Formulation and characterization of formaldehyde free chemically modified bone-based adhesive for lignocellulosic composite products

ABSTRACT

This study investigates the efficacy of chemically modified bone adhesive as a formaldehyde-free binder for wood-based industries. Two different types of adhesive are formulated after chemical modification of bone powder using sulfuric acid (0.5 m) and polyvinyl acetate (PVA). Gel time, solid content, Fourier-transform infrared spectroscopy (FT-IR), thermogravimetric analysis (TGA), viscosity, and single lap joint test for shear strength are analyzed in order to assess the adhesive properties. To analyze the efficacy of the formulated adhesive, particleboards are fabricated using boiled and unboiled sugarcane bagasse. The physical and mechanical properties of the fabricated panels are measured following ASTM standards. It is found that adhesive Type C (T-C) has the shortest gel time of 4.2 min for the highest shear strength, i.e., 5.31 MPa. The particleboard (BTC-2) fabricated using T-C adhesive shows a highest density of 0.73 g cm−3, a modulus of elasticity (MOE) of 1975 N mm−2, and a modulus of rupture (MOR) of 11.80 N mm−2. The dimensional stability of the fabricated particleboards does not follow the standard requirements; however, further study might be helpful for using the chemically modified bone adhesive as a biobased adhesive.