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BIO-PACKAGING IN THE FOOD INDUSTRY AS THE BASIS FOR ENVIROMENTAL CONSERVATION

PhD student Hadaieva Yuliia,
Chemical Engineering and Industrial Ecology dep.
English language supervisor:
Associated Professor Natalya Turlakova,
Cross-Cultural Communication and Foreign Language Dep.

Abstract. The article discusses the advantages and prospects of using bio-packaging made from biodegradable polymers in the food industry. Bio-

packaging can replace traditional plastic packaging based on petrochemical raw materials, which causes serious environmental problems. The production and use of biopolymers from renewable agricultural raw materials and waste can reduce greenhouse gas emissions, pollution, and waste accumulation. The article analyzes the current problems of bio-packaging implementation and ways to overcome them.
Keywords: bio-packaging, bio-plastics, bio-degradability, edible films, ecology, food industry, environmental safety.

Introduction. In the modern world people cannot do without polymeric materials, actively consuming plastic products, a large part of which is used for packaging food products. This stimulates the growth of polymer production from non-renewable petrochemical raw materials. Traditional packaging contributes to the extension of the shelf life of products, which is important for the food industry. However, due to their persistent chemical structure, such materials decompose extremely slowly, accumulating in the environment and causing serious harm to ecosystems.

Worldwide plastic production has soared in geometric progression over the last several decades. It now stands at roughly 400 million tons per year. However, estimates suggest that only 12% of the plastic produced has been incinerated, and only about 9% has been recycled. The rest has either been dumped in landfills or discarded into the environment, including the oceans. Without meaningful action, it is expected that the flow of plastic waste into water ecosystems will almost triple from approximately 11 million tons in 2016 to around 29 million tons by 2040.The goal of this work is to substantiate the advantages of using bio-packaging made from biodegradable polymers in the food industry for environmental conservation.

Only about 14% of the plastic material consumed worldwide is recycled, with the majority ending up in landfills or breaking down in the natural environment.

Ways to solve the problem such as recycling and burning plastic are not sufficiently effective and entail new environmental risks. The technological cycle of secondary recycling is complex, energy-intensive, and associated with the emission of greenhouse gases, while the quality of products from recycled plastic deteriorates. When burning, toxic substances, ash, and effluents are also released into the atmosphere, which contain hazardous components. Therefore, complex and costly emission filtration systems are required.

An alternative to traditional plastic packaging is the use of bio-packaging from biopolymers - polymers obtained from renewable plant materials and waste from agriculture and the food industry. Biopolymers based on corn starch, sugarcane, and cellulose is some of the most efficient and environmentally friendly materials for producing biodegradable packaging.

Such packaging retains its packaging properties only during use and then easily degrades in the natural environment by microorganisms, compared to the more persistent oil-based plastics [2].

The main advantages of bio-plastics are their ecological nature, the renewability of the raw materials, and the absence of hazardous emissions during production and disposal.

Nowadays, bio-packaging made from biodegradable polymers is already being actively implemented by leading food industry companies such as Nestlé, PepsiCo, Danone. They use biodegradable bags, boxes, containers, and other packaging for food and beverages. Edible films and coatings made from biopolymers, which are applied to fruits, vegetables, and meat to extend their shelf life, are also gaining popularity. In Ukraine, an edible biodegradable film for food products is also being developed [3].

At the same time, several factors hinder the wider distribution of bio-packaging. Firstly, its production is still more expensive compared to traditional plastic packaging due to the high cost of renewable raw materials and relatively small-scale production. Secondly, there is a lack of strict environmental regulations and standards for the mandatory use of biodegradable packaging in different countries. Thirdly, further scientific research is required to improve the technologies for producing biopolymers and to expand the range of their applications.

To accelerate the large-scale transition of the food industry to bio-packaging, the following measures are necessary:

1. Development of biopolymer production from more accessible renewable resources - waste from agriculture, food, and wood processing industries.

2. Expansion of the use of edible films and coatings made from biopolymers to increase the shelf life of food products.

3. Tightening of environmental legislation and introduction of mandatory quotas for the use of biodegradable packaging in various sectors.

4. Encouragement of scientific research in the field of biotechnologies to create cheaper and more efficient biopolymers.

5. Increasing public ecological awareness of the benefits of bio-packaging.

Conclusions.

The implementation of biodegradable packaging from biopolymers is a very promising path for large-scale environmental conservation in the food industry and other sectors. Bio-packaging can significantly reduce greenhouse gas emissions, pollution of air, water, and soil, and the accumulation of polymer waste compared to traditional plastic packaging based on petrochemical raw materials.

A comprehensive set of measures aimed at developing production of affordable biopolymers from renewable sources, the application of edible

films, technology improvement, tightening of 'green' standards, and raising consumer awareness will facilitate a large-scale transition of the food industry to environmentally safe and sustainable bio-packaging in the coming years. This will considerably reduce the negative impact of human activities on nature.

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LANDFILL LEACHATES AS A SOURCE OF PATHOGENIC ENVIRONMENTAL IMPACT

Phd student Dmitro Ivanenko
English language supervisor:
Associated Professor Natalya Turlakova,
Cross-Cultural Communication and Foreign Language Dep.

Abstract. Domestic waste management in Ukraine has reached a critical level, as the vast majority of the total amount of waste generated is stored in open areas. Solid household waste is deposited in landfills and landfills with a total area of about 9 thousand hectares. Not counting the countless amounts of waste generated as a result of combat maidens, 37.6 billion tonnes of waste have been accumulated in our country, of which 1.6 billion tonnes are hazardous. This situation leads to significant man-made pressure on the environment and the emergence of an environmental disaster in general. In this context, it is important to develop effective mechanisms for environmentally safe collection, transportation and disposal of household waste, as well as to improve the efficiency of existing waste management approaches.