INFLUENCE OF WATER ON THE PHYSICO-MECHANICAL PROPERTIES OF COMPOSITES CONTAINING LOW-DENSITY POLYETHYLENE AND LINEN YARN PRODUCTION WASTE

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Natural vegetable fibres, for example linen, and their textile manufacturing waste is a very perspective reinforcement for polyolefines, since they are ecologically friendly and their utilization in polymer composites is defined by their low cost and density as well as practically unlimited quantity in nature with ability to reproduce. Previous investigations showed that modification of virgin and recycled polyolefines with linen yarn production waste enhances the physico-mechanical parameters (rupture strength, elongation at break, tensile and bending modulus) of composites. Disadvantage of the composites is their high water sorption. There is no information in literature about the influence of water on the mechanical properties of such composite materials.

In the present paper, the results of investigating the water influence on physico-mechanical properties of composites based on low-density polyethylene (LDPE) and linen yarn production waste (LW) are presented. Virgin LDPE grade 15813-020 is used as polymer matrix. Diphenylmethane diisocyanate (DIC) 3 wt.% from polymer matrix and stearic acid (SA) 3 wt.% from LW are used as modificators. LW is dried at 80°C for 24 hours. The polymer/LW combinations selected (filler content 10-50 wt.%) are compounded in Banbury plastomer at 160°C for $t = 8$ min, $n^* = 80$ rev/min. 1.0-1.5 mm thick sheets are formed in rolling mills from the hot mass. After cooling, the compounded material was granulated (granule sizes < 3-5 mm) and compression moulded in 1 mm thick sheets at 145°C for 3 min. Before and after holding in water ($T = 23$°C), the specimens of width 5 mm were tested in tension using a dynamometer UTS-100 with programmed calculation of experimental results.

The investigations show that the tensile strength and elastic modulus of both modified and unmodified, and especially of DIC, systems increase with increasing filler content. A gradual decrease in the tensile parameters is observed after exposure of the specimens to water. The diminishing degree depends on the exposure time and composition parameters. The smallest effect of water was observed in systems containing 3 wt.% of DIC. This is in a good agreement with the previous results on water sorption kinetics, which shows that the DIC containing composites have the best water resistance.