywords: hotels and restaurants, tourism, life safety, ecology, hospitality, health, safety, plastic, synthetic detergents.

Джога Ольга Валентинівна доктор філософії, доцент, Уманський державний педагогічний університет імені Павла Тичини, вул. Садова, 2, м. Умань, 20300, тел.: (04744) 4-06-44, https://orcid.org/0000-0003-2574-4906

ЕКОЛОГІЧНА ХАРАКТЕРИСТИКА ЖИТТЄДІЯЛЬНОСТІ ЛЮДИНИ

Анотація. Людство планети все сильніше відчуває на собі наслідки свого впливу на екологію. Сьогодні світова спільнота не лише активно обговорює питання захисту екології в усіх сферах людської діяльності, а й впроваджує заходи з покращення екосистеми, перетворюючи їх на екотренди. Україна знаходиться у центральній частині Європи і також переймається питаннями екології. Питання безпеки життедіяльності для нашої країни дуже болючі, адже мешканці України вже відчули на собі наслідки Чорнобильської катастрофи, підриву греблі Каховської гідроелектростанції, нищення екосистеми у південних та східних областях через військову агресію росії. Узбережжя Одеси, Коблево, Залізного Порту та інших популярних курортних містечок стали непридатними для купання через зараження водойм, небезпеку ураження мінами та руйнування будівель**.** Однак, навідь у таких складних умовах, бізнес країни намагається утриматись та розвиватися. Власники готельних закладів прагнуть покращити якість надання послуг обслуговування у відповідності до Європейських стандартів. Перед готельєрами України стоять глобальні задачи по створенню безпечних умов діяльності закладів відносно до довкілля, створенню безпечних умов перебування мешканців у готелях та роботи обслуговуючого персоналу.

У статті автор аналізує вплив діяльності закладів готельно-ресторанного господарства на водні та земляні ресурси у наслідок використання засобів особистої гігієни, засобів для чищення та обробки обладнання, устаткування, приміщень. Піднімється проблема засмітчення екосистеми пластиком та його негативним впливом на організм людини. Автор робить спробу дослідити законодавчу базу, яка регулює питання обліку та використання миючих засобів, і пластику у закладах індустрії гостинності. Звертає увагу на нові законодавчі акти та еко-стандарти. Розглядаються альтернативні спрособи використання пластикових відходів та інноваційні розробки для зменьшення негативного впливу шкідливих складників на екологію.

Ключові слова: заклади готельно-ресторанного господарства, туризм, безпека життєдіяльності, екологія, сфера гостинності, здоров'я, безпека, пластик, синтетичні миючі засоби.

Formulation of the problem. The problem of environmental pollution is close to every inhabitant of the planet. Today, humanity is increasingly aware of the

impact of its lifestyle on the health of future generations. Consumers of services in the hotel and restaurant industry increasingly choose establishments that consciously save energy resources, use natural materials in the decoration of premises, and reduce costs for synthetic detergents. Socio-economic circumstances encourage entrepreneurs to look for new solutions for creating business projects in the field of hospitality, to implement innovative developments to reduce damage to the environment, to comply with the requirements of environmental protection legislation.

Analysis of recent research and publications. The importance and relevance of issues of greening of hotel and restaurant establishments and tourist facilities were considered in their works by S. S. Belyaeva and I. V. Herman [3], D. O. Ositnyanko, T. Yu. Primak [10], N.M. Ganych, O.M. Gatalyak [5]. The implementation of the principles of sustainable development in the tourism industry is considered in their research by S. P. Stasevich, O. V. Nedzvetska and O. I. Khomzyak [14]. Scientists E. O. Mykhaylova, D. Deineka M., Pancheva H.M. [9] write about the harmful effects of plastic and synthetic detergents. Prospects for the development of eco-hotels in Ukraine and the impact of environmental certification on their rating are considered in the scientific works of N.M. Shuvar, H.M. Zakalyk, I.R. Udud [19], N.V. Tereshchuk [17].

Therefore, the problem of environmental sustainability of the hospitality industry and tourist facilities is raised by modern scientists and is actively researched. However, in our opinion, there are not enough studies that reflect the rationing of the consumption of detergents in hospitality establishments in order to preserve the environment. Therefore, we consider it necessary to consider the problem of the harmful influence of tourists and the lifestyle of vacationers in hotel and restaurant establishments on water and land resources.

