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INVESTIGATION OF THE MECHANICAL PROPERTIES OF WOOD FIBER REINFORCED POLYMER COMPOSITES

Zoltán Kocsis*, Tibor Czigány
Budapest University of Technology and Economics
Dapartment of Polymer Engineering
H-1111 Budapest, Műegyetem rkp. 3.
* Tel.: +36-1-463-2462, e-mail: kocsis@pt.bme.hu

The use of wood fiber as reinforcement in polymer composites has a great history. Nowadays there has been a boom in the manufacturing and use of these materials, due to the rediscovery of wood fiber as cheap reinforcement and the increasing environmental regulations. Plastics are a considerable part of the accumulated waste, and because of their low density they cause a great expansion of its volume. The recycling of the polymeric materials decreases the quantity of waste materials and thus reduces the impact on the environment. The goal of the work is to develop new materials, which are recyclable without any degradation, and to produce polymer composites with renewable fiber reinforcement instead of conventional ones.

The industrial use of wood fiber and other natural fibers can fulfill these requirements. A complete recycling process can be realized with wood fiber, as a timber-industrial secondary product, and recycled polymer matrices. The importance of wood fiber reinforced composites is continuously increasing due to their good mechanical properties. In comparison with the conventional reinforcing fibers the density of the cellulose fibers is less, hence with the use of these fibers a considerable weight loss, which has a great importance among others in the automotive industry, is accessible. Nowadays, there are several automotive parts made of wood fiber reinforced polymer composites, most often built in the passenger compartment as covers.

These composites can be produced with the conventional plastic-manufacturing methods, for example with extrusion or injection molding. During manufacturing the high tool performance (e.g. high pressure and clamping force) is of great importance because the fiber content may reach even 60-70% in some cases. The wide-spread manufacturing methods are the thermoforming technologies (e.g. hot pressing, vacuum-forming), with which large surfaces can be produced.

The mechanical properties of wood fiber reinforced polymer composites are comparable with the properties of the conventional ones (e.g. glass fiber reinforcement). The tensile strength and modulus, as well as the flexural strength and modulus, increase simultaneously with the fiber content (Figure 1.) [1]. The importance of the coupling agents is of great importance because otherwise there is a poor adhesion between the hydrophilic fibers and the hydrophobic matrices, and thus it can result in a decrease in the mechanical properties [2]. The tensile modulus increased in some cases with more than 100%. In most cases the coupling agents decrease the moisture uptake, which is also of great importance in natural fiber reinforced materials.

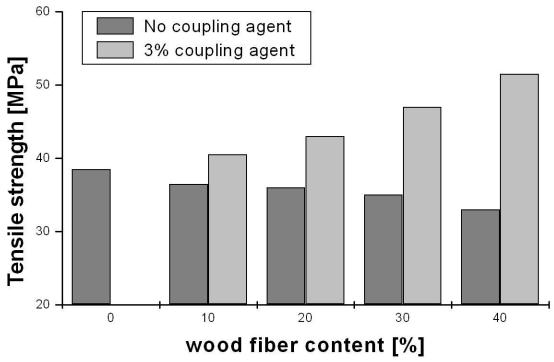

Figure 1. The relationship between tensile strength and filler loading with and without coupling agent [1]

In case of cellulosic fiber reinforced composites the high moisture uptake has a significant influence on the mechanical properties. The water uptake depends on the fiber content, the absorption temperature and time. In case of constant fiber content, the absorption of water is largely increasing at higher temperature, as well as at constant temperature with increasing fiber content. The mechanical properties of the water-saturated samples decrease, such as the tensile modulus and strength (Figure 2.). Both impact strength and elongation at break increase simultaneously with the moisture content [3].

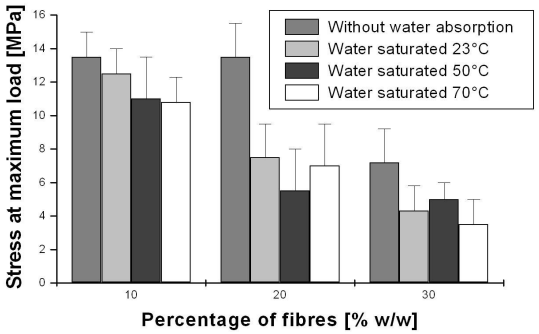

Figure 2. Effect of the water absorption on the strain [2]

The aim of the poster is to demonstrate the static mechanical properties of wood fiber reinforced polypropylene composites as a function of reinforcing content and surface adhesion.

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