POLLUTION OF THE WORLD OCEAN WITH PLASTIC WASTE – NO MORE PLASTIC

Valeriy Leonov[1]

DOI: https://doi.org/10.30525/978-9934-26-536-5-30

Introduction. In the modern world community, there is a persistent opinion that the world ocean, land, air basin are created exclusively for the storage and neutralization of liquid, solid, gaseous/vaporous waste of man-made systems. However, as follows from real life, the storage and purification capacities of natural ecosystems are not unlimited, there is a limit to everything. The latter has led to negative changes in the natural cycles of the planet and, as a consequence, to the intensification of the "greenhouse" effect, a climate crisis of a planetary nature. The way out of the current dangerous state of the planet is to comply with the Laws and Categories of Ecology, International Law, the Principles of Rational Nature Management, to create conditions for a "healthy" economy with a "healthy" ecology, to comply with the principle of the unity of the three "E"s (Economy – Ecology – Energy).

1. The problem of littering the World Ocean with plastic waste: status, solutions. In November 2025, the 13th annual World Ocean Congress (WCO-2025) is planned to be held in Osaka (Japan) - the motto of which is "A Sustainable Future for Our Oceans". One of the most significant criteria of this motto is to improve the quality of the marine environment, biota and increase the efficiency of the blue economy. One of the most significant tools for ensuring this criterion is the regulatory and executive document MARPOL 73/78 [1, p. 697].

Tens of millions of tons of household and industrial solid plastic waste are dumped into the world's oceans every year. The problems that arise in the ocean and the environment are:

1) disruption of the natural water cycle due to a decrease in the rate of evaporation and condensation of water vapor on the sea surface covered with plastic waste;

2) a decrease in the concentration of dissolved oxygen in the marine environment;

3) an increase in the temperature of the marine environment in the area covered by plastic waste of a part of the sea, which initiates a "greenhouse" effect;

[1] Kherson State Maritime Academy (until 2023), Ukraine

4) pollution of the marine environment and the air basin with decomposition products of plastic waste.

The decomposition time, neutralization of plastic waste in the marine environment varies approximately between 350 and 700 years, depending on the molecular weight of plastic waste, pH, temperature of the marine environment, duration and intensity of solar radiation. At the same time, new batches of plastic waste are constantly entering the world's oceans with waste water and the influence of the human factor. From here it is easy to determine how long it will take for the entire surface of the seas and oceans to be covered with plastic waste, and this is death to all life on the planet. Indeed, at present, in the waters of the Pacific and Atlantic oceans, “islands” of plastic waste have formed, which disrupt shipping, fishing, scientific research, geological exploration, and the extraction and transportation of mineral raw materials.

The surface of plastic waste in the marine environment is used by algae, crustaceans and their communities to organize their life activities, the end product of which, as a result of the death of living organisms, is solid crystallized fragments fixed on the surface of plastic waste - the products of their death. As a result, the mass of plastic waste increases, and this leads to a decrease in the buoyancy of plastic waste and, as a result, floating, hovering and bottom plastic waste is formed. Each of these resulting types negatively affects the life of marine organisms, leads to a decrease in their productivity and biodiversity.

2. Ways to solve the problem of plastic waste:

1) eliminate the use of plastics for packaging materials, containers, tableware in industry and in everyday life;

2) switch to the use of paper and glass instead of plastics;

3) switch to the reuse of paper and glass products.

Currently, the share of recycled plastic waste in the world does not exceed 10%. The technology of recycling plastic waste includes collecting, sorting, cleaning, crushing waste, melting crushed material at high temperature, drawing the film, and manufacturing the required products. As a result, the products obtained in the recycling process are more expensive than those obtained from the original plastics, which is unprofitable for the entrepreneur. Therefore, the problem of recycling plastic waste has not been solved. It is advisable to search for new ways of recycling plastic waste, which will result in substances with a higher cost than the original plastics.

- As shown above, pollution of the marine environment with plastic waste leads to an increase in the temperature of the marine environment, disrupts the natural water cycle on the planet, and the end products of the decomposition of plastic waste are unsaturated hydrocarbons – ethylene, propylene, which are among the main components of “greenhouse” gases. All these factors, caused

by the pollution of the world's oceans with plastic waste, contribute to the acceleration of the development of the "greenhouse" effect on the planet [2, p. 35]. In the work [3,p.158] analysis of the work of international organizations under the auspices of the UN in terms of preventing the "greenhouse" effect on the planet is carried out. The activities of these organizations are reduced to holding regular climate summits, developing final agreements to counter the "greenhouse" effect on the planet and allocating funds for the implementation of the activities of the final agreements. An analysis of climate summits over the past 27 years was conducted, – as a result of which it was established that the final agreements are practically no different from each other, and the recommendations arising from the adopted agreements are unsuitable for practical implementation, the main marker of this conclusion is the intensification of the "greenhouse" effect on the planet and the deepening of the negative consequences of the climate crisis of a planetary nature [3, p. 159].

