BIODEGRADABLE POLYLACTIDE PACKAGING MATERIALS

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Today in the field of polymer and composite materials there is an increased interest in the use of polymers with the ability to biodegrade and biocompatibility, which would be synthesized on the basis of renewable natural raw materials. This is due to the pollution of the environment with wastes of polymer materials and products based on them, as well as the depletion and environmental stress during the extraction of non-renewable natural resources used for the production of synthetic polymers. That issue is most acute in the field of packaging materials, as it accounts for about 40% of used polymer materials, which is> 140 million tons of waste annually. Also, modern polymeric packaging materials have the lowest degree of recycling into primary products due to significant contamination with organic residues.

Promising in terms of new biodegradable polymers, in particular for the packaging industry are polylactide (PLA) and materials based on it. PLA is a polycondensation product of lactic acid, it is a linear aliphatic biodegradable polyester obtained from reducing raw materials (starch). Polylactide can be used for medical purposes, as well as for products in contact with food. The melting temperature of the polylactide is in the range of 170-180 °C, which allows to process it by known industrial methods: injection molding, extrusion, 3D printing, etc.

However, there are a number of problems associated with the processing and use of PLA, including in the packaging industry: -relatively high price compared to other "classic" polymers; - difficulties of processing into products on standard equipment while maintaining the required properties and biodegradability; unsatisfactory thermophysical and barrier properties, low rate of biodegradation under normal conditions. Therefore, there is a need for additional modification of the PLA to provide it with the necessary properties for use as a material for the packaging industry.

In this work, the method of influencing on the morphology of the material (additional heat treatment after molding the product) and the method of introducing a fine filler (talc, hydroxyapatite, calcium carbonate) into the polymer material were used to modify the PLA. It is noted that additional heat treatment at 100-120 °C for 3-5 min contributes to changes in the structure of the material (increasing the degree of crystallinity of the polymer, changing the size of crystallites) and, as a consequence, significant changes in physical and mechanical and thermophysical properties. In particular, an increase in Vicat softening point, surface hardness, thermal deformation temperature, modulus of elasticity and deformation, tensile strength of heat-treated polylactide materials was determined. Such changes in the properties of polylactide allow it to be used as a container for hot and cold food, lids and corks of various packing, containers, etc.al.

It should be noted that the introduction of inorganic fine fillers can significantly reduce the cost of polylactide products, reduces the required time and temperature of additional heat treatment, allows to directly regulate the biodegradability and biocompatibility of polylactide, and, depending on the type of filler, allows to achieve higher performance properties. Due to the modification of PLA by low molecular weight compounds - plasticizers (glycerin, dioctyl phthalate), the possibility of obtaining film and fibrous materials based on it is noted.

The developed methods of targeted modification of the structure and properties of polylactide materials allow to significantly expand the field of application of the developed polylactide composite materials. In particular, they open up significant opportunities for the substitution by polylactide materials of oil-derived non-biodegradable polymers in the field of packaging materials.

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