

Abstract

THE IMPACT OF BIODEGRADABLE PLASTICS ON THE ENVIRONMENT

DOI: 10.5937/EcoTER26630J

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Abstract

Plastic materials are among the most widespread products of modern society, but they also pose one of the greatest environmental problems due to their slow degradation and accumulation in the environment. Biodegradable plastic was developed as a potential solution to this issue, designed as a material that can be broken down by microorganisms into simpler, more environmentally friendly compounds. However, although it is often regarded as a more sustainable alternative to conventional plastics, its actual impact on the environment and ecosystems is still not fully understood. The aim of this paper is to analyse and review the impact of biodegradable plastics on various components of the environment, including soil, aquatic ecosystems, plants, animals, and potential effects on human health.

A review of previous research shows that biodegradable plastic can help reduce long-term pollution, as it breaks down into carbon dioxide, water, and mineral substances under certain conditions. However, numerous studies indicate that complete decomposition often occurs only in controlled industrial or laboratory settings, while in the natural environment decomposition may be incomplete, leading to the formation of microplastics. These tiny particles can persist in soil or water for long periods and potentially affect organisms and ecosystems.

Analysis of scientific papers shows that the most studied types of biodegradable plastics are polylactic acid (PLA), polybutylene adipate-co-terephthalate (PBAT), polybutylene succinate (PBS), and polyhydroxyalkanoates (PHA). Most research has been conducted under laboratory conditions and over a relatively short period, usually less than a few months, which limits the ability to observe long-term ecological effects.

The results of numerous studies indicate that biodegradable plastics can affect soil physicochemical properties, including changes in pH, soil structure, and nutrient availability. In some cases, there is a decrease in soil nitrogen content and changes in microbial communities, which can influence plant growth and development. Experiments have shown that the presence of biodegradable plastic can slow the growth of various plant species, including wheat, soybeans, maize, and lettuce, as well as reduce the content of chlorophyll and other important biochemical compounds.

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The impact of biodegradable plastics has been observed in both terrestrial and aquatic organisms. In certain invertebrates, such as earthworms and insects, negative effects on growth, reproduction, and survival have been recorded, while in some organisms these effects were minimal or statistically insignificant. In aquatic ecosystems, plastics can cause metabolic disturbances, reduced growth, and organ damage in fish and other organisms, especially at higher concentrations and with longer exposure times.

In addition to environmental effects, potential risks to human health are also considered. Microplastics can enter the human body through food, water, and air, and some research indicates that biodegradable plastic can serve as a carrier of microorganisms and pollutants. During decomposition, small plastic particles can affect the balance of microorganisms in the digestive system and potentially cause inflammatory processes.

In conclusion, although biodegradable plastics represent a promising alternative to conventional plastic materials, their environmental effects depend on the type of plastic, concentration, duration of exposure, and environmental conditions. Previous research indicates that they can have both positive and negative impacts on ecosystems. Therefore, long-term research is needed to better understand their real effects and enable safe and sustainable use in the future.

Keywords: plastic materials, environmental, biodegradation

ACKNOWLEDGEMENT

The research presented in this paper was done with the financial support of the Ministry of Education, Science and Technological Development of the Republic of Serbia, within the funding of the scientific research work at the University of Belgrade, Technical Faculty in Bor, according to the contract with registration number 451-03-34/2026-03/200131.

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