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Oral Presentation

Novel analytical methods for characterizing chemical and physical properties of biomass

AU-IGERT: Integrated Biorefining for Sustainable Production of Fuels and Chemicals

Abstract

We are developing a method to use microfibrillated cellulose (MFC) along with soy protein to synergistically reinforce the adhesive, phenol formaldehyde (PF), which is used in the production of oriented strand board (OSB). The soy protein can attach to the active sites on MFC increasing the effectiveness of both to increase the strength of the adhesive. MFC's high surface area to volume ratio increases the amount of active sites available for the soy protein to attach. The MFC also has very high aspect ratios which can aid in interconnectivity of the adhesive to strengthen the adhesive as well as aid in crack propagation.

By increasing the strength of the adhesive, less will be needed to achieve the same strength standards required for OSB manufacturing with PF alone which saves money for the manufacturer as well as decreases formaldehyde, which is a known carcinogen, off gassing from OSB with PF adhesive.

This study uses the Box-Behnken experimental design to optimize the mechanical strength and water solubility of the adhesive mixture. Modifications to the adhesive included four parameters: % MFC and soy protein (0%, 1%, and 2% MFC and soy protein/PF dry wt%/wt%), temperature of cure (125, 150, and 175 ° C), time of cure (7, 10, and 15 minutes), and loading (90, 110, and 130 g/m2). A tensile shear test was investigated and showed an increase in strength with the addition of MFC and soy protein. Thermogravimetric Analysis (TGA) along with Derivative TG were used to show a difference at 290 °C suggesting an interaction between MFC and PF. Water solubility was also studied and showed an increase in water solubility with the addition of MFC and soy protein.