A CRITICAL REVIEW ON GREEN COMPOSITES

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Abstract

Research has been going on in the field of development of green composites because of growing concern towards the environmental issues. Green composites have lot of potential than the traditional petroleum based composites which are toxic and non biodegradable. These composites have been used with wide range of applications from automotive sector to construction sector. A green composite consists of natural fibers as a reinforcement and polymer as a matrix material. This article gives the review of recent developments of green composites and the summary of main results presented in literature, with more focus on processing techniques, surface treatment of fibers, mechanical characterization and applications of green composite.

1. INTRODUCTION

Polymer blends can be categorized into different groups [2]. The first one is completely miscible blends. These blends exhibits homogeneity in the molecular level and also they have specific interactions with each other. The second category is partially miscible blends. In these type of blends, a small part of one of the blend components is dispersed in the other leading to a partially compatible phase morphology. The majority of polymer blends belong to the third category, which is fully immiscible polymer blends. They have very sharp and finite interfaces due to the lack of specific interactions between the blend components. Various strategies were adopted to compatibilize an immiscible polyblend system [3], out of which use of a block or graft copolymer, which can react to both the blend components in-situ, is a very popular method to produce technologically compatible polymer blends. The strength and the Modulus of the polymer can be further improved by introduction of a reinforcing filler leading to the development of high performance composite materials. The composites exhibits the stress transfer mechanism, where the applied stress to the matrix is transferred to the reinforcing medium by the viscoelastic displacement [4]. While the dimensions of the reinforcing filler are of order of micrometers in conventional composite, at least one of the dimensions of the reinforcing filler is in nanometer range in polymer nanocomposites. The enhanced molecular interactions between the polymer and the nanoparticles with an extraordinary set of material properties that conventional polymers coul not exhibit [5]. As a result of the unique filler-polymer interaction, the nanocomposites exhibit may major performance properties including improved mechanical properties, thermal properties, fire resistance, moisture resistance, improved barrier properties, charge dissipation and chemical resistance [6].

2. BIODEGRADABLE POLYMERS

Polylactic acid (PLA) is a biodegradable biopolymer produced from natural resource. It is considered as one of the most promising bio based polymers and hence attracted the interest of researchers over the last two decades. The majority of the lactic acid available in the market today is produced by bacterial fermentation of carbohydrates such as corn, sugarcane [7]. Recently Costa et al. developed an efficient catalyst deactivator, which can improve the efficiency of devolatilization of the unreacted monomer during PLA synthesis process.

3. GREEN COMPOSITES

The incorporation of natural fiber to a PLA matrix leads to the development of a completely bio-based composites material. The study conducted by the Graupner et al [8]. showed that incorporation of kenad and hemp fibers into PLA resulted in an improvement in tensile and modulus values. Cotton/PLA composites exhibited excellent impact properties, whereas Lyocell/PLA composites possess improved tensile strength, Young's modulus and impact properties. Nettle fibers were used as reinforcement for PLA by Fischer et al [9]. They have also compiled the effect of other fibers such as hemp, flax, jute, bamboo, kenaf and ramie as reinforcements for PLA reported by other research groups. Flax fiber was used a reinforcement for PLA by Oksman et al [10]. The composites were prepared by extrusion followed by compression moulding. The properties of the composites were compared with that of PP/flax fiber composites, which are widely used in making automobile components. The PLA/flax fiber composites showed 50% better strength compared with PP counterpart. The SEM micrographs of the fractured surface (figure 1.1) showed that the fiber-matrix adhesion needs to be improved in order to improve the performance properties of PLA/Natural fibre composites.

4. CONCLUSION

Polymers have been an integral part of mankind since its great discovery due to their ubiquitous properties. Research on enhancing their properties to suit specific applications is done by numerous research groups all over the world. Blends, alloys and composites are the general categories to do this. All these methods may affect the properties depending on the inherent properties of the components and their interactions.

References

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