Manufacture of Moisture-resistant and Mould-resistant Insulating Fibreboards from Modified Fibres

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Initial Situation and Objective

Wood-fibre-based insulating materials count among the insulating materials that are ecological and especially healthy in the human habitat. As with all fibre-based insulating materials, the structural-physical framework conditions for their insulating effect and fungus resistance are of decisive importance to insulating materials based on wood fibres, too. If high moisture occurs, condensate may form in or on the surface of the insulating materials and, therefore, lead to infestation by mould.

This results in the failure of the insulation and the formation of cold bridges which, in their turn, may aggravate condensation. Consequentially, the insulating materials will lose their form stability and insulating effect, as the pores essential for insulating fill with water or get lost in that the material partially collapses (clodding). Moreover, mould infestation is highly hazardous to health.

The objective of the project was to chemically modify wood-fibre-based materials already during their stage of manufacturing and to enhance the practice-relevant properties of the wood-fibre-based insulating panels made from them. Thereby, the chemical modification potential was to be evaluated, which had proven successful with solid wood and veneers, especially with a view to reducing moisture absorption and preventing fungal infestation. The project was to find out to what extent fungal infestation and the failure of the insulating material exposed to high levels of moisture could be prevented by modification.

Results

For one thing, chemical modification was successfully performed in the batch procedure (fibres and woodchips) and, for the other, during defibration in the refining process. The raw materials (spruce, pine), the process parameters of defibration (pressure, the spacing between grinding disks) and also the modifying chemicals (siloxanes, 1,3-dimethylol-4,5-dihydroxyethylene urea (DMDHEU), low-molecular phenol-formaldehyde condensates (PF), ethanoic anhydrid (EAH)) were subjected to variation for the investigations.

The wood-fibre insulating boards of a targeted raw density of 200 kg/m³ were manufactured by means of high-frequency pre-heating (80 °C) and subsequent hot pressing (130 °C). A polymeric diphenyl methane diisocyanate (pMDI) was used for gluing the fibres.

A reduction of moisture absorption, maintaining the insulating performance at the same time, could be achieved by chemically modifying the woodchips by EAH. It showed that the conditions during the thermomechanic fibre pulping hardly result in a decrease in the fixation of chemicals in the cell wall. Furthermore, the addition of low-molecular PF during the refining process