

## IMPROVED MECHANICAL PROPERTIES OF SILANE TREATED JUTE/POLYETHYLENE/CLAY NANOCOMPOSITES

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### ABSTRACT

In recent years, the jute reinforced polyethylene nanocomposites have developed attention to the scientists. The hydrophilic nature of fiber and nanofillers exhibited poor interfacial interaction to hydrophobic polymer matrix. In this study, silane treated jute and organically modified different types of montmorillonite (MMT-1.28E, MMT-1.30E, MMT-1.31PS, MMT-1.34TCN, and MMT-1.44P) nanoclays were used for the manufacturing of the nanocomposites. Tensile tests, Fourier Transform Infra-Red (FTIR) and Scanning Electron Microscopy (SEM) were carried out to investigate the mechanical and surface characterizations. The improved interfacial adhesion among jute, polyethylene (PE), and nanoclay in the composite system were reflected on the mechanical behaviour. It was observed that, the treated jute composites showed higher tensile strength and modulus compared to raw jute composites and the nanoclay filled composites showed higher values compared to without nanoclay one. In addition, the MMT-1.31PS filled nanocomposites found highest improvement among the five nanoclays used in this work.

**Key words:** Jute fiber, chemical treatment, montmorillonite, nanocomposites, mechanical properties

### INTRODUCTION

Currently, jute polymer composites have been widely used in various industries (George *et al.*, 2001; Khan *et al.*, 2012; Dewan *et al.*, 2013). The hydrophilic nature of jute weakens the fiber-matrix interaction in the composite system (Bledzki *et al.*, 2007). The chemical or physical modification of fibers can be carried out in order to enhance the interfacial bonding between fiber and matrix. Thus, 3-isocyanatopropyl triethoxysilane has been used to overcome the incompatibility between the natural fiber and polymer matrix. Different types of silane have been used for the fiber surface treatment (Rong *et al.*, 2001; Asumani *et al.*, 2012). In this study, has been used for jute fibers modification in order to enhance the interfacial attraction with polymer matrix. On the other hand, jute-polyethylene composites have shown remarkable improvement in morphological and thermo-mechanical properties (Hossen *et al.*, 2015). Hence, polyethylene (PE)

matrix has been used for the manufacturing of composites in this study.

The addition of a small quantity of montmorillonite (MMT) nanoclay can significantly improve the composite properties (Pavlidou & Paspaspyrides, 2008; Tcherbi-Narteh *et al.*, 2016). The hydrophilic nature of MMT nanoclay also incompatible with hydrophobic polymer chains and cause weak interfacial interactions (Aranda & Riuz-Hitzky, 1992; Lan & Pinnavaia, 1994). It had been reported that 2 wt.% of modified MMT filled treated jute/PE nanocomposite exhibited significant improvement in the different properties (Hossen *et al.*, 2016). To enhance the compatibility with various polymer matrices, the different surface modified MMT nanoclays have been used in this research. Thus, in this work, five types of chemically modified 2% MMT nanoclay have been used as nanofillers for nanocomposites fabrication.

Therefore, the effect of silane chemical treatment and MMT nanoclay on the mechanical properties of prepared nanocomposites has been investigated in this study. FTIR, SEM and tensile testing were used to evaluate the surface characterization and

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