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Development and optimization of novel liquefaction modified cornstarch wood adhesives

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The development and optimization of an environmental friendly wood adhesive system for plywood from abundant and renewable cornstarch and *pine* bark are presented in this study. Cornstarch was chemically modified by two methods viz., oxidation with 3% (w/w) hydrogen peroxide and also chemically fortified with glycerol and/or oxalic acid in the range (10-50 %) (w/w). *Pine* bark is a waste product also used to modify cornstarch hence the optimized conditions for the preparation of cornstarch-liquefied *pinus* bark adhesives were determined. *Pine* bark in phenol in the weight ratio of (2:1 = phenol: bark) with the catalyst of *para* toluene sulphonic acid yielded 65% (w/w) liquefaction product and oxidized cornstarch was blended at different weight ratios to investigate the improvement of thermoplastic nature. The influence of oxidation and blending of cornstarch was evaluated and the optimum parameters studied are the percentage of cornstarch, amount of liquefied bark in the adhesive system and pressing time of the plywood specimens. Shear strength of different concentrations of modified cornstarch and unmodified cornstarch were compared. It was found that cornstarch at 65 % weight ratio with that of 10% (w/w) liquefied bark addition has improved the mechanical properties of both oxidized and native cornstarch. The optimum time at 120^{o}C temperature hot pressing was 5 min. The results indicated that the thermo plasticized corn starch specimens containing a mixed plasticizer showed the highest values of shear strength, because this mixed plasticizer system could form stronger hydrogen bonds with wood and cornstarch molecules.

Key words: liquefied bark, oxidized cornstarch, plywood, shear strength

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