Abstract

These days increasing environmental concerns are driving the composite industry towards the development of green composites using natural fibers/fillers. Natural reinforcement materials are having several advantages like light weight, cost effectiveness and lower environmental impacts. However the major drawbacks of such composites are high water absorption and poor mechanical strength due to poor adhesion of the hydrophilic fibers/fillers with the hydrophobic resin. The objective of this work is todevelop green polymer matrix based composites for engineering applications with different natural reinforcements.In this work jute, coir, rice husk, walnut shell powder and jack fruit leaf fiber were selected as natural reinforcements. Differenttreatment methods of natural fibers/fillers like RF plasma treatment, acrylic treatment and NaOH treatment were studied to improve the adhesion of natural fiber/filler with the polymeric resin for better mechanical strength and reduced water absorption of the composite. The most effective chemical treatment parameters like treatment temperature, time and concentration of the chemical were determined for different natural fibers/fillers to reduce water absorption. Plasma treatments were also carried out to reduce the water absorption. The effect of plasma treatment parameters likes RF power, treatment time and reactor pressure were investigated and most effective treatment parameters were established. Similarly the effect of these treatments on flexural strengths were analysed for the composites made from the treated fibers/fillers at the optimized treatment conditions for both chemical and plasma treatments. The surface chemistry, surface morphology and composition (hydroxyl, cellulose and hemicelluloses content) of the treated and untreated natural fibers/fillers were also studied in this work. It has been observed that, different pre-treatments reduce the water absorption significantly with marginal improvement in flexural properties. Finally the impact of the green composites on the environment were established by performing life cycle assessment (LCA) of an automobile parts manufactured with jute-glass fiber hybrid sheet molding composite (SMC) in place of traditional glass fiber

Keywords: green composites;natural fibers/fillers; polymeric composites; chemical treatments;radio frequency discharge; water absorption; flexural strength; surface energy; life cycle analysis.