Ecologically friendly rigid polyurethane foams with fragments of natural compounds in the main chain

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Rigid polyurethane foams are widely used in practice as structural and thermal insulation materials [1]. Traditionally, they are made from petrochemical components, but modern technologies allow partial or complete replacement of the starting raw materials with naturally renewable sources

A topical issue that now receives great attention is the protection of the environment and the problem of utilization polymer materials after the end of their service life. The introduction of a natural component into a synthetic polymer makes it possible to combine the necessary mechanical properties and, hypothetically, the ability to degrade [2]. The development of this direction will allow obtaining environmentally safe PM with a regulated service life and a wide range of operational properties [3]. When creating degradable PUFs, polysaccharides have become widespread. Therefore, the aim of the work is to create rigid structural polyurethane foam materials with a high level of performance properties and a high content of renewable components of plant origin to ensure the replacement of hydrocarbon raw materials with renewable ones.

Rigid polyurethane foams (RPUF) were obtained based on: polyoxypropylenetriol ether L-503; polyisocyanate; catalysts: tin octoate and UP-606/2; organosilicon foam stabilizer (KEP-2) and vaseline oil; and renewable raw materials - castor oil (CO) and Mediterian sea brown algae (BA).

The synthesis of the RPUF based on polyisocyanate and a mixture of catalysts and foam stabilizers with castor oil and with a content of (10 - 30) wt. % of BA was carried out, as well as the synthesis of RPUF based on PIC, a mixture of catalysts and foam stabilizers with L-503 and CO (25-50) wt. %, with a content of (10-30) wt. % of BA and a total content of renewable components (35.0 - 80.0) wt. %.

The synthesis of RPUF based on natural compounds involves combining the functional properties of PUF with the ability to degrade in the environment. The introduction of the CO and BA into the macrochain structure is reflected in the change in the physical and mechanical properties of the resulting RPUF.

The introduction of castor oil (50%) into the composition of RPUF reduces water absorption to 0.12% compared to 0.47% for RPUF, which does not contain a natural component, and gives the former resistance to the action of hydrochloric acid and potassium (solutions, 20 %; 30 days; 36-37°C) - there is no weight loss.

Varying the amount of CO and BA introduced into RPUF allows one to regulate the ability of the polyurethane foam to degrade. Thus, the introduction of an additional 10% BA into the polyurethane foam containing 50% CO leads to an increase in water absorption to 0.79. The water absorption of RPUF containing only 25% CO and 10% BA is even higher, namely 0.97, which indicates the greatest ability to degrade under the influence of the environment.

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