New developments of water-borne preservatives for forest products

M. R. CLARKE and J. R. RAK

Department of the Environment
Canadian Forestry Service
Eastern Forest Products Laboratory
Ottawa

The forest products industry is undergoing rapid change which calls for the development of more highly finished wood products to meet consumer demands. In the wood preservation industry it reflects a demand for wood products with a broad spectrum of properties such as protection of wood against biological attack, fire resistance, cleanliness, paintability, and natural appearance.

Another demand on the preserving system is to be stable under storage and treating conditions and to penetrate adequately even difficult-to-penetrate (refractory) species. For example spruce, an abundant species in Canada, can not be widely used because it can not be satisfactorily treated with acid systems presently in use.

We have developed model preservative systems based upon copper arsenate and zinc arsenate — chemicals with known long-term effectiveness (Gjovik and Davidson 1972) — and combined them with special additives¹ to upgrade some properties of wood. For treatment, the preservative salts are dissolved in aqueous ammonia. When the solvent evaporates from the wood, the salts are well fixed in the structure.

In defining the formulation of the new preservative system we have placed considerable emphasis on water repellency. Additives which can be of inorganic or organic nature considerably increase water repellency of wood treated with the preservative formulation. These additives do not interfere with high toxicity of the preservative. An example of spruce with a highly water repellent surface is shown in Figure 1.

With many treated wood products (for example, roofing materials, posts, and poles), beside protection against decay, glowing combustion resistance is desirable. The new preservative system when formulated with zinc does not accelerate glowing combustion, in contrast to other preservative systems, particularly those based on chromium or copper, that do accelerate glowing combustion.

Another important advantage of the new systems is its stability at high temperatures (up to 200°F) in the presence of wood or wood extractives. Commonly used chromium-copper-arsenic preservatives (CCA) cannot be used at temperatures above 120°F without risk of precipitating out the active components from solution.

If the new preservative is precipitated out from solution (e.g. due to loss of solubilizing ammonia), it can be redissolved by adding ammonium hy-

A new heavy duty water-borne preservative system is described. The system is based on aqueous ammonia solution of inorganic salts with additives. The preservative formulation penetrates deeply into difficult-to-penetrate forest products and wood species and provides well balanced properties of treated wood. The preservative formulation is stable under processing conditions.

Fig. 1. White spruce treated with a new ammoniacal system with additives. Note the depth of penetration and high water repellency demonstrated by water drops (arrow).

droxide or concentrated treating solution. This has two advantages. First, solid waste material in treating retorts can be used again after redissolving, and second, preserved wood products which have failed to meet quality standards, such as preservative retention or depth of penetration, can be re-treated. In the case of the CCA preservatives solid waste disposal from treating equipment can create problems.

The new system also penetrates faster and deeper into wood; the solution is capable of altering the microstructure of wood and of improving its permeability to liquids. This can be used with advantage in double treatments. The penetration of preservative is also more uniform than in the case of acid preservative solutions. All these features result in satisfactory penetration of refractory species such as spruce and will permit greater utilisation of this timber resource — important, because easily treated wood species are becoming exhausted and new timber resources are sought.

We have scaled up our treatments to full-scale industrial treatments of spruce roundwood. Preliminary results of these treatments — preservative retentions of about 12 pcf (192 kg/m³) and average depth of penetration of more than 0.75 inches (2.0 cm) in spruce roundwood — offer promise that the new system is capable of treating refractory species at the industrial scale.

References

- GJOVIK, L. and H. L. DAVIDSON. 1972. Comparison of wood preservatives in stake tests. 1971 Progr. Rep. US Dep. Agr. Forest Serv. Res Note FPL-02.

¹Clarke, M. R. and J. R. Rak. Heavy duty aqueous wood preservative. Can. Patent Applied, 12 Dec. 1972, US Patent Applied, 21 May 1973.