Development of Nanofibrillated Cellulose (NFC) Reinforced Polypropylene Based Composite for Engineering Applications

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Abstract

Thermoplastics have very high demand over the world due to the low cost and reusability with better performances. Polypropylene has been used in thousands of applications including packaging, automotive, medical, and textile. The wide range of applications of Polypripylene is based on the advanced characteristics such as reusability, low toxicity, inexpensiveness, excellent chemical and water resistance, better process ability and high shelf life. Cellulose is a homo-polysaccharide and the most abundant biopolymer present on the earth. Nanofibrillated cellulose (NFC) consists of a bundle of long chains, flexible cellulose molecules with high aspect ratio. This can be used as a reinforcement nano material for various applications.

The objective of this research is to develop a NFC reinforced Polypropylene based composite for engineering applications. NFC have indicated a remarkable reinforcement effect on polymer composites due to the high specific area. However, the hydrophilic NFC is not compatible with hydrophobic polypropylene. Silane-based surface modification technique was used improve the compatibility of NFC and polypropylene. Polypropylene based composite was prepared by varing surface modified NFC up to 5% weight. Compression moulding technique was used to prepare the NFC and polypropylene based composite. The developed product was characterized by SEM, FTIR, XRD, TGA and DTA and mechanical property investigation techniques. 3.5% siylated surface modified NFC reinforced with polypropylene composite was given the optimum properties. Experimental results indicated that tensile strength, impact strength and hardness of the composites were higher than that of pure polypropylene samples. These results clearly showed the reinforcement effect of NFC with polypropylene materials. These composite materials can be used for various types of engineering applications due to significantly enhanced physical and mechanical properties.