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ОСНОВНІ ЕКОЛОГІЧНІ ПРОБЛЕМИ НА МОРСЬКОМУ ТРАНСПОРТІ ЗАГАЛЬНА ХАРАКТЕРИСТИКА ЕКОЛОГІЧНИХ ПРОБЛЕМ

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Анотація. *Індустрія морського судноплавства, як найважливіша складова світової економічної системи, бере активну участь у вирішенні основних глобальних проблем сучасності, оскільки понад 80 % міжнародної торгівлі здійснюється морським шляхом. Зростання кількості суден вимагає посилення заходів щодо поліпшення екологічних характеристик та безпеки судноплавства. Протягом всієї історії мореплавства з суден в океан скидалося все, що вважалося зайвим: харчові відходи, залишки вантажів, сміття, забруднена вода тощо. Вважалося, що безмежному і глибоководному морю це не зашкодить. Однак можливості самоочищення океану не безмежні, а масштаби морської діяльності постійно зростають. У статті автори розглядають і систематизують аналітичні оцінки вітчизняних і міжнародних експертів щодо проблеми забруднення та зміни клімату, яка вимагає негайних заходів для зменшення негативного впливу морського транспорту на навколишнє середовище. Мета статті передбачає окреслення питань основних екологічних проблем на морському транспорті та полягає в узагальненні результатів опублікованих наукових досліджень.*

Підкреслимо, що проблема екологічної безпеки включає, по-перше, систематизацію складових факторів забруднення морського середовища нафтою, хімічними та іншими токсичними речовинами, викидами парникових газів, втратою паливних цистерн під час аварій тощо. На нашу думку, виявлення та класифікація основних причин впливу негативних факторів експлуатації морського транспорту на екологію та стан навколишнього природного середовища з метою подальшого зменшення або усунення цього впливу є важливою актуальною проблемою сучасності. Для досягнення мети дослідження використано теоретичні методи систематизації, формалізації, статистичної обробки та узагальнення даних екологічного моніторингу вітчизняних і міжнародних вчених. Зазначено, що наукові дослідження в цьому напрямі вважаються найбільш перспективними.

Ключові слова: *морський транспорт, екологічні проблеми, безпека судноплавства, експертні оцінки, міжнародні конвенції та стандарти.*

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MAIN ECOLOGICAL PROBLEMS IN SEA TRANSPORT GENERAL CHARACTERIZATION OF ENVIRONMENTAL PROBLEMS

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Abstract. *The maritime shipping industry, as a crucial component of the global economic system, is actively involved in solving the major global problems of our time, as more than 80% of international trade is carried out by sea. Growth in the number of ships requires enhanced measures to improve environmental performance and safety of*

navigation Throughout the history of navigation, ships have been discharging everything that was considered unnecessary into the ocean: food waste, cargo residues, garbage, polluted water, etc. It was believed that the endless and deep sea would not be harmed by this. However, the possibilities of ocean self-cleaning are not unlimited, while the scale of marine activities is constantly growing. In this article, the authors review and systematize the analytical assessments of domestic and international experts on the problem of pollution and climate change, which requires immediate measures to reduce the negative impact of maritime transport on the environment. The purpose of the article is to outline the issues of main environmental problems in maritime transport and to summarize the results of published scientific research.

We emphasize that environmental safety issues include the systematization of the constituent factors of marine pollution by oil, chemicals and other toxic substances, greenhouse gas emissions, loss of fuel tanks during accidents, etc. In our opinion, the identification and classification of the main causes of the impact of negative factors of maritime transport operation on the ecology and the state of the environment with a view to further reducing or eliminating this impact is an important topical problem of our time. To achieve the purpose of the study, theoretical methods of systematization, formalization, statistical processing and generalization of environmental monitoring data of domestic and world scientists were used. It is noted that scientific research in this area is considered to be the most promising.

Keywords: *sea transport, environmental problems, shipping safety, expert assessments, international conventions and standards*

Introduction. Maritime states implement an active shipping policy because maritime transport provides transport links for both foreign economic and domestic economic relations of any country. However, despite the fact that maritime transport is an integral part of global trade and transportation, it leads to significant environmental pollution and causes large emissions of harmful substances into the air and water basins. Air and water pollution can arise from a variety of sources, such as emissions from ship engines, garbage dumping, and oil and other chemical spills. All of this can have a serious negative impact on the marine environment and human health, so finding and developing ways to overcome the above problem remains an urgent task.

