Additives on a Montan Wax Basis for Hydrophobing Wood-based Materials

Project Leader: Dr. Detlef Krug
In-charge: Dr. Detlef Krug
Dipl.-Ing. (FH) Jürgen Bonigut
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Initial Situation and Objective

In the production of wood-based materials, a number of special additives are mixed in. Apart from binding agents, hydrophobing agents are the most frequently administered additives. The aim of their application is to reduce swelling and the related decrease in the characteristics of the use of wood-based materials when they come in touch with water.

The goal of these investigations was to apply montan-wax-based hydrophobing agents in the manufacture of wood-based materials. Approaches to tackling this task were seen in purposefully combining systematically modified montan waxes, if necessary, also in combination with paraffinic components exploiting the synergetic effects of both active substance systems.

Material and Methods

By using montan-wax-based additives, fibreboards were produced at the laboratory of the *Materials* Department of IHD on a laboratory scale. The fibreboards were manufactured in several successive work programs (WP). The following presents and discusses the results of this property testing of fibre-based materials made in two WP on a laboratory scale. The principal parameters as well as the differences regarding board manufacture in the above-mentioned series are shown in Tab. 1.

The main differences between the two series presented consisted in having initially been treated with a bonding agent share of 12 %[1], which was reduced to 8 % in the second, and that in the first series three different additive dosages were applied (0.20 %, 0.35 % and 0.50 %), of which one (0.20 %) continued to be used.

Pine (*Pinus sylvestris*) was adopted as regards wood species. The targeted raw density was 850 kg/m^3, thickness 9.0 mm and the hot plate temperature 220 °C during hot pressing being. The bonding agent applied was a urea-formaldehyde (UF) resin commonly used in the industry.

The active basis of all above-mentioned additives was montan wax, which is a sophisticated mix of a multitude of substances.

Unlike most synthetic waxes (e.g., PE wax, FT paraffin), chemical modification of montan wax is possible owing to the availability of reactive functional groupings (e.g., carboxyl groups) after refining. Such modification can be performed with the help of a multitude of reactive partners to define special properties for application.

[1] *Dosages indicated hereinafter always relate to solid matter in relation to bone-dry fibres.*

Tab. 1: Parameters of fibreboards made on a laboratory scale

Series	A	B
Montan wax variants	1, 2, 7, 9, 13	22 ... 25
UF share (%)	12	8
Share of additive (%)	0.20; 0.35; 0.50	0.20

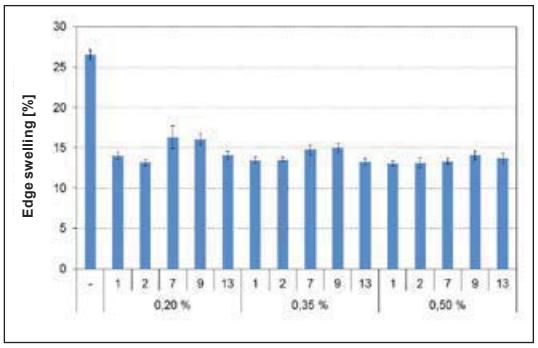

Fig. 1: Edge swelling after 24 h of water storage of UF-bonded laboratory-scale fibreboards depending on the additive applied (A Series; n = 12)

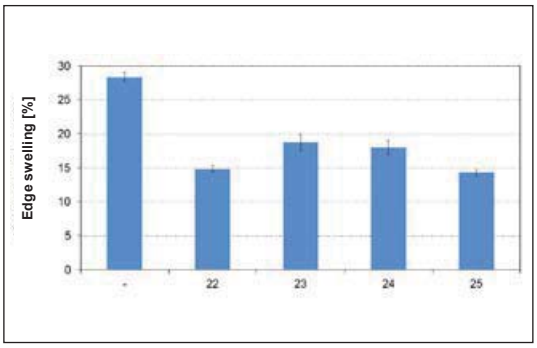

Fig. 2: Edge swelling after 24 h of water storage of UF-bonded laboratory-scale fibreboards depending on the additive applied (B Series; n = 12)

After the fibreboards were manufactured on a laboratory scale, appropriately conditioned and air-conditioned, certain properties, including raw density (EN 323), transverse tensile strength (dry; EN 319), thickness swelling after 24 and 48 h of water storage (EN 317) as well as edge swelling after 24 h of water storage (of samples coated with decorative paper; EN 13329) were tested.

Results and Discussion

A significant impact of the use of hydrophobing additives based on montan wax was especially clearly seen in edge swelling. However, regarding the additivies applied in the A series, the differences between the three dosages of 0.20, 0.35 and 0.50 % were only little (Fig. 1), which allows to conclude that the adhesive share of 12 % has an overlay effect on hydrophobing.

A reduction in the amounts of adhesives and additives made the differences between the additives applied better visible (Fig. 2) and permitted to make conclusions regarding further optimisation. It was positively noticed that all additive variants showed clearly lower edge swelling than the non-hydrophobed zero-variant.

Summary

The results shown regarding edge swelling after 24 h of water storage and the results of the transverse tensile strength (dry), of thickness swelling after 24 or 48 h of water storage unambiguously show that (Fig. 1) the montan-wax-based additives applied are fit for use in fibre material manufacture and (Fig. 2) that, even if applying 8 % of bonding agent and at an additive dosage of 0.20 %, the results exceed expected levels of acceptance.