A GREEN APPROACH FOR SURFACE HYDROPHOBIZATION OF MICROCRYSTALLINE CELLULOSE USING SUNFLOWER OIL

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Incorporation of natural fibers into synthetic polymers in fabrication of polymer based composites have attracted immense research interest owing to its biodegradability, low impact on environment, economic feasibility, conservation of energy and availability in modern automotive, aerospace and different engineering applications. Among all the other natural fibers, cellulose, the most abundant of all, prevailed in the composite industry with its great contribution in reinforcing polymers. To make cellulose a more ideal candidate, microcrystalline cellulose (MCC) has been derived, impregnating a higher degree of crystalline regions.

Together with MCC's high aspect ratio and high surface area it also gives rise to enormous surface hydroxyl (OH) groups leading to prominent hydrophilicity prone to agglomeration. This creates a bottleneck in dispersing MCC in non-polar environments such as hydrophobic polymers. Consequently, there is a heightened demand on surface modification of MCC to improve the surface hydrophobicity and thereby to achieve compatibility with hydrophobic polymers.

Ultrasonication assisted pathway was utilized without using any acid or base catalysts to prepare sunflower oil bio diesel with higher energy recovery. Biocompatible sunflower oil ethyl esters (SFEEs) or sunflower oil bio diesel was used in this study to graft and replace OH groups on MCC surface avoiding typical toxic, unstable and expensive modifiers prioritizing green chemistry.

SFEE treated MCC showed positive results in all characterization techniques. New bands were pronounced in FTIR spectra at 1745, 2855 and 2920 cm^{-1} ascribed for ester carbonyl, asymmetric and symmetric CH_2 bonds of aliphatic fatty acid chain stretching vibrations respectively for modified MCC. Similar XRD diffarctograms confirmed the negligibility in crystal structure changes in the modification process. Thermogravimetric analysis suggested that the improved thermal stability of modified MCC is broadening the processing temperature window. Qualitative confirmation was taken with the wettability test where modified MCC migration to non-polar dichloromethane from polar aqueous phase indicating its improved hydrophobicity.

Surface OH groups of MCC were reacted with SFEEs to improve its surface hydrophobicity and to achieve uniform dispersability in non-polar environments

making them ideal for the hydrophobic polymer composite fabrication. This study bestowed a greener, industry-friendly approach widening the usage of sunflower oil to render MCC surface hydrophobicity. This surface modified MCC can be used for various modern engineering applications.

Keywords: Microcrystalline cellulose, Sunflower oil ethyl esters, Surface modification, Transesterification

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