The purpose of the article is to draw attention to the problem of the impact of hotel residents and tourists on the environment and to investigate the legislative framework that regulates the activities of hospitality industry establishments on issues of reducing harmful factors for the health of the nation and the environment.

Presenting main material. The issue of greening hotel enterprises is more relevant today than ever and has turned into a trend. Hotels must be safe for the environment, employees and vacationers. At the current stage of cleaning in the hotel sector, it is impossible to maintain cleanliness and disinfection without the use of chemicals. They are powder, gel, liquid, tablet, capsule, aerosol, pasty and granular. All these products contain many different components, the main component of which are biodegradable surface-active substances. The requirements of DSTU apply to such products, according to which the components must not contain surface-active substances, chlorine and phenols. Using a large amount of highly concentrated cleaning products can harm the human body, suppressing immunity due to the destruction of the body's beneficial microflora. Decisive criteria when choosing

cleaning products in hotels are not only cost, but also their safety, the number of milliliters or grams in the package, concentration, speed of action of the product, ease of use. After all, the bet during cleaning is made on the quality and speed of the process.

A study of the quality of wastewater in Ukraine shows that most hospitality establishments exceed the standards for the use of detergents, not following the rules for diluting concentrated agents with water. The main reason for this phenomenon is the human factor and the low level of control of cleaning service managers over the process of using detergents. Violations occur both on the part of hotel staff and on the part of visitors who do not control the consumption of detergents, thereby violating the quality of wastewater.

Toothpaste is a big problem today. Today, videos and articles about the amount of toothpaste that needs to be squeezed out of a tube are gaining popularity in social networks. Its quantity should not exceed the diameter of a pea. The problem was created as early as 1892 by an advertisement that depicted the amount of toothpaste being liberally applied to the brush along the entire length of the bristles. Consumers of the product get the impression that the more paste you squeeze out of the tube, the better the tooth brushing process will be. For quite a long time, no one paid attention to this problem. But with the growing relevance of ecology and wastewater quality problems, numerous studies have shown an excess of fluoride in water. Today, they are actively looking for an alternative to storing pasta in tubes in order to reduce its cost. Colgate has spent the last five years developing a new type of toothpaste tube. Like many other giants of the consumer goods market, the company has committed to switching to fully recyclable, reusable or compostable packaging by 2025. This will significantly reduce the amount of waste. Company representatives emphasize the expediency of conducting an information campaign among buyers regarding the need to dispose of new packaging in a sorting container, and not in the trash. When toothpaste tubes end up in landfills, they pollute the environment due to their content of a mixture of materials, particularly aluminum, that are not accepted for recycling by typical businesses [15]. Plastic tubes are very difficult to recycle, because the components can take more than 400 years to decompose. Therefore, scientists suggest using ultra-modern toothpaste instead of classic toothpaste, which will eliminate the need to enrich landfills. Toothpaste in tablets is an innovation. Tablet paste is the best option for tourists and travelers, as it takes up a minimum of space. It is very easy to use this paste. It is enough to put the tablet in the oral cavity, and slightly moisten the toothbrush with water. Under the influence of water and the mechanical action of the brush, the tablet turns into a paste. Fluoride-free toothpastes are becoming more and more popular. Scientists predict that from 2022 to 2030, the segment of fluoride-free toothpaste tablets will grow by an average of 7.6% per year. Allantoin, bisabolol, natural plant raw materials and natural essential oils are preferred as part of tablet compositions [11]. Another movement in hotel landscaping is the rejection of plastic toothbrushes.

Ukrainian inventors have developed a new brush that is made of pressed cellulose and has a coating of corn starch. During disposal, the corn cob is eaten by bacteria in the soil, and paper decomposes much faster than plastic. In the future, brushes will be made exclusively from recycled paper, which will make us even more friendly to nature. The manufacturers also plan to include tablet toothpaste in the toothbrush packaging. According to the Ukrainian development team, it makes no sense to put a plastic tube of toothpaste in an environmentally friendly brush. It is nice to note that the development of Ukrainians was included in the top five startups in the world in the field of climate at the Clim@ competition in Germany [6]. Packaging tubes of toothpaste in a cardboard box is additional packaging that immediately ends up in the trash. According to environmentalists, paste tubes do not need additional protection, and cardboard waste can be significantly reduced. It is the use of tablet paste or packaging that can be recycled that will help make our planet cleaner.

