

Effect of alkaline treatment on the properties of oil palm empty fruit bunch fiber-reinforced polypropylene composite

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Abstrak

Oil palm empty fruit bunch (OPEFB) is one of the waste products of oil palm plantations and has not been optimally used in Riau Province, Sumatera, Indonesia. OPEFB is reduced by incineration, which causes pollution problems. However, the combustion of OPEFB generates ash, which is rich in potassium. Moreover, OPEFB fiber has good strength, low cost, low density, and biodegradability, and it can be used as composite reinforcement. However, the natural fibers in composites have poor compatibility with the matrix and relatively high moisture absorption. Hydrolysis of OPEFB ash creates a base solution that can be utilized in an alkaline treatment process to increase the mechanical properties of natural composites.

The aim of this study was to investigate the effect of various extracts of OPEFB ash on the tensile strength, flexural strength, and water absorption of an OPEFB fiber-polypropylene composite. The experimental design used was the Response Surface Method-Central Composite Design (RSM-CCD). The results showed that the tensile strength increased with an increase of fiber length and concentration of the OPEFB ash extract solution, but tensile strength decreased with a longer soaking time. Flexural strength increased with an increase in fiber length but decreased with an increase in the concentration of the OPEFB ash extract solution and longer soaking time. Water absorption increased with lower and higher concentrations of OPEFB ash extract solution and fiber length and with shorter and longer soaking times. The highest tensile strength (20.100 MPa) was achieved at 5% wt alkaline concentration, 36 h soaking time, and 3 cm fiber length. The highest flexural strength (30.216 MPa) was achieved at 5% wt alkaline concentration, 12 h soaking time, and 3 cm fiber length. The lowest water absorption (0.324%) was achieved at 10% wt alkaline concentration, 24 h soaking time, and 2 cm fiber length.