
ABSTRACTS (MASTER THESIS)

Investigation of new natural adhesives from sugars and phosphate compounds and applications to particleboard

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Currently, wood-based materials were made by bonding between wood elements with synthesis resin adhesives. However, synthetic resin adhesives are mainly produced from fossil resources, and which lead to environmental load and depletion of fossil resources. Therefore, it is desirable to replace to natural-based adhesives based on non-fossil resources. Conventional natural adhesives have some issues such as complicated preparation, low water resistance. Recently it was found that mixed aqueous solution of sugar and phosphate compound had a potential to be used as an adhesive for wood.

In this study, mixtures using six types of sugars and four kinds of phosphate compounds were prepared, and the curing properties and bonding properties were clarified. The effects of type of sugars and phosphate compounds, mixture ratios and heating conditions on the curing properties were examined by thermal analyses, insoluble matter and FT-IR analysis. Furthermore, based on the results obtained, particleboards bonded with sugar and phosphate compound were prepared by changing the mixture ratio of the sugar and phosphate compound, hot press temperature and time and resin content. Some tests referring to JIS A 5908 were performed to evaluate physical properties and clarify preferable production conditions as well as the adhesive performance.

Preferable sugar and phosphate compound were sucrose and ammonium dihydrogen phosphate (ADP), respectively. The sufficient curing condition of the mixture of sucrose and ADP was temperature of 180°C and time of 10 minute. The particleboard bonded with sucrose and ADP as an adhesive had excellent mechanical properties, water and decay resistances. The mechanical properties and water resistance of the boards satisfied with JIS standard and were comparable to those of the particleboards bonded with synthetic resin adhesives. Preferable production conditions were mixture ratio of sucrose and ADP of 85/15, press temperature of 200°C, press time of 10 minutes and resin content of 20 wt%. Consequently, it was clarified that the mixture of sucrose and ADP had good bonding properties and could be used as a natural adhesive.