Considering the number of single-use toothpaste tubes, toothbrushes, single-use razors and detergent packages used in the hospitality industry, the amount of plastic in landfills is huge and replenishing quickly. If at home one person can use a toothbrush for a month, then in accommodation facilities such duration of use is most often 1-3 days. The 50-bed hotel throws about 20 toothbrushes into the garbage every day.

Plastic from the packaging of disposable detergents in the form of shower gels, conditioners and shampoos also remains among the critical amount of waste. We propose to introduce dispensers for such products in the bathrooms according to the principle of dispensers for liquid soap. Especially for consumers who like to wash their hair with more than one portion of shampoo. Increasingly, ecologists are expressing their opinion about the return of the popularity of bar soap, because it is much more economical.

Liquid dispensers make it easy to pour water, detergents, disinfectant solutions and other liquids without the need to use regular bottles or containers. They have a different dosing mechanism - from a simple push of a button to more complex automated systems.

Among the advantages of using dispensers for liquid soap

- hygiene, because the contact of hands with an ordinary bar of solid soap is reduced. This function is enhanced if the dispenser is equipped with an automatic sensor system;
- cost-effectiveness, as the dispenser allows you to accurately determine the required amount of material for use;
- environmental friendliness, as the amount of plastic waste that ends up in the trash after unpacking individual packages decreases;
- aesthetics, because such devices are elegant and stylish and fit well into the interior of the premises;
- ease of use, as touch dispensers reduce maintenance time.

In our opinion, the use of dispensers not only for liquid soap, but also for shampoo, shower gel, air conditioners will reduce the amount of plastic waste by 80%.

It should be remembered that synthetic detergents cause great harm to the environment. Many of them decompose slowly or do not decompose at all. Accumulating in water, they change its surface tension, contribute to the formation of thick and stable foam. As a result, the supply of oxygen to the water decreases, which leads to the death of living organisms [7]. To create a uniform consistency, polyquaternium microplastic is added to the shampoo. This synthetic polymer has a large molecule and cannot directly penetrate the human body. However, entering water bodies and soil with sewage, molecules of this substance can enter the body of animals and plants. Scientists have discovered polyquaternium molecules in tap water, beer, copper and sugar. Thus, a person becomes an indirect consumer of microplastics [18]. Cosmetics, hygiene products, household chemicals, lipsticks, creams, shampoos, shower gels, deodorants, hair sprays, dishwashing detergents, powders, etc. can contain microplastics from 1 to 90%. It plays the role of a stabilizer, viscosity regulator, emulsifier, antistatic, and in recent years, manufacturers add it for the attractiveness of the product in the form of sparkles [8].

We made an attempt to investigate the availability of regulatory documentation that regulates the costs of hygiene products in the hotel industry of Ukraine. It turned out that such documentation is missing. From Clause 5 of the Requirements for Hotels of Different Categories of the National Standard of Ukraine. Hotel services. In DSTU 4269:2003, we see only notes about the presence of detergents and inventory in rooms of different comfort categories, but this document does not contain information about the quantitative measurement of detergents. It is difficult to control the costs of detergents in hotel premises due to the variety of types of accommodation facilities, different occupancy rates, different levels of room comfort and the intensity of cleaning, so hoteliers develop such costs exclusively from their own practical experience. However, it is not only liquid personal hygiene products that are responsible for excess detergents in hotel wastewater. Service personnel spend a large amount of detergents and disinfectants for sanitizing premises, washing dishes and equipment, washing clothes. Sodium salts of polyphosphates, used to soften water, are added to detergents to protect equipment and pipes from scaling and reduce foaming. For humans, water with an overdose of phosphates causes allergic reactions, damage to the lungs, kidneys, brain and liver, as well as immune disorders. In more than fifty countries of the world, legal restrictions or a complete ban on the use of phosphate washing powders have been introduced [4].

