Investigation of Thermal and Mechanical Properties of Micro Cellulose Based Composites

J.A.S.R.Silva, S.M.K.Maduranga, A.M.P.B.Samarasekara*, D.A.S.Amarasinghe
Department of Materials Science and Engineering, University of Moratuwa, Sri Lanka
**email: banduamp@gmail.com*

This research is based on preparation of a composite with Micro Crystalline Cellulose (MCC) and Polypropylene (PP). MCC is hydrophilic and PP is hydrophobic in nature. To avoid less compatibility of these two materials, surface modification was done for MCC. Coconut oil was used as a green surface modifying agent in this research. Transesterification mechanism was used for surface modification. Modified MCC was characterized by using specific techniques to confirmation of surface modification.

PP based composites were prepared by varying 1-5 wt%. percentages MCC for both unmodified and modified MCC conditions. Ingredients were blended in an internal mixer. Composites were prepared by pressing compounded mixers using compression molding technique. Mechanical properties and thermal properties of prepared composites were characterized under standards conditions. Tensile test, water absorption test and hardness test were conducted for all prepared composites. Vicat softening temperature (VST), differential thermal analysis and Thermo gravimetric analysis were conducted for all prepared composites according to standards.

A mechanical property prediction model was formulated to model the tensile strength and tensile modulus of PP-MCC based composites. Modified Halpin-Tsai equation model was used to predict above mentioned properties. It was observed that the properties of modified MCC-PP composites were higher than the unmodified MCC-PP composites. Results which were obtained from predicted modified Halpin-Tsai model were in good agreement with experimental data.

According to the outcomes of this research, biodegradable, eco- friendly and environment-friendly MCC can be used to improve mechanical and thermal properties of PP based composites. Readily available, cheap and environment-friendly coconut oil can be used for MCC surface modification. This developed composite can be used for various engineering applications.

Keywords: Polypropylene, Micro crystalline cellulose, Surface modification, Coconut oil