Abstract

Conventional natural fiber reinforced thermoplastic composites are non biodegradable. Biodegradable protein based resins like soy protein isolate and concentrate, require a lot of processing from soy bean, and have been extensively explored as strong and biodegradable matrix for natural fiber composites by past researchers. Development of a simplified process for preparation of soy resin from soy bean without going through isolation or concentration of the soy protein and preparation of composite by soaking of non woven fabric of natural fiber in water based liquid soy resin to develop biodegradable composites has been explored in this work. Non woven jute felt surface was modified by alkali treatment for better resin adhesion. Water based soy resin was prepared from soy beans. Effect of different crosslinking agents like citric acid, glutaraldehyde and furfuraldehyde on soy resin properties was evaluated and soy resin formulation was optimized. Composites were fabricated with different fiber loading. Composites with 60 wt% of fiber loading showed maximum mechanical properties. Alkali treatment of jute fibers improved mechanical properties of the composites. Soy jute composites prepared were tested for loss in mechanical properties after water absorption and was found that composites were stable in high humidity conditions, but were unstable when immersed in boiling water. To improve the water resistance and durability of these composites, soy resin was modified using cashew nut shell liquid (CNSL) and melamine formaldehyde. Melamine formaldehyde modified soy jute composites showed enhanced mechanical properties, better water resistance, high load bearing capacity and better resistance to impact than the unmodified and CNSL modified composites. Ageing of composites in accelerated weathering conditions was assessed by sequential drying and water spray under ultra violet light. Dimensional and mechanical stability of composites were assessed after exposure to accelerated weathering conditions. Soil burial and microbial degradation studies of soy jute composites were carried out in compost soil and cultured fungal bed respectively. Weight loss, tensile loss and scanning electron micrographs of composites after biodegradation revealed that composites are biodegradable in nature. Some laboratory based products like composite panels and sapling pot were developed and characterized. These composites can be utilized in automobile, packaging, furniture sectors by replacing non-degradable plastic based composite.

Keywords: Non woven jute felt, soy resin, soy jute composites, mechanical properties, and biodegradation