ABSTRACT

The research investigation describes the synthesis and characterization of a series of natural occurring oils based polyurethanes (PUs) and their biocomposites using naturally occurring fillers such as ginger spent (GS) and microcrystalline cellulose (MCC). The physico-mechanical properties, chemical resistance, water uptake, thermal behavior and morphological behaviors of green composites have been studied. The thesis entitled, “Investigation on naturally occurring oil based polyurethanes and their biocomposites”, encompass the results of investigation on the aforementioned subject. The thesis has been divided in to eight chapters. Chapter 1 covers the general introduction and literature survey on PU and its biocomposites, fillers and their applications. Chapter 2 deals with materials and equipments used in this research investigation; chapter 3 deals with the synthesis and characterization of mixture of vegetable oils (coconut oil and castor oil) based PUs. Chapter 4 reveals the fabrication and characterization of ginger spent (GS) incorporated PU green composites. Chapter 5 covers the fabrication and characterization of microcrystalline cellulose (MCC) loading polyurethane green composites. An improvement in tensile strength and tensile modulus with increase in GS and MCC content in PU matrix were noticed. Chapter 6 reveals the influence of nanoclay (NC) on the performances of PU/GS nanocomposites. The ginger spent weight percentage was maintained at 5 wt. % in all the formulations with varying amounts of nanoclay content viz., 0, 0.5, 1 and 2 wt. %. A significant improvement in mechanical properties, thermal stability and chemical resistance of the composites was noticed with increase in nanoclay content. Chapter 7 covers the restricted equilibrium swelling of n-alkanes posed by ginger spent filled PU green composites during sorption (S), desorption (D), resorption (RS) and redesorption (RD) processes.

The fabricated PU/GS, PU/MCC and PU/GS/NC composites were characterized for sorption studies, microcrystalline parameters by WAXS, contact angle and morphological behaviors (SEM). The prepared composites were analyzed for water uptake, moisture absorption behaviour in different RHs and chemical resistivity to test their ability for suitable applications. The PU composites were stable upto 193 °C as confirmed by TGA analysis. The FTIR and SEM images confirmed the good interaction between filler and PU matrix. Summary and scope for future work is highlighted in chapter 8.
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