Development of Environmental-Friendly Boards from Gramineous Plants

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【Introduction】 In recent years, non-wood lignocellulosic plants have been of great interest from the viewpoint of effective utilization for natural resources. However, the only limited kinds of plants have been studied. In addition, fossil resources-based synthetic adhesives which have serious problem for human health and environment were usually used. The purpose of this study is to manufacture of boards from various Gramineous plants by using steam-injection press. First, various binderless boards (BB) utilizing self-bonding properties were investigated. To improve the board properties, the addition of chitosan was also investigated.

【Materials and Methods】 Bagasse-rind and -pith, straws (wheat, rice and reed) and bamboo were used as Gramineous materials. In each material, particle having the moisture content of about 10% were prepared. The steam-injection condition of BB was a steam pressure of 1MPa (180°C) for 6 min, and total pressing time was 7min. The dimension of each board was 230×230×7(mm) and the target density was varied from 0.6 to 1.0g/cm^3. In chitosan added board (CB), chitosan was dissolved in acetic acid solution (1wt%), and the solution was sprayed. The solid content of chitosan sprayed was 2 to 10%. As references, the board bonded with polymeric diphenylmethane diisocyanate resin (PMDI) was manufactured. In this case, solid content was 6%. The board properties were evaluated not only modulus of rupture (MOR) and internal bond strength (IB) by JIS A 5908, but also accelerated aging treatment.

【Result and Discussion】 Fig.1 shows the MOR and IB of various boards (density: 0.9 g/cm^3) from wheat, bamboo and bagasse-rind. In BB of wheat, bamboo and bagasse-rind, the strength of bagasse-rind was superior to those of other materials. When chitosan was added to the bagasse-rind board, the MOR and IB were 25 and 0.64 MPa, respectively. These values indicated about twice as strength as those of the bagasse-rind binderless board. Compared to the PMDI board, the strengths were slightly low. Fig.2 shows the thickness swelling of various bagasse-rind boards under accelerated aging treatments. The thickness swelling of BB increased with the treatment. The behavior of CB was similar to that of PMDI board. This indicated that chitosan-added board has good dimensional stability. This reason seemed to be that the chemical reaction between chitosan and sugar in bagasse-rind occurred.

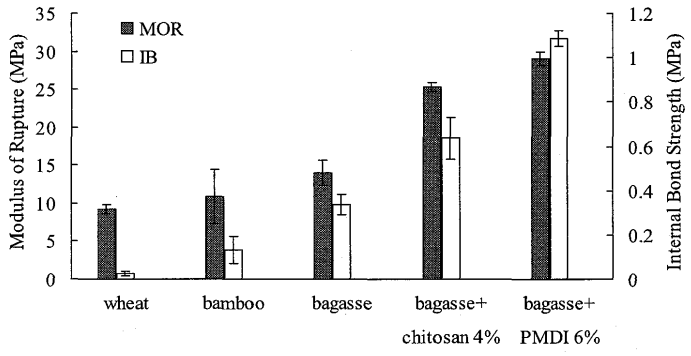

Fig. 1 MOR and IB of each board.

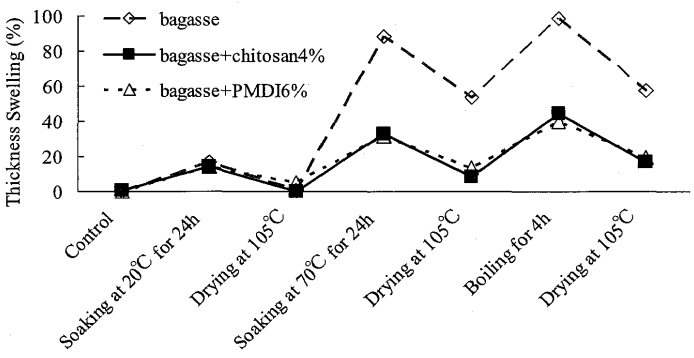

Fig. 2 Thickness swellings of each board under accelerated aging treatment.