Formulation of the problem. Maritime transport is one of the most important links in the sphere of national interests and economic relations of the country. It provides a connection between countries and regions, between production and consumption, etc. It influences the development of the economy as a consumer of metal, energy, wood, and other products. However, environmental issues in maritime transport have serious consequences and represent pressing challenges, so monitoring and control by international organizations and maritime companies is required to ensure balanced development and environmental protection.

Review of recent research and literature. Important aspects of environ-mental safety of shipping have repeatedly attracted the attention of scientists. Thus, in particular, studies [1, 102-120; 3; 6; 11, 659-688; 19, 231-241; 20, 664-665, etc.] considered the role of the “human factor” in ensuring environmental safety in maritime transport, reasonably

identified problematic issues and emphasized the features of the use of information and communication technologies in a systematic approach to shipping safety in general. Legal support for the protection of maritime transport operation in domestic and international activities plays a significant role [2, 91-95; 5; 7; 10, 123-143; 13, 73-81; 15; 22, 1230-1242, etc.] Thus, it is necessary to improve the methodology of comprehensive studies of the impact of characteristic factors on the level of environmental safety of navigation, taking into account the latest changes in the maritime sphere.

Research results and their discussion. The world's oceans are a significant component of the biosphere, ensuring the quality of the planetary environment on a global scale. Environmental safety and environmental protection in ship operations is a relevant and important topic in the modern world. Due to the growth of global trade and transportation, maritime transport has become an essential component of international economic cooperation. However, along with the development of maritime transport, environmental risks associated with emissions of harmful substances and other negative environmental impacts have also increased. Along with the tasks of technical improvement of ships and their equipment, there are also tasks such as the optimal use of available regulatory and technical means [4, 218-224; 8,168-188; 9, 7–14; 16; 18, 257-261, 21, 1-7, 23, etc.]. On their basis, it becomes possible to improve the experience of ensuring prevention of marine and atmospheric pollution during ship operation [12, 92-95; 14, 88-95; 17, 93–99, etc.]. This determines the need to protect the marine environment from pollution during ship operation as the most pressing problem of our time.several millennia. Based on the results of existing studies, in our opinion, it is necessary to pay more attention to the detailed study of the factors protecting the external marine environment and improving the directions for ensuring the comprehensive development of any measures that affect the improvement of this problem in general. It is clear that the oceans are a common huge reservoir from which water, having completed a large cycle, returns to humans, animals and plants. Marine water pollution should be considered taking into account the complex exchange of natural waters between geospheres and their constituent systems in the process of water turnover and evolutionary development of the Earth. The problems of protecting the oceans have also become of global importance for all states due to the fact that the system of currents through surface runoff and interconnection with the atmosphere spreads harmful substances over vast areas and considerable distances. That is why international cooperation in this area is of paramount importance for all global cooperation.

It is possible to identify such types of pollution from the operation of vessels as, for example, pollution from marine economic activities on the seabed (in particular, exploration and development of natural resources of the seabed and its subsoil in the open sea), pollution resulting from discharges of garbage, household and operational waste into the sea, as well as emergency circumstances in the event of accidents, etc. But oil and oil products are the main pollutants of the water basin during the operation of maritime transport, and oil has also begun to enter the seas from drilling rigs. At present, almost 20% of oil is extracted from the bottom of the seas and oceans from 28,000 wells worldwide. According to experts, up to 10 million tons of tankers spill into the seas and oceans per year, that is, this occurs under normal conditions of technological processes of

oil transportation, its processing in ports, during repairs of ships and mechanisms, due to insufficient tightness of technological equipment and violations of operating technology. It should be emphasized that the tanker fleet is one of the main sources of oil pollution of the sea. Oil leaks into the sea occur during the loading and unloading of tankers, refueling of ships with oil fuel at sea, during tanker accidents and disasters, tankers dumping oil cargo residues with ballast water, and in other cases. Oil has a devastating effect on marine organisms even when they are exposed to clean seawater for a short time. Changes and even death of flora and fauna under the influence of oil pollution are well known, especially, as a rule, in case of accidental oil spills, for example, in the case of tanker sinkings, breakthroughs in underwater oil pipelines, etc.

