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# Fabrication of Surface Modified Microcrystalline Cellulose-Polypropylene Composites for Engineering Applications

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## Abstract

There's a heighten interest in nanometric and micrometric dimensions of cellulose fibers for its greater potential in reinforcement of composites. Microcrystalline cellulose (MCC) gained its peculiar features with its high aspect ratio, large surface area and high mechanical properties making MCC a better candidate as the potential starting material for cellulose fiber reinforced nano-composites. The surge of sustainable development and environmentally benign plastics have attract much attention in biodegradable natural fiber reinforced polymer composites. The objective of this research was to fabricate MCC reinforced polypropylene (PP) composites improving the mechanical, thermal and physical properties. Extreme hydrophilicity of MCC and hydrophobicity of PP leads to weak compatibility with poor performance in the composite. Thus, surface modification is essential to abate the hydrophilicity of MCC and thereby to improve the compatibility and overall performance of the composite. Sunflower oil was converted into its corresponding sunflower oil ethyl esters (SFEEs) and grafted onto the MCC surface in order to improve MCC surface hydrophobicity. Unmodified and SFEE modified MCC were separately added into PP matrix up to 5% loading. Two series were characterised using FTIR, XRD, TGA-DSC, universal testing machines and shore D hardness tester according to its mechanical, thermal and physical properties. Higher thermal stability and mechanical properties were achieved with 5% SFEE surface modified MCC reinforced PP composite. Tensile, impact and hardness properties of neat PP were 27 MPa, 7 $kJm^{-2}$ and 60 shore D which were improved up to 30 MPa, 12 $kJm^{-2}$ and 75 shore D respectively, with the addition of 5% SFEE modified MCC-PP composites. This study mainly focused on a low cost, ecologically green and industrially friendly pathway to improve MCC-PP compatibility which can be used as a sustainable material in many engineering applications.

***Keywords:*** Microcrystalline cellulose, Polypropylene, Surface modification, Sunflower oil ethyl esters