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Author(s)	ZHANG, Min; KAWAI, Shuichi; SASAKI, Hikaru
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Production and Properties of Composite Fiberboard*¹

Min ZHANG*², Shuichi KAWAI*²
and Hikaru SASAKI*²

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Introduction

Due to the deterioration of the global environment in recent years, the environment-protection function of forests has been gradually realized and the research to effectively utilize plant resources other than wood has received more and more attention. The research reported here aimed at the industrial use of the fast-growing plant resources. The lauan (*Shorea spp.*) grown in Southeast Asia, such as jute (*Corchorus capsularis L.*) and bamboo (*Phyllostachys pubescens*), and bagasse (*F bagasse fr.*) grown in Brazil were selected as raw materials and different composite fiberboards were made. The properties of the fiberboard were investigated.

Materials and Methods

The size and shape of the fibers were first determined and the mechanical properties of the fibers were measured. Jute and bamboo fibers are narrower and longer than wood fiber. In addition, the tensile strength of the natural fiber was found to decrease substantially with increasing the diameter of the fiber. Fiber drying device, adhesive blender and fiber mat forming machine in laboratory-scale were fabricated and used to manufacture the different composite fiberboard.

During the production of the jute/wood composite fiberboard (JWB) and bamboo/wood composite fiberboard (BWB), the mixing ratios of jute fiber to wood fiber and bamboo fiber to wood fiber were 1/0, 3/1, 1/1, 1/3, 0/1. The target specific gravity for JWB were 0.45, 0.65, 0.85, 1.00 while 0.60 and 0.80 for BWB were considered. Isocyanate resin

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*² Lab. of Structural Function, Div. of Wood Material Science, Wood Research Institute, Kyoto University Uji, Kyoto, 611.

was used as binder for both JWB and BWB and the amount of adhesive addition was 10%.

Results

For JWB, the effect of mixing ratio was dependent on the specific gravity of the board. At a specific gravity of 0.45, no significant difference was observed on the MOR of the boards of all mixing ratios. This may have been due to the specific gravity of the jute fiber which is 2.5 times higher than that of wood fiber. The compaction ratio of the boards was very much low. However, when the specific gravity of the board was higher than 0.65, the bending strength increased and the high strength properties of jute fiber was realized (Fig. 1, for example). In addition, when the mixing ratio of jute fiber to wood fiber was 3/1, the contact area between two fibers reached the minimum value since there is a substantial difference between the diameter of jute fiber and that of wood fiber. As a result, the internal bond strength (IB) of the board arrived at the minimum point and the thickness swelling (TS) reached the maximum value. The retention ratio became minimum as well.

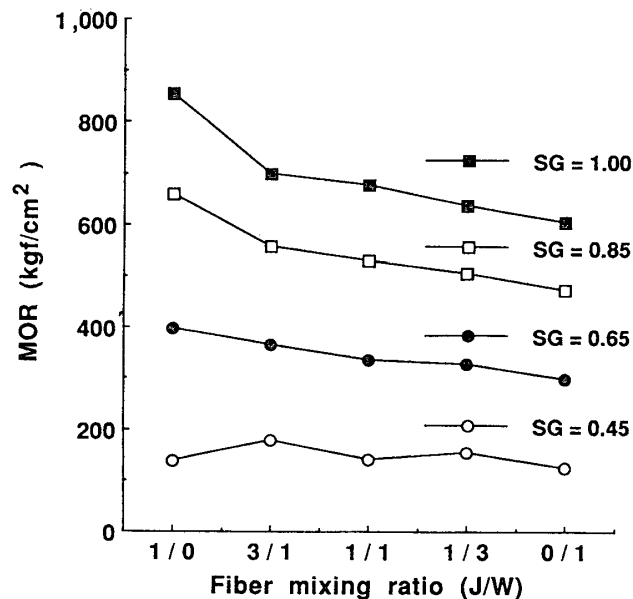


Fig. 1. Relationships between jute/wood fiber mixing ratios (J/W) and MOR of composite boards with parameters of specific gravity (SG) of boards.

Bamboo fiberboard with a specific gravity of 0.60 has similar strength properties as the wood fiberboard of the same specific gravity. But the retention ratio of the former is higher than that of the latter. When 25% bamboo fiber was mixed with wood fiber, the TS of the composite fiberboard increased by about 2 times while the linear expansion (LE) decreased to 1/5 (Fig. 2, for example). Therefore, the dimensional stability in the plane direction has been improved remarkably.

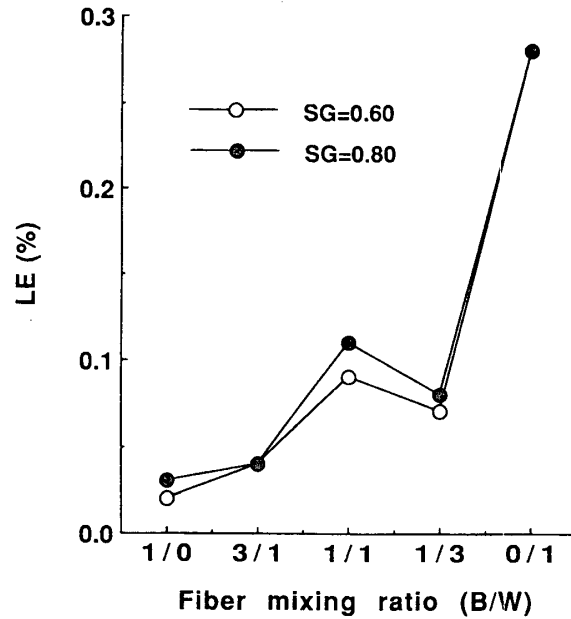


Fig. 2. Relationships between bamboo/wood fiber mixing ratios (B/W) and linear expansions (LE) of boards with parameters of specific gravities of boards (SG).

In another part of the study, bagasse particles processed using a hammermill and bagasse fibers produced from a single disc refiner (SDR) with steam pretreatment were used as materials to manufacture particle and fiber, respectively. Three kinds of adhesive were used. The particleboard having a specific gravity of 0.70 bonded with UF adhesive has a MOR of 300 kgf/cm², an IB of 13 kgf/cm², and a TS of 18%. The dimensional stability of fiberboard was much better however, the mechanical properties were smaller than those of the particleboard.