From the analysis of modern scientific sources, it follows that even under normal operating conditions, the main sources of environmental pollution by maritime transport are also ship engines, primarily the main power plant, and water used for washing cargo tanks, and ballast water drained overboard from cargo tanks. Ship power plants pollute the atmosphere with exhaust gases, primarily from where toxic substances partially or almost completely enter the waters of the seas and oceans. Currently, the vast majority of ships in the domestic (and world) fleet are equipped with diesel engines. A small proportion are ships with steam turbines, the number of which has been decreasing in recent years (due to lower efficiency compared to diesel engines). Experts include, for example, the use of clean fuels and technologies as key aspects of ensuring environmental safety. This approach aims to reduce emissions of harmful substances into the air and reduce the impact of maritime transport on the environment.

Due to the constant increase in the number of sea freight shipments, as well as the expansion of the territories through which the transportation route passes, the likelihood of environmental pollution by emissions of operational waste and toxic substances is significantly increasing. In this regard, measures aimed at ensuring environmental protection and preventing environmental pollution from ships are constantly being implemented and improved at the national and international levels. At the level of international legislation, the legal regulation of the prevention of marine pollution and responsibility for such actions is carried out by a number of regulatory legal acts, among which, first of all, it should be noted the UN Convention on the Law of the Sea, the International Convention for the Prevention of Marine Pollution by Oil (MARPOL 73/78 Convention), etc. Article 1, paragraph 4, of the 1982 United Nations Convention on the Law of the Sea defines «marine pollution» as «the introduction by man, directly or indirectly, of bioenergy substances into the marine environment which may have harmful effects». At the present stage, the norms established by the MARPOL 73/78 Convention apply to more than 90% of the world's merchant fleet. In addition to the provisions of the MARPOL 73/78 Convention, developed at the universal level of international legal regulation of the protection of the marine environment from pollution, the following also apply: The International Code for the Management of the Safe Operation of Ships and Pollution Prevention (ISMC), which aims to provide an international standard for the management of the safe operation of ships and the prevention of pollution; The 1982 UN Convention on the Law of the Sea, which obliges states that have acceded to it to take all measures to prevent pollution of the marine environment from any source (from the

shore, from vehicles, from the atmosphere); The International Regulations for Preventing Collisions at Sea, 1972, are aimed at preventing accidents to ships as a result of collisions, thus fulfilling the objective of reducing the risk of marine pollution, etc. To protect the marine environment from pollution, provisions of international codes are also aimed, such as The International Maritime Dangerous Goods Code, which regulates the maritime transport of dangerous goods, ensures the implementation of the mandatory provisions of SOLAS-74. Environmental safety is not only a component of *national* security, but often the consequences of environmental safety violations are *international* in nature. This is due to the fact that incidents at sea can have a negative impact on the environment not only in one country but also in the entire region. Therefore, an important aspect of ensuring environmental security is the clear qualification of environmental offenses as intentional actions directed against the environmental security of the country and the environment as a whole. Based on the scale of environmental damage, in our opinion, international cooperation in the field of monitoring compliance with environmental legislation, and in the event of its violation, holding them accountable in accordance with international law, is important in combating violations during the operation of vessels. It should be noted that sometimes violations of environmental legislation are discovered too late, when serious damage has already been caused to the environment.

Conclusions. The importance of environmental protection in maritime transport cannot be overstated. We live on a planet where the oceans and seas play an important role in supporting life and maintaining biodiversity. The development of transport vehicles is part of the general scientific and technological progress, is necessary and cannot be stopped. The obvious advantages of sea transportation include the fact that this type of transport allows the transportation of absolutely all types of cargo, including oil and gas, and there are no size restrictions typical of other types of transport. However, today there are significant conflicts between vehicles and the human environment. Over the past 20 years, there has been a sharp increase in transportation volumes, as well as the opening of new routes for the transport of dangerous and potentially harmful goods. This directly affects the change in the level of environmental safety and increases the risks of an emergency. A review of literary sources confirmed that the rapid development of technologies, including transport, leads to the same rapid growth of environmental pollution.

This work systematized the problem and classified the main causes of the negative impact of maritime transport on the ecology and the state of the environment in order to further reduce or eliminate this impact. A description of the main reasons for the negative impact of maritime transport on the ecology and state of the environment was carried out, and an attempt was made to generalize possible ways to improve the situation, which can be the basis for further formation of management decisions to increase the effectiveness of the environmental impact of maritime transport.

Thus, the main ways to solve environmental problems of maritime transport are the following: regulatory activities of international and local organizations, transition to alternative energy sources, development and implementation of electric and hybrid drive systems, use of highly efficient and environmentally friendly fuels, etc. The imple-

mentation of the above measures is aimed at reducing the negative impact of maritime transport on the environment, and, therefore, at improving the environmental situation as a whole.

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