Title

ENZYMATIC AND COLD PLASMATIC TREATMENT OF NATURAL MICROFIBRES FROM GRAIN BY-PRODUCTS USED AS A REINFORCEMENT OF EPOXY BIOCOMPOSITES

Abstract text

Environmental awareness creates industrial needs for developing eco-friendly "green composite materials" based on renewable resources, like natural fibres instead of traditional synthetic (glass and carbon) fibres, which are used in various applications (automotive industry, building trade). Wood fibres are currently the most widely used natural fibres for reinforcing thermoplastic and thermoset matrices, but, due to the increasing price of wood fibres, a proper alternative for them is being searched for. In our study, we would like to reveal that cereal waste, which is an annually renewable fibre and available in abundant volume throughout the world, has the potential to replace wood fibre successfully.

In regards of these developments, our investigations are based on the use of modified microfibres obtained from various cereal husks as grain by-products of the milling industry. We used them to reinforce bio-based epoxy resins. The applied microfibres were conditioned, subject to mechanical treatment (tearing), and suitably sorted. Subsequently, the microfibres were modified with enzymes and low temperature plasma for surface treatments of lignocellulosic fibres, enabling an efficient removal of impurities in the fibre structure. As a result, the adhesion between the reinforced fibre and the matrix as well as the thermal stability of the fibres were improved and the odour emission decreased during processing and the life cycle of the final product alike.

This paper presents the thermal and mechanical behavior of fibre-reinforced bio-epoxies in which the bio-content has been varied from 0 up to 100 %. Assorted formulations were based on traditional epoxy systems and epoxidized plant oil. Microfibres made of grain by-products modified by enzyme and low temperature plasma treatments were used as reinforcement. Thermal properties (glass transition temperature, heat deflection and heat resistance temperatures) as well as mechanical properties (tensile, flexural and impact strength) of the epoxy biocomposites reinforced with various microfibres modified in this way were determined. The obtained results were being referred to those determined for the composites reinforced with industrial wood flour. The results of the investigations showed that such biocomposites can compete as an alternative for biocomposites reinforced with wood flour in various technical applications.

Keywords

BIOCOMPOSITE, BIO-BASED EPOXY RESIN, EPOXIDIZED PLANT OIL, GRAIN BY-PRODUCT, NATURAL MICROFIBRE, ENZYME, LOW TEMPERATURE PLASMA

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