

BIOEDAGRADATION OF THERMOPLASTIC POLYURETHANES

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Relevance. Pollution of the environment by the waste of polymers – the planetary problem. Decomposition of waste takes place in the environment during decades and centuries. It is prospectively sustainable to use of plastic biomaterials, which can easily be destroyed in the soil. Starch is one of the cheapest raw materials for the organization of industrial production of biopolymers. Due to its polysaccharide nature, starch is easily digested by microorganisms of the soil.

Goals and objectives. The aim of this work is to study the properties of biodegradation of thermoplastic polyurethane that contains starch. The object of research is a thermoplastic polyurethane, that contains starch. The subjects of research are the mass of film samples, specific density and viscosity of solutions of thermoplastic polymer.

Methods. The thermoplastic polyurethane was dissolved in dimethylformamide. The concentration of polymer in a solution is 20%. Starch (concentration of 10, 30 and 50%) was added into the solution of polymer. The control is a solution of the polymer without starch. A thermoplastic polyurethane film, that contains starch, was maintained into the biohumus. Biohumus is a product of processing of sunflower husks by vermiculture *Eisenia fetida* (requirements of TU 3336406.002-95). The weight of the samples was measured with an accuracy of 0.00001 g. The density was determined by the method of hydrostatic weighing. The viscosity of the polymer solutions was determined by a capillary Ostwald viscometer. Destruction of films was studied by microscope of ICBM 1-E (increase of 400 times).

Research results. It was found that the reduction of the mass of samples depends on the concentration of starch in the thermoplastic polyurethane. At concentration of starch 10 and 30% reduction of film weight is 10–13%, at concentration of 50% starch, filmweight decreases by 20%. In the control version, the film lost its weight by 4% only. This indicates that starch initiates the decomposition process of the thermoplastic polyurethane.

The study of the change in the density of thermoplastic polyurethane compositions filled with starch during exposures during 45 days in a biohumus showed that the duration of exposure significantly affects the magnitude of the specific gravity. Within 15 days, a slight change in density was observed, and the subsequent exposure of the film samples to the substrate contributed to a significant increase in specific density, which could be explained by the introduction of the particles of the biosubstrate into their surface. In addition, an increase of the concentration of starch in the thermoplastic polyurethane is accompanied by a decrease in density, which is the result of a decrease in the molecular weight of the polymer during the destructive action of microorganisms.

The concentration of starch in the polymer substantially affects viscosity changes. Thus, an increase of the concentration of starch contributes to a decrease of the viscosity of the solution of the thermoplastic polymer. At exposure of 45 days in biohumus, the viscosity of the solution of thermoplastic polyurethane is reduced.

Conclusions. The results of studies indicate that the addition of starch in thermoplastic polyurethane contributes to the biodegradation of matrix polymer - polyurethane. Consequently, the biodegradation of the investigated polymeric compositions is accompanied by a decrease in the molecular weight of the macromolecular compound. Creating mixtures of plastics with starch, which initiates their biodegradation, is the simplest and cheapest way to obtain promising polymeric compositions.

Products of biodegradation of polyurethane after their assimilation by microorganisms and microbes enrich the soil with useful elements and natural fertilizers (biohumus). Application in industry and life of packing containers, etc. materials from biopolyurethane will help to reduce environmental pollution.

Key words: Biodegradation of Thermoplastic Polyurethane, Biohumus