

REPEATING POLYETHYLENE DERIVATIVES OF THE LOW DENSE OF HRYBVOVITSKY DUMP

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Relevance. The dump in the village Veliky Gribovitchy near the city of Lviv (Lviv Solid Waste Landfill) is one of the largest environmental pollutants in the Lviv region. At present, the landfill is closed. The reason for the closure was the fire that arose on its territory on May 29, 2016, and the subsequent shift of a significant amount of garbage. Among the whole variety of polymer waste in the landfill, is the largest share of low density polyethylene waste (LDPW). The main products on the basis of LDPW, which fall on the Gribovitchy waste dump, are containers after repeated use, various packaging materials.

Goals and objectives. The purpose of the work is to determine the technological and operational properties of materials on the basis of mixtures of LDPW waste with the commodity LDPW for the establishment of the possibility of recycling of polyethylene waste from landfill.

Methods. Materials for researches were mixtures based on waste LDPW and commodity LDPW (grades 10203-003, 10702-020 and 10603-007). LDPW waste was collected on the surface of the Gribovitsky landfill site and subjected to purification from extraneous impurities, dirt before their granulation, and the production of standard samples for research ISO R527 (type 2). Experimental data were obtained using standard techniques and state-of-the-art methods for investigating the structure and properties of polymeric materials.

Research results. Investigation of the rheological properties of LDPW-based mixtures has shown that as the temperature rises, the viscosity of LDPW and its waste products decreases. For LDPW waste, the melt viscosity decrease at the same temperature, compared to the LDPW, is more significant. Throughout the studied interval of shear rates of all melt materials, the values of their effective viscosity are not constant. This suggests that, with increasing tensile displacement, the anomaly of the viscosity of the molds manifests itself to a greater extent.

One of the important methods by which one can determine the structure of polymer macromolecules is infrared spectroscopy (IR spectra). In the IR spectra of LDPW waste, unlike the IR spectra of the commodity LDPW, there are additional bands that can indicate the presence of a polymeric material in the process of natural aging. This process is accompanied by oxidative degradation. Confirmation of oxidative destruction of material is the presence in the waste LDPW of a band in the region of 1900 cm^{-1} and strips with an absorption rate of 1740 cm^{-1} , which corresponds to valence fluctuations of carboxyl groups.

Thermomechanical characteristics of polymer materials, which are related to the flexibility of macromolecules and their internal structure, should be investigated using thermomechanical curves. From the obtained thermomechanical curves it can be seen that the melting point of the T_{p1} of the commodity LDPW is $\sim 128\text{ }^{\circ}\text{C}$ and is higher than its waste ($T_{p1} \sim 117\text{ }^{\circ}\text{C}$). Obviously, this is due to the decrease in the molecular weight of LDPW waste, in contrast to the commodity LDPW, and, accordingly, with some changes in the crystalline structure of the materials under study.

Performance indicators of materials based on mixtures of thermoplastics significantly differ from the commodity homogeneous thermoplastics. They can be broadly regulated by the physical condition of the material, the nature of the source components, the nature of the distribution of ingredients in the volume of the material, heat treatment or technological conditions of processing, affecting the process of melt crystallization and the formation of various supramolecular structures.

Conclusions. To improve the environmental situation on the territory of Gribovitchy landfill, LDPW waste can be recycled with a commodity LDPW for the production of «non-technological» products. In order not to make significant changes in the technological process of manufacturing products on the basis of commodity LDPW it is possible to add waste LDPW in an amount not more than 20 % by weight. The presence of a small amount of waste is not significantly influenced by the operational performance of the products and the ability to process the material, compared with the commodity LDPW