RECENT RESEARCH ACTIVITIES

Investigation of a new natural particleboard adhesive composed of tannin and sucrose

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In the face of dwindling fossil fuel resources and the environmental imperative to reduce emissions associated with petrochemistry, there is strong demand for a wood composite bonding procedure using natural alternatives. Our laboratory carried out a series of the research on the natural adhesives. In this study, particleboards were manufactured with a new material adhesive composed of tannin and sucrose (as Figure 1 shows), and the ratio of tannin and sucrose was 25/75 with the concentration of solution at 40wt%. The boards were hot-pressed for 10 min. The size of the board was 300×300×90mm and the target density was 0.8 g/cm3. The effects of the resin contents and hot pressing temperature on the physical properties of the resulting particleboard were investigated.

Materials

Recycled wood particles were dried in oven at 80°C for 12h. Wattle tannin (Fuji Chemical Industry Co.) and sucrose(Nacalai Tesque, Inc.) were dried in vacuum oven at 60°C for 15h.

Evaluation of particleboard

The boards obtained were conditioned for 1 week at 20 °C and RH 60%. The static 3-point bending test, the internal bond strength (IB) test and thickness swelling (TS) test were carried out.

Effects of resin content

Particleboards were manufactured with the resin content at 10, 15, 20, 30 and 40wt%. Both MOR and MOE were slightly enhanced with the increase of resin content. The maximum average values of MOR and MOE were 21.2 MPa and 5 GPa, respectively, obtained at 40wt% resin content case. The IB strength performance did not change obviously with changes in resin content. The maximum average value was 1.3 MPa at resin content of 30wt%. The TS value decreased as the resin content increased. The lowest value of TS was 20% with 40wt% resin content. Based on the results above, the optimum resin content was between 30 to 40wt%.

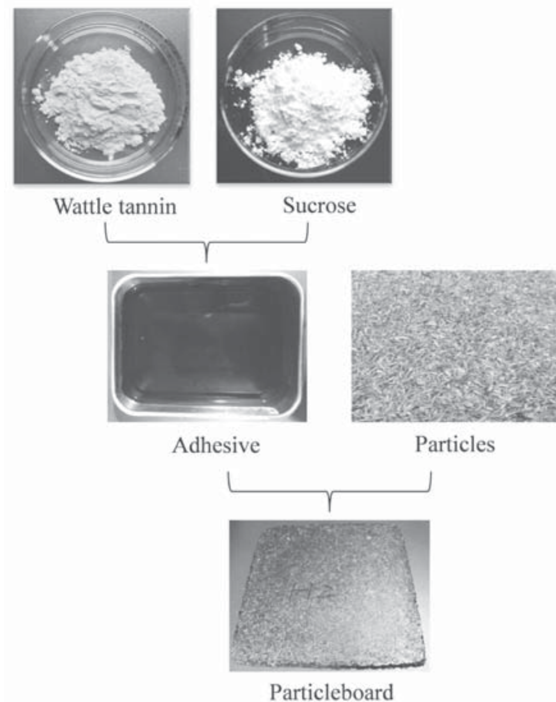

Figure 1. The manufacture of the particleboard bonded with tannin and sucrose

Effects of hot pressing temperature

Particleboards were manufactured with the hot pressing temperature at 160, 180, 200 and 220℃. The maximum value of MOR and MOE were 21.9MPa and 4.95GPa, respectively, when the board was bonded with 40wt% resin content at 220℃. The maximum value of IB was 1.6MPa from the board bonded with 40wt% resin content and 220℃. When the board bonded with 30 and 40wt% resin content at 220℃, the TS values were 9.6 and 7.3%, respectively, this value satisfied requirement of 18 type of JIS A 5908. The results obtained above indicated that, when the hot press temperature increased to 220℃, the particleboard board bonded with tannin and sucrose performed excellent mechanical properties and water resistance.