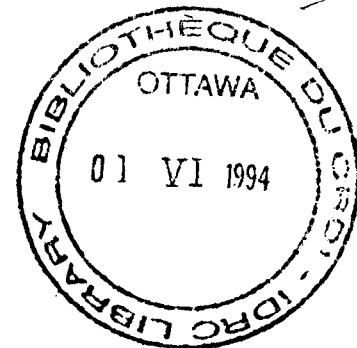


Wood Utilization (China) 86-0098

Submitted by: 1. Dr Emmanuel Bello (Philippines)  
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3. Dr Buhnum Kyokong (Thailand)  
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**Preliminary Report of the Evaluation Team**

The International Development Research Centre (IDRC), sponsored the participation of Messrs Emmanuel Bello, P M Ganapathy, Buhnum Kyokong, K M Siddiqui and A S N Murthy for undertaking an evaluation of the Wood Utilization (China) project supported by them.

Members of the Evaluation Team (Members) arrived in Beijing on March 14, 1991 (except Dr Bello, who for reasons beyond his control arrived on March 16) and followed a well planned evaluation procedure which consisted of:

- a) presentation of project results by the project scientists and/or their associates and discussions thereof,
- b) visit to laboratories of the Research Institute of Wood Industries (RIWI) where the project was implemented, and
- c) visit to site/industry where results of the project were applied.

In the presentation and discussion sessions, two visiting Indian scientists, Mr S S Zoolagud (Specialist - Adhesives) and Dr R Gnanaharan (Specialist - Wood Preservation) participated. The Members acknowledge with appreciation their inputs in the discussions.

The Members record with gratitude the courtesy extended to them by the President of Chinese Academy of Forestry and scientists of RIWI. They are particularly thankful to project scientists who spared every effort towards a comprehensive presentation and patiently provided clarification on issues raised during discussions. Members are beholden to the Project Leader, Dr Zhu Huanming, not only for the excellent arrangements made for conducting the evaluation but also for acting as their friend, philosopher and guide throughout their stay. Special mention must be made of the meticulous care with which he organised the entire exercise. To Ms You Xiujun and Mr Zhu Ruxiang, the Members owe a debt of gratitude for forming them in their tour of Wuhan City and Hubei province and for extending their help and assistance.

Members are of the unanimous opinion that the project has achieved the general and specific objectives for which IDRC provided the support. They are, particularly, surpassed by the following achievements:

- i) A highly successful multi-disciplinary team work which led to fulfillment of project objectives.
- ii) Application of results of the study during project period itself.

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It is, the Members are pleased to observe, the drive, initiative and enthusiasm of the Project Leader, Dr Zhu Huanming, which has led to the above achievement.

While endorsing the achievement of objectives of the project, the Members would like to make the following comments:

1. The project has established the feasibility of employing PRF resin adhesives in the place of RF resin adhesives for finger grounding and lamination. This is a very useful contribution in view of the high cost of resorcinol. While success has been achieved with P/R in molar proportion of 1:1 and 1:08, success is referred in ratio of 1:08 down to 0.4. From test results given, it is apparent that any formulation below 1:08 should be viewed with caution. Much further work is suggested before recommending lower phenol/resorcinol ratio. As shown in cost analysis, adhesive cost accounts for 3.4% only. Hence, at least in Chinese conditions, effect of reducing resorcinol would have a marginal effect only.
2. Further studies are recommended on Tannin Resorcinol phenol formaldehyde. Utilization of tannin from Larix gmelenii is a study of pioneering nature as hitherto tannin from Acacia, Mimosa and mangrove species only had been tried. It is seen that yield varies from 6-16%. This may be due to method of extraction or some other reasons. This needs to be investigated. Moreover, conclusions reached is based on limited trials from one source only. Variation in properties of tannin from different sources, different batches from the same source and seasons, is a well established fact. It is because of this tannin phenol formaldehyde resin adhesives developed in Australia, India, Philippines and to some extent South Africa, were not successful in industrial scale applications. Hence, more extensive studies are suggested before conclusions are drawn on tannin based adhesives.
3. Studies on UF resin adhesives have given some useful indications. Further, investigations for standardisation of resin synthesis and use of catalysts like formic acid are suggested. As employment of UF resin adhesives for interior applications will be highly cost effective, further work on this is strongly recommended.
4. Finger grounding of small wood of temperate species only has been studied. To extend the usefulness of this significant development further, it is suggested that studies may be conducted on
  - a) small wood of tropical hardwoods,
  - b) plantation raised species of fast growth, and
  - c) mixture of species within a determined density range.
5. In studies conducted on preservative treatment, it is shown Boric acid/Borax/Sodium fluoride is highly cost effective and that dry salt retention (DSR) of 12.1 kg/m<sup>3</sup> was observed by immersing wood of massor pine in 5% solution for 15 minutes. As mc of specimen was 2-8% , this could have been possible. Although DSR was high, depth of penetration was rather low. It is suggested that studies on solutions of lower concentrations (2-3%) employing specimens of 8-12% mc and longer immersion time be carried out before standardising the technique.

6. It is found that statistical analysis are carried out for each experiment separately. It is desirable that analysis on combination of variables are carried out and the most significant package recommended.
7. Further studies on profile geometry particularly in respect of application for different end uses for e.g door/window frames will be extremely useful to extend the application of this study.
8. The technology will be useful to timber deficit countries in the Asia Pacific region as emphasis on plantation raised fast growing species is becoming increasingly evident. Hence, mechanism for transfer of technology should be worked out in consultation with IDRC.

APPENDIX - I

**Comments on the Preservation Technology  
in the IDRC Wood Utilization Project (China)**

The study has shown that wood of Masson Pine from thinning is easily treatable and BBF (boric acid/borax/sodium fluoride) preservative is cost effective. The easy treatability is reflected in the high dry salt retention (DSR) obtained ( $12.1 \text{ Kg/m}^3$ ) by immersing wood ('L type') in 5% solution of BBF. As the moisture content of wood at the time of treatment was 2 to 8%, chemical pick-up would have been high. It might be good to check the DSR at moisture contents normally used for treatment.

Even though the DSR is very high, depth of penetration has been found to be low (penetration area, 10-60%).

The report suggests that immersion time could be reduced from 30 minutes to 15 minutes while treating 'L-type' wood in 5% BBF preservative solution.

It is suggested that instead of reducing the immersion time, the concentration of the solution should be reduced to 2-3% and immersion time increased appropriately so as to get adequate loading and deeper penetration of chemicals.

Also, as BBF is a diffusing-type preservative, it should be possible to treat wood at a higher moisture content level. This will help in reducing the drying time before treatment.

Dr. R. Gnanaharan