Considering the high hygienic and ecological danger of phosphates, the world community has set very strict requirements for their content in waste water, drinking water and food products. Thus, the EU Directives 98/83/EU and 75/440/EU set the

maximum permissible concentration (MPC) of phosphates in water intended for drinking purposes at the level of 0.7 mg/l, and DSanPiN 2.2 is in force in Ukraine. 4-171-10 provides for a maximum permissible value of 3.5 mg/l. According to the Directive 76/160/EC, the content of phosphates in surface waters for cultural, domestic, economic and recreational purposes should not exceed 0.2 mg/l, and in Ukraine, according to DSanPiN 4630-88, the maximum allowable concentration of phosphates in waters of similar the purpose is up to 3.5 mg/l. [16]. However, from December 31, 2023, the situation changed for the better, as restrictions on the content of phosphates and other phosphorus compounds in detergents were also introduced in Ukraine by Resolution of the Cabinet of Ministers of Ukraine "On Amendments to the Technical Regulations of Detergents" dated June 2, 2021 No. 575.

To significantly reduce the level of phosphates in wastewater, it is effective to use water softening systems based on ion exchange resin. These systems replace calcium and magnesium ions with sodium ions. Such ions do not affect the properties of surfactants and do not form solid compounds that settle on heating elements. Water softening reduces the consumption of washing powder, soap, shampoos and detergents; saves electricity spent on heating water in kettles, washing machines and dishwashers, boilers; contributes to the protection and preservation of the environment [16].

One of the reasons for the overdose of phosphates in wastewater is the uncontrolled use by the staff of concentrated cleaning solutions for cleaning the hotel premises, which are delivered to the facility in large plastic containers. It is in the process of diluting concentrates that non-compliance with the instructions occurs. The human factor leads to overdose. This phenomenon can be prevented by: strengthening control over service personnel; increasing the responsibility of personnel by informing and nurturing a caring attitude towards the environment; using devices that help minimize the consumption of detergents. An example of such devices is the ECOSHOT dosing system. It is designed to control the consumption of detergents during dosing of solutions of various concentrates into a bottle, bucket or sink. The ECOSHOT system can be configured to dispense any amount of concentrates from 5 to 30 ml and can dispense from any container [12]. For efficient purification of city wastewater from phosphates, their treatment is carried out sequentially in anoxic (anaerobic) and aerobic bioreactors. This treatment of wastewater with the mobilization of microorganisms on polymer carriers allows to achieve a high degree of purification of water from phosphorus compounds - more than 70% during wastewater treatment for 3 hours in anaerobic conditions and 4 hours in aerobic conditions. Dephosphorylation processes in the biological treatment of wastewater occur at the expense of two groups of bacteria: facultative in anaerobic conditions and strict aerobes in aerobic conditions. Bacteria of the genera Aeromonas, Citrobacter, Proteus, Acinetobacter, Achromobacter, Bacillus, Moraxella, Escherichia are the main ones in the processes of dephosphorylation of wastewater. [16]

In addition to the documents that regulate the production of detergents and cosmetics, there are also a number of documents that prescribe requirements for the environmental friendliness of packaging. An example of such documents is

- Technical regulation of environmental labeling:
- DSTU ISO 14020:2003 (ISO 14020:2000, IDT) Environmental labeling and declarations. General principles;
- DSTU ISO 14021:2016 (ISO 14021:2016, IDT) Environmental labeling and declarations.

Self-declarations of type II (Ecological labeling of type II);

- DSTU ISO 14024:2018 (ISO 14024:2018, IDT) Environmental labeling and declarations. Ecological labeling type 1. Principles and methods.

The technical regulation of ecological labeling was approved by the resolution of the Cabinet of Ministers of Ukraine dated 18.05.2011 No. 529. This document was developed in accordance with the Regulation of the European Parliament and the EU Council 66/2010/EU of November 25, 2009 on the EU ecological labeling sign [2]. According to this document, information about the composition of the product must be displayed not only in relation to the cosmetic or detergent, but also contain a description of the substances from which the package is made. At the request of this normative legal act, no business entity has the right to apply ecological labeling or declarations of ecological content to goods or services: "ecologically clean", "ecological", "environmentally safe", "friendly to nature", etc. without confirmation environmental benefits through certification. Products that are not environmentally friendly, as stated on the label, fall into the category of greenwashing. Such unscrupulous "green" PR should be prosecuted by law [13]. At the beginning of 2020, the Cabinet of Ministers Resolution No. 88 of February 12, 2020 amended the Technical Regulations of Detergents. In particular, it is determined that in order to check the compliance of products with the requirements of this Technical Regulation with the application of module A1 (which provides for the implementation of internal production control and the conduct of product tests under supervision), relevant tests of typical representatives of the corresponding assortment (model) range of detergents or surface-active substances are carried out. When ordering body care products, hoteliers should choose packaging that does not contain microplastics and petroleum derivatives. Microplastics are not recyclable and can pollute the ocean and enter the bodies of marine life. Petroleum derivatives also include paraffin oil, propylene glycol and ethylene. Look out for packaging containing alternative ingredients such as beeswax, cocoa paste and vegetable oils. Marine extracts and algae are useful for both humans and the environment - they convert carbon dioxide into oxygen [11].