The main "intrigues" of the last climate summit (November 2024), as well as those held earlier, were two main issues:

1) the development of a final agreement of the summit of two "opposing" parties on the issue of the climate crisis;
2) the allocation of financial resources to overcome the climate crisis.

On the second issue, a request was received from the climate summit in the amount of one trillion dollars to compensate for the consequences of the climate crisis, but in reality only 300 billion dollars were collected, which led to disappointment and dissatisfaction of the summit participants.

3. Research work on solving the problem of pollution of the world's oceans with plastic waste

It follows from the above material that recycling plastic waste into commercial plastic products is not economically feasible. Therefore, our goal is to obtain products from plastic waste whose price, taking into account the added value, will be higher than commercial plastic products. We have developed a theoretical platform for the targeted conversion of plastic waste into economically viable and environmentally safe production facilities for recycling plastic waste that is dangerously drifting in the ocean. Some fragments of research papers on recycling plastic waste are given in the monograph edited by Professor V.Ye. Leonov [4, p. 535].

Thus, in order to solve the problem of plastic waste in the world's oceans and the environment, it is necessary to:

1) stop using plastics in production and in everyday life;
2) instead of plastics, functionally use paper, cardboard, glass in industry and in everyday life, followed by recycling of products made from them;

3) continuously recycle accumulated plastic waste on land, in the world's oceans, and in the air.

Suggestions for the practical implementation of the above recommendations:

- create a research and design institute for the processing of solid waste;
- allocate targeted funding for conducting exploratory, applied research, pre-design and design developments for the construction of industrial installations for the processing of solid waste;
- conduct an environmental audit of existing industrial enterprises, taking into account the assessment of their impact on the environment, and in the event of their harmful or dangerous impact on the environment and the biosphere - up to their closure;
- conduct personnel training taking into account the needs of man-made systems;
- conduct research and development, design and development work at the level of inventions and patents.

Conclusion

Thus, as a result of the work carried out, we can draw some conclusions on the problem of pollution of the world's oceans and the environment with plastic waste and propose possible ways to solve this global problem:

1. Pollution of the planet with plastic waste is regular, systematic, and of a massive scale.
2. The planet’s natural restorative resources are not able to neutralize the harmful effects of plastic waste on the environment and the biosphere, and given their massive accumulation, this will inevitably lead to disruption of the planet’s natural cycles and, ultimately, to the cessation of the life of planet Earth.
3. Recommendations have been developed to prevent the negative impact of plastic waste on the environment and the biosphere in the near (2025–2030) and long (2030-2035) future.
4. The immediate future provides for the legislative refusal to use plastics in industrial and domestic conditions with the replacement of plastics with paper, cardboard, glass.
5. The long-term future provides for the implementation of research and development and design work based on the developed theoretical platform in order to create an industrial plant for the processing of plastic waste contained in the waters of the world's oceans, the earth's surface, and the air basin.
6. The adoption of this or that decision should be accompanied by discussions and strict technical and economic justifications, taking into account the impact assessment of the industrial facilities being created on the environment, the biosphere, and humans.

7. Updating the process of education and training of professional personnel with sufficient technical and environmental training required to solve pressing problems of our time.

References:

1. MARPOL 73/78 “International Convention for the Prevention of Pollution from Ships” (2021). London: IMO, MEPC. 810 p.

2. Leonov V.Ye., Gurov A.A. (2021). Greenhouse effect. Fiction or result of the prolonged action of the technogenic systems? *Hungary: The scientific Heritage.* Vol. 1, № 60 (60), p. 29–39. DOI: 10.24412/9215-0365-2021-60-1-29-39

3. Leonov V.Ye. (2024). The Planetary “Climate” Crisis is a Problem for the International Community. VII International Conferense “Innovative Technologies in Science and Education. European Experience”. Materials. Electronic publication. Dnepro: Jurfond. – p. 157–161. ISBN 978-966-934-625-4

4. Leonov V.Ye. (2020). Sovremennye metody Issledovaniy i obrabotki eksperimentalnyh dannyh [Modern Methods of Research and Processing of Experimental Data]. Kherson: IC HGMA, 698 p.