COMPARISON OF THE PHYSICAL AND CHEMICAL FEATURES OF COMPOSITES PRODUCED FROM TEXTILE WASTE AND CELLULOSES PLANTS

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One of the most concerning unresolved problems is the massive amount of textile waste that is not recycled. Our current studies have shown that reinforced textile recycling materials by plant cellulose fibers are suitable for the production of functional composites. We try to find out a plant polysaccharide fibers that will maintain the functionality of composites while being ecologically friendly at the same time. We tested following fibers plants: sisal, cotton, linen, coconut, wood, abaca, jute, and hemp,. Both fiber plants and textiles were grinding, the plant materials to fragments with lengths ranging from 2 to 15 mm. Plant-textile composites were produced in extruder at temperatures up to 195℃, it allowed plasticizing polymers of textiles .Fiber plants were added to textile recycling material from 3 to 6%. Total 245 different plant-textile composite samples were tested for their mechanical properties: tensile strength, bending, and compression. Fiber glass additive exhibited significantly higher stiffness (Et) than all tested natural fibers, as confirmed by ANOVA results ($p < 0.0001$ modulus values compared to fibers glass, as demonstrated by the Tukey HSD results). Fibers glass samples demonstrated significantly higher **flexural modulus (Ef)** ($F = 13.99$, $p < 0.0001$) and **maximum flexural stress (σfм)** ($F = 8.68$, $p < 0.0001$) values compared to natural, cellulose fibers, confirming their superior stiffness and strength. However, natural fibers like 3% **abaca** and 3% **sisal** showed comparative values. With regard to **strain at break (εfb)**, the performance of natural fibers such as **abaca, hemp**, and **sisal** was superior to that of fiberglass ($F = 5.60$, $p < 0.0001$. Although **breaking stress (σfb)** ($F = 2.53$, $p = 0.0033$) values were higher for fiberglass. FTIR spectra of all cellulose fibers displayed the characteristic cellulose bands, but with notable differences in intensity and distribution. The O-H stretching band (3600–3200 cm^{-1}), which is indicative of hydrogen bonding within cellulose, varied significantly between materials. The C-H stretching band (~2900 cm^{-1}), which is associated with aliphatic chains in cellulose and hemicellulose, was present across all fibers but was particularly strong in cotton and flax, suggesting these fibers have a high degree of purity and structural uniformity in their polysaccharide matrix. Clear differences were detected in lignin content between fibers, as shown by the C=O stretching band (1740–1600 cm^{-1}), which was particularly intense in coniferous fibers, In contrast, cotton and flax showed weaker signals in this region, indicating lower lignin content and a higher proportion of pure cellulose. The C=C stretching band (~1600–1500 cm^{-1}), indicative of aromatic groups in lignin, was similarly more pronounced in coniferous fibers, further confirming their higher lignin content. The SEM microphotographs surface of the sisal-reinforced composite was relatively smooth and even, with a regular structure, while the fiberglass composite had a rough and crinkled surface texture. In conclusion textile – celluloses fibers plants composites, offer a new, eco-friendly textile recycling method.

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