



EFFECTS OF HEMP FIBERS PRE-PROCESSING ON LINEAR LOW DENSITY POLYETHYLENE MATRIX COMPOSITE MECHANICAL PROPERTIES

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ABSTRACT

Natural fibres show poor compatibility with hydrophobic polymers due to their hydrophilic nature. Compatibility with hydrophobic polymers could lead to weak interfacial adhesion. Research focused on improving mechanical properties of LLDPE composites reinforced with pre-treated hemp fibres.

Chemical pre-treatment of natural fibres used in this research are 2% sodium hydroxide treatment, grafting with 5% maleic anhydride in combination with the sol-gel fibres pre-processing were used to obtain eleven composite variants. Composites were prepared by mixing of the components on two rolls mill.

Composites with fibres content in a range from 40 wt.% to 50 wt.% were evaluated by universal material testing machine UTS-100 (standard ASTM D 638 M – 93). Microhardness (HV) was examined by Vickers M41 at load 200g.

Surface microhardness of composites is decreased by chemical pre-processing of fibres and varies in range 62.87 MPa ($\text{Zn}(\text{CH}_3\text{COO})_2 \cdot 2\text{H}_2\text{O}$ used as the modifier of the sol-gel system treated hemp fibres (40wt% composite) to 344.77 MPa (50wt.% sample with silica sol pre-treated fibres).

The tensile tests of composites showed the increase of mechanical properties by chemical pre-processing of fibres. Elastic modulus varies in range 117.68 MPa (40wt.% sample with silica sol pre-treated fibres) to 700.06 MPa (40wt.% sample sol-gel with $\text{Zn}(\text{CH}_3\text{COO})_2 \cdot 2\text{H}_2\text{O}$ fibres pre-treatment and 5 wt.% MA-g-PE additive).

Keywords: composite, hemp fibres, linear low density polyethylene, sol-gel method, mechanical properties