Engineers and scientists of the world are actively developing projects to create "hotels of the future" in which eco-production products will be offered:

- shower gels, soaps, shampoos, conditioners, lotions, the packages of which quickly decompose in the ground, and the products themselves do not contain silicones, parabens, synthetic surface-active substances that pollute water. Such products are also called "zero waste" products, which means "zero waste" in English;

- napkins and towels that do not need to be washed, but can be recycled multiple times (saving water, time and labor costs);

- bamboo stands and waste baskets (bamboo is actually grass, it has a fairly high rate of growth and decomposition in nature);

- eco-agents, which are considered chemically safe and do not harm both employees who use them and hotel visitors [16].

Progressive technologies using artificial intelligence in robotics help to replace the manual work of hotel staff with mechanized work. It is already known about the robotization of cleaning processes in toilets and showers. In 2013, developers Hill and Ariel Ben Amram from the New York company SpinX created a toilet that can clean itself. The device has a built-in brush that cleans with rotating movements, treating the surface of the toilet bowl with a portion of the cleaning solution. After cleaning, everything is rinsed with built-in water jets and dried using built-in fans. The cleaning process takes 90 seconds, and the mechanism is powered by a battery that lasts for 30 cleaning cycles [2]. In Japan, there is a cleaning robot for toilets and showers in hotel premises, which can not only clean the toilet, but also wash the shower cabin, tiles on the walls, clean the mirror, wash the floor. Using robots to clean toilets makes the cleaning and disinfection process faster and more efficient, because the robot does not get tired and controls the consumption of detergents. It is cheaper to maintain a robot than to pay several employees who work in shifts, periodically get sick and need vacations. The use of such robots is an eco-trend [1]. Therefore, the safety of the guests in the hotel premises, the safety of the work of the service personnel and the state of the environment depend on the conscious use of natural resources, energy sources and means that make our life comfortable. The field of hospitality is an integral participant in the process of using and transforming resources. The ecological awareness of visitors and hotel staff is formed thanks to information in social networks and mass media, the movement of ecoactivists, the level of education, international experience, the legislative base of the state, as well as the introduction of progressive technologies for processing and waste disposal.

Conclusions. The problem of the influence of the activities of the hotel and restaurant industry and tourism on the natural environment remains very relevant and requires regulation, support and proper control by the state. This issue is regulated by a number of legal acts, including the Law of Ukraine "On Tourism" dated November 18, 2003, "On Environmental Protection" dated June 25, 1991, "On Local Self-Government in Ukraine" dated April 9, 1999 [18]. However, today, in connection with Ukraine's desire to update legislation in the field of ecology and

natural environment protection, many legislative acts have lost their validity, and new ones have not yet entered into force. This situation allows unscrupulous entrepreneurs to commit violations in the field of natural resource use and remain unpunished. The creation of a legislative framework focused on European values is a positive movement in protecting the safety of life for both vacationers and service workers, as well as a guarantee of the preservation of existing eco-resources. The process of implementing modern environmental measures in the hospitality industry is hampered by the fact that compliance with environmental requirements is expensive and requires significant financial investments. Unfortunately, not all business representatives are able to make such financial investments. Waste disposal, the use of energy-saving power elements, the use of non-toxic detergents, a high-quality system of sewage and drainage - all these measures require significant financial funding. In order to motivate entrepreneurs to switch to ecological technologies in the hotel business and to implement progressive measures of caring for nature, support and encouragement from the state is necessary.

References:

1. Anto, I., Johnson, B., Wilson, F., Fitha, A. and Francis, A. (2020). Arduino-based Automated Washroom Sanitizing System. *4th International Conference on Intelligent Computing and Control Systems (ICICCS)*, Madurai, India. (pp. 1196-1199) [in English].

