BIOCOMPOSITES FROM SURFACE MODIFIED REGENERATED CELLULOSE FIBERS AND LACTIC ACID THERMOSET BIORESIN

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Abstract:

Thermoset bioresin was synthesized from lactic acid and glycerol, and the resin was characterized for it to be used in composite applications. On the other hand, regenerated cellulose fibers were surface treated to improve the physico–chemical interactions at the fiber–matrix interface. The effect of surface treatments, silane and alkali, on regenerated cellulose fibers was studied by using the treated fibers as reinforcement in lactic acid thermoset bioresin. Mechanical tests were used as indicator of the improvement of the interfacial strength. Fiber surface treatments and the effect on adhesion to the matrix were characterized using microscopy images and thermal conductivity. Mechanical properties of the composites showed an increase when treated with silane as the bi-functional silane molecule acts as link between the regenerated cellulose fiber and the bioresin.

Porosity volume decreased significantly on silane treatment due to improved interface and interlocking between fiber and matrix. Decrease in water absorption and increase in contact angle confirmed the change in the hydrophilicity of the composites. The storage modulus increased when the reinforcements were treated with silane whereas the damping intensity decreased for the same composites indicating a better adhesion between fiber and matrix on silane treatment. Thermogravimetric analysis indicated that the thermal stability of the reinforcement altered after treatments. The resin curing was followed using differential scanning calorimetry and the necessity for post-curing was recommended. Finite element analysis was used to predict the thermal behavior of the composites and a non-destructive resonance analysis was performed to ratify the modulus obtained from tensile testing. The changes were also seen on composites reinforced with alkali treated fiber. Microscopy images confirmed the good adhesion between the silane treated fibers and the resin at the interface.

Keywords:

Cellulose Fibers, Thermoset Resin, Surface Treatment, Biocomposites, Properties