Highly efficient water-repellent agents based on montan wax – some case studies for lab development & upscale

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Abstract

In addition to binding materials, hydrophobizing additives are used during the production of wood-based materials to improve the properties of the resulting MDF plates. Paraffin-based water repellents obtained from petroleum are the most commonly used additives. Recently, we have developed and tested various dispersions based on montan wax [1, 2]. Montan wax, a fossil hard wax obtained from lignite, has been proven to show good hydrophobizing and binder-effective properties [3, 4]. Furthermore, its properties as a multi-component system containing polar groups giving hints to a good dispersing behaviour [5]. These polar structures within the montan wax should have a high affinity to the polar surface of the wood fiber particles.
In collaboration with the Institute of Wood Technology Dresden (IHD), we have shown that it is generally possible to produce high density fiberboards with excellent water-repellent properties using montan wax-based dispersions. Next steps of development included the transfer from the pilot to industrial scale applying praxis tests to validate these results.

In dependence on their special application wood materials must have a number of standardized properties. Transverse tensile strength as well as the thickness and edge swelling of the resulting MDF plates after immersion in water are significant values which have to be evaluated. MDF plates of high density have been produced and examined in various test series. Pilot plant experiments were performed using the dispersion from lab production whereas industrial application was tested with dispersion produced at industrial scale. Latter were carried out using common and comparable technologies for processing softwood. Figs. 1 and 2 clearly show the improved thickness and edge swelling of the montan wax based dispersion DW 55 compared to the paraffin-based reference. This behaviour suggests additional binder assisting effects when using montan wax in additives for hydrophobization. These trends could be verified in industrial scale in two cases. Overall, the thickness as well as the edge swelling after immersion in water have been found to be significantly lower when using the DW 55 as an additive (Fig. 3). Differences in the total

percentage of the swelling values result from different manufacturing processes and concentrations of the hydrophilizing agent.

We can summarize that the montan wax-based dispersion DW 55 optimized for the hydrophobization of wood-based materials has been found to produce high-density fiberboards (MDF). These show properties suitable for industrial application, especially with regard to thickness and edge swelling. Here, DW 55 acts as a highly efficient water-repellent additive.

Current trends focus on the production of wood-based materials based on hardwood or mixtures thereof. So, we will align our developments there. Thus, a recent project evaluates the effectiveness of different montan wax-based dispersions in MDF plates which consist of different hardwoods (beech, poplar) and mixtures of pine and hardwoods [6]. Not surprisingly, the mixture pine/beech showed the best results after treatment with the dispersion DW 55. Further statistical experiments as well as variations in the dosage of the dispersion are planned to validate these results.

Literature

[1] Bonigut J, Krug D, Mieth A, Abraham J (2014) Wasser-Abweiser. MDF-Magazin 2014: 66-69.
[2] Bonigut J, Krug D (2015) Entwicklung multifunktionaler wachshaltiger Additive für Holzwerkstoffe. Abschlussbericht. Hrg. v. Institut für Holztechnologie Dresden gGmbH, Dresden, Projektträger AiF, FKZ 17040 BR
[3] Naundorf W, Wollenberg R, Kuschel M, Naundorf T (1999) Verfahren zur Herstellung und Anwendung von Suspensionen aus Harzen, Wachsen, Bitumina und Pechen mit hohen Schmelzpunkten. Patentschrift DE 19730410 A1, 21.01.1999
[4] Edel J, Mieth A, Abraham J (2009) Verwendung eines Hydrophobierungs- und Bindemittel in Faserbau- bzw. -dämmstoffen. Patentschrift DE 19805344 B4, 02.04.2009
[5] ULLMANNS Enzyklopädie der Technischen Chemie (1983) Montan Wax, 4. Neubearbeitete und erweiterte Auflage, Bd. 24, Sonderdruck, Verlag Chemie GmbH, Weinheim, S. 20-22
[6] IGF-Vorhaben Nr. 20166 BR der Forschungsvereinigung Forschungsgemeinschaft Deutsche Braunkohlen-Industrie e.V., Nutzung montanwachshaltiger Additive zur Herstellung von Holzwerkstoffen auf Basis von alternativen Rohstoffen, 2018

Fig. 1: Effect of DW 55 on the edge swelling of fiberboards after 24 h water immersion (pilot plant, IHD)

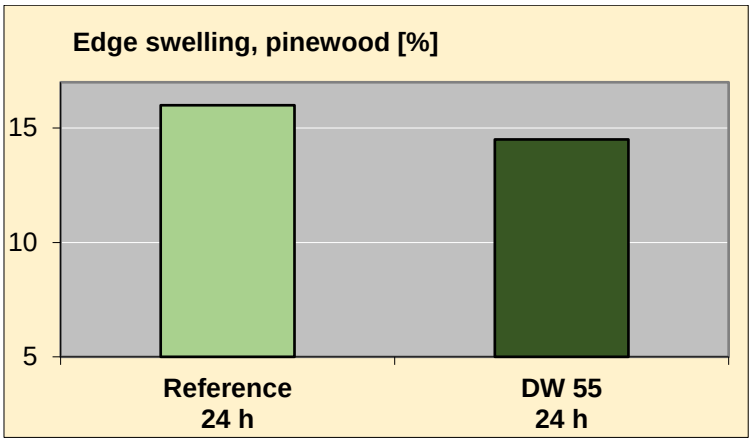

Fig. 2: Effect of DW 55 on the thickness swelling of fiberboards after 24 h and 48 h water immersion (pilot plant, IHD)

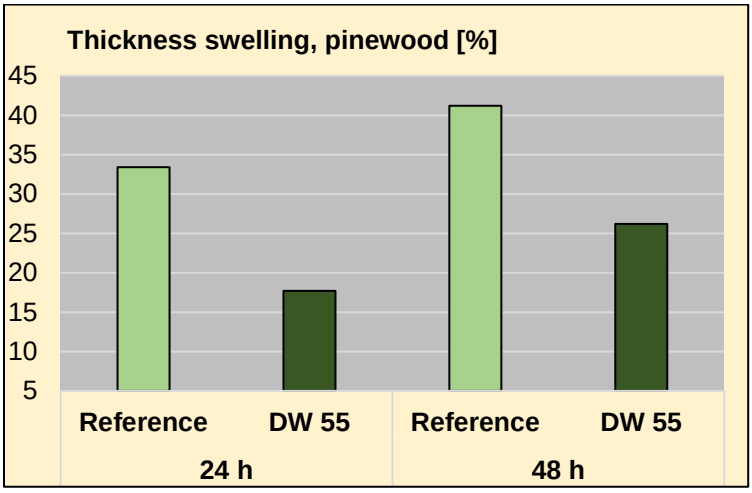

Fig. 3: Effect of DW 55 on the thickness and edge swelling of fiberboards after 24 h water immersion (industrial scale, test 1 and 2)