2. Tezuka, S., Tomizawa, T. (2021). Development of a restroom floor cleaning robot equipped with a deformable roller mechanism. *The 7th International Conference on Advanced Mechatronics*. Retrieved from https://www.jstage.jst.go.jp/article/jsmeicam/2021.7/0/2021.7_OS2A-5/_article/-char/ja/ [in English].

3. Bєljaєva, S.S., German, I. V. (2022). Vidnovlennja rekreacijnih teritorij jak perspektivnij naprjamok dlja rozvitku turizmu [Obnova rekreačních oblastí jako perspektivní směr rozvoje cestovního ruchu]. *Innovations and Technologies in the Service Sphere and Food Industry*, 1 (5), 39-43 [in Ukrainian].

4. Vasilenko, L.O., Bereznic'ka, Ju.O., Kravchenko, M.V., Shevchenko, O.S., C'oma, T.O. (2022). Zabrudnennja poverhnevih vod fosfatami ta vazhkimi metalami [Pollution of surface waters by phosphates and heavy metals]. *Problemi vodopostachannja, vodovidvedennja ta gidravliki - Problems of water supply, drainage and hydraulics*, 38, 4 – 17 [in Ukrainian].

5. Ganich, N.M., Gataljak, O.M. (2015). Ekologizacija gotel'nogo ta restorannogo biznesu [Greening of the hotel and restaurant business]. *geography.lnu.edu.ua* Retrieved from https://geography.lnu.edu.ua/wp-content/uploads/2015/03/Hataliak-Ekolohizatsiia-hotel-noho-i-rest.-biznesu.pdf [in Ukrainian].

6. Zagorodnja, T. S. (2020). Osoblivosti eko-startapiv v Ukraïni [Peculiarities of eco-startups in Ukraine]. *Proceedings from IX Vseukraïns'ka naukovo-praktychna konferentsiia «Pidvishhennja efektivnosti dijal'nosti pidpriєmstv harchovoï ta pererobnoï galuzej APK» – The Ninth International Scientific and Practical Conference «Increasing the efficiency of the enterprises of the food and processing industries of the agricultural industry»*. (pp. 19-20). Kiïv : NUHT [in Ukrainian].

7. Kobishhan, G.D., Basova, Ju.O., Guba, L.M., Tkachenko, A.S (2021). Osoblivosti ekologichnoï standartizaciï j sertifikaciï mijnih zasobiv [Peculiarities of ecological standardization and certification of detergents]. *Visnik Hmel'nic'kogo nacional'nogo universitetu - Bulletin of the Khmelnytskyi National University*, 2 (295), 7-16 NUHT [in Ukrainian].

8. Mihajlova, Є. O. (2020). Zabrudnennja Svitovogo okeanu plastikom [Pollution of the World Ocean with plastic]. *Proceedings from V Mizhnarodna naukovo- tehn. konferentsiia «Voda. Ekologija. Suspil'stvo» – The Fifth International Scientific and Techn. Conference «Water. Ecology. Society». (pp. 38-41).* Harkiv: HNUMG im. O. M. Beketova [in Ukrainian].

9. Mihajlova, Є. O., Dejneka, D. M., Pancheva, G. M. (2021). Analiz metodiv pereroblennja plastikovih vidhodiv [Analysis of plastic waste processing methods]. *Visnik Nacional'nogo tehnichnogo universitetu "HPI" - Bulletin of the National Technical University "KhPI",* 1 (7), 80-89 [in Ukrainian].

10. Ositnjanko, D. O., Primak, T. Ju. (2020). Vprovadzhennja principiv stalogo rozvitku v turistichnij industrії [Implementation of the principles of sustainable development in the tourism industry]. *Efektivna ekonomika - Efficient economy,* 1. Retrieved from http://www.economy.nayka.com.ua/pdf/1_2020/154.pdf [in Ukrainian].

11. Peredrij, O.I. (2022). Reglamentacija bezpeki kosmetichnih zasobiv v kraïnah ЄS ta Ukraïni [Regulation of the safety of cosmetic products in EU countries and Ukraine]. *Tovaroznavchij visnik - Commodity Bulletin,* 1(15), 252-263 [in Ukrainian].

