ABSTRACT

Due to the increasing environmental challenges like pollution, land fills, rapid depletion of natural resources vitalised way for hunting an alternate source for synthetic fibres. Agricultural wastes which were thrown away uselessly after the plantain cultivation can provide an ideal substitute which replace many synthetic fibres in structural applications. The most important criteria is the effective usuage of the natural fibres in composite materials for their multi-functionality, by the combination of suitable resin matrix. In view of all these aspects banana fibres, considering as waste from pseudostems of plant family Musaceae and vinyl ester, a moderate effective resin with suitable properties were selected and subjected to research work. The effect of different forms (fibre, fabric) of banana fibres on mechanical properties of the composites were studied for the upgraded performances.

The present study is aimed to analyse the mechanical properties of banana fibre and banana cotton fabric composites. The composite laminates were prepared by random distribution of Raw Banana Fibres (RBF) and alkali treated fibres separately with the cut lengths of 2,4,6,8 and 10 mm with vinyl ester matrix by compression moulding machine. Comparison of mechanical properties of treated composites with untreated one were observed. Treated fibre composites shows increased mechanical properties. SEM images confirms the surface clearance due to the effect of alkali treatment on fibres.

This work also aims to analyse the impact of various weave patterns of RBF. Handloom woven structures (plain, twill, sateen and basket) of banana-cotton hybrid fabrics were made into composite laminates with vinyl ester resin using compression moulding machine. The layers were stacked alternatively with warp and weft ways to distribute evenly using hand layup

technique. Mechanical properties were found to be superior for plain woven fabric and was used for further process in carrying out the research work.

The study also includes the analysis of the effect of surface treatment process. In this conjunction, different chemicals such as sodium hydroxide (NaOH), potassium permanganate ($KMnO_4$) and sodium lauryl sulfate (SLS) were used for the surface treatment process of plain fabric. Composites were prepared from the surface treated fabrics using compression moulding method. Mechanical properties like tensile, flexural, impact and compression properties were determined through UTM. In addition to this, effect of nano particles on mechanical properties of composites was also studied. Halloysite Nano Tubes (HNTs) were incorporated in the resin solution at fixed proportion of 1,2,3 and 4 wt.% with the plain woven fabric. The mechanical properties of composites were analysed and also surface morphology and chemical constituents were examined using SEM and FTIR.

The fibre reinforced composites shows enhanced properties generally at 6mm level of fibre length. Better properties were observed in the case of plain woven composites than other woven structures. The highest values obtained were 27MPa, 51 MPa, 36 MPa and 1.0 J/mm of tensile, flexural, compression and impact strength at 30 wt.% of fabric reinforcement. The surface treatment of the fabric with NaOH exhibits optimum properties than other chemical treated composites which are taken as a whole. Also Halloysite Nano Tubes (HNTs) added composite results shows an overall peak elevation at 2% level of nano particles in the mechanical properties. The tensile, flexural, compression and impact strength increases with the addition of HNTs by 84%, 51%, 33% and 63% respectively. From the results obtained, it was observed that the desirable compositions are suitable for structural applications in automobiles.