12. Prucev, O. S. (2022). Povtorne vikoristannja fosfatnih produktiv ochistki stichnih vod [Reuse of phosphate waste water treatment products]. *Proceedings from XIV Mizhnarodna naukovo-metod. konferentsiia «Bezpeka ljudini u suchasnih umovah» – The Fourtenth International Scientific and metod. Conference «Human safety in modern conditions».* (pp. 105-107). Harkiv: NTU "HPI". [in Ukrainian].

13. Prucev, O. S. (2022). Povtorne vikoristannja fosfatnih produktiv ochistki stichnih vod [Reuse of phosphate waste water treatment products]. *Proceedings from XIV Mizhnarodna naukovo- metod. konferentsiia «Bezpeka ljudini u suchasnih umovah» – The Fourtenth International Scientific and metod. Conference «Human safety in modern conditions».* (pp. 105-107). Harkiv: NTU "HPI". [in Ukrainian].

14. Stasevich, S. P., Nedzvec'ka, O. V., Gomzjak, O. I. (2021). Zabezpechennja stalogo rozvitku turistichnoї galuzi v Ukraïni v umovah pandemiї [Ensuring sustainable development of the tourism industry in Ukraine in the conditions of a pandemic]. *Efektivna ekonomika - Efficient economy,* 11. Retrieved from http://www.economy.nayka.com.ua/?op=1&z=9532 [in Ukrainian].

15. Tabletovana zubna pasta jak ideal'ne rishennja v koncepciї Zero-waste [Tableted toothpaste as an ideal solution in the Zero-waste concept]. *inveran.com.ua* Retrieved from https://inveran.com.ua/news/statti/tabletovana-zubna-pasta [in Ukrainian].

16. Tarasjuk, V.S., Mironov, Ju.B. (2019). Ekologichni innovaciї v industrії gostinnosti [Environmental innovations in the hospitality industry]. *Proceedings from I Mizhnar. nauk.-prakt. konf. «Innovaciї, trendi ta perspektivi industrії gostinnosti» – The First International Scientific and Practical Conference «Innovations, trends and prospects of the hospitality industry».* (pp. 165-168). L'viv. LTEU [in Ukrainian].

17. Tereshhuk, N.V. (2022). Vpliv ekologichnoї sertifikaciї na rejting goteliv z boku klientiv [The influence of environmental certification on the rating of hotels by customers]. *Infrastruktura rinku - Market infrastructure,* 65, 133-137 [in Ukrainian].

18. Chagajda, A. O.,Tarasjuk, G. M. (2023). Tendenciї zrostannja u navkolishn'omu seredovishhi mikroplastiku ta jogo vpliv na spozhivachiv poslug industrії gostinnosti [Growth trends of microplastics in the environment and its impact on consumers of services in the hospitality industry]. *Ekonomika, upravlinnja ta administruvannja - Economy, management and administration,* 1(103), 76–87 [in Ukrainian].

19. Shuvar, N.M. Zakalik, G.M. Udud, I.R. (2018). Perspektivi rozvitku ekogoteliv v Ukraïni: ekonomichnij i psihologichnij aspekti [Prospects for the development of eco-hotels in Ukraine: economic and psychological aspects]. *Ekonomika i suspil'stvo - Economy and society,* 15, 502-508 [in Ukrainian].

Література:

1. Anto I., Johnson B., Wilson F., Fitha A. and Francis A. Arduino-based Automated Washroom Sanitizing System. *4th International Conference on Intelligent Computing and Control Systems (ICICCS)*, Madurai, India, 2020. P. 1196-1199.

2. Tezuka S., Tomizawa T. Development of a restroom floor cleaning robot equipped with a deformable roller mechanism. The 7th International Conference on Advanced Mechatronics, July 1-2, 2021, onlaine (Aichi, Japan) URL: https://www.jstage.jst.go.jp/article/jsmeicam/2021.7/0/2021.7_OS2A-5/_article/-char/ja/ (дата запиту 18.03.2024).

3. Бєляєва, С.С., Герман, І. В. Відновлення рекреаційних територій як перспективний напрямок для розвитку туризму. *Innovations and Technologies in the Service Sphere and Food Industry*. 2022. № 1 (5). С. 39-43.

4. Василенко Л.О., Березницька Ю.О., Кравченко М.В., Шевченко О.С., Цьома Т.О. Забруднення поверхневих вод фосфатами та важкими металами. *Проблеми водопостачання, водовідведення та гідравліки*. Київ. КНУБА. 2022. №38. С. 4 – 17.

5. Ганич Н.М., Гаталяк О.М. Екологізація готельного та ресторанного бізнесу. URL: https://geography.lnu.edu.ua/wp-content/uploads/2015/03/Hataliak-Ekolohizatsiia-hotel-noho-i-rest.-biznesu.pdf (дата запиту 08.04.2024).

6. Загородня Т. С. Особливості еко-стартапів в Україні. *Підвищення ефективності діяльності підприємств харчової та переробної галузей АПК*: Матеріали IX Всеукраїнської наук.-практ. конф., 18- 19 листопада 2020 р. Київ : НУХТ, 2020. С. 19-20.

7. Кобищан Г.Д., Басова Ю.О., Губа Л.М., Ткаченко А.С. Особливості екологічної стандартизації й сертифікації мийних засобів. *Вісник Хмельницького національного університету*. 2021. №2 (295). С. 7-16.

8. Михайлова Є. О. Забруднення Світового океану пластиком. *Вода. Екологія. Суспільство* : тези доповідей та інформаційні матеріали V міжнар. наук.-техн. конф., 1-2 жовт. 2020 р. Харків: ХНУМГ ім. О. М. Бекетова, 2020. С. 38-41.

9. Михайлова Є. О., Дейнека Д. М., Панчева Г. М. Аналіз методів перероблення пластикових відходів. *Вісник Національного технічного університету "ХПІ"*. 2021. № 1 (7). С. 80-89.

10. Осітнянко Д. О., Примак Т. Ю., Впровадження принципів сталого розвитку в туристичній індустрії. *Ефективна економіка.* 2020. №1. URL: http://www.economy.nayka.com.ua/pdf/1_2020/154.pdf (дата запиту 11.04.2024).

11. Передрій О.І. Регламентація безпеки косметичних засобів в країнах ЄС та Україні. *Товарознавчий вісник*. 2022. №1(15). С. 252-263.

12. Пруцев О. С. Повторне використання фосфатних продуктів очистки стічних вод. *Безпека людини у сучасних умовах* : зб. доп. 14-ї Міжнар. наук.-метод. конф. та 149-ї Міжнар. наук. конф. Європ. Асоц. наук з безпеки (EAS), 1-2 грудня 2022 р. НТУ "ХПІ". Харків, 2022. С. 105-107.

13. Пруцев О. С. Повторне використання фосфатних продуктів очистки стічних вод. *Безпека людини у сучасних умовах* : зб. доп. 14-ї Міжнар. наук.-метод. конф. та 149-ї Міжнар. наук. конф. Європ. Асоц. наук з безпеки (EAS), 1-2 грудня 2022 р. НТУ "ХПІ". Харків, 2022. С. 105-107.

14. Стасевич С. П., Недзвецька О. В., Гомзяк О. І. Забезпечення сталого розвитку туристичної галузі в Україні в умовах пандемії. *Ефективна економіка*. 2021. № 11. URL: http://www.economy.nayka.com.ua/?op=1&z=9532 (дата запиту 22.03.2024).

15. Таблетована зубна паста як ідеальне рішення в концепції Zero-waste. Веб-сайт ТОВ "Леко Стайл". 2022. URL: https://inveran.com.ua/news/statti/tabletovana-zubna-pasta (дата запиту 20.03.2024).

16. Тарасюк В.С., Миронов Ю.Б. Екологічні інновації в індустрії гостинності. *Інновації, тренди та перспективи індустрії гостинності*: матеріали І Міжнар. наук.-практ. конф., 12 грудня 2019 р. Львів. ЛТЕУ. 2019. С.165-168.

17. Терещук Н.В. Вплив екологічної сертифікації на рейтинг готелів з боку клієнтів. *Інфраструктура ринку*. 2022. № 65. С. 133-137.

18. Чагайда А. О.,Тарасюк Г. М. Тенденції зростання у навколишньому середовищі мікропластику та його вплив на споживачів послуг індустрії гостинності. *Економіка, управління та адміністрування*, 2023. №1(103). С. 76–87.

19. Шувар Н.М. Закалик Г.М. Удуд І.Р. Перспективи розвитку екоготелів в Україні: економічний і психологічний аспекти. *Економіка і суспільство*. 2018. №15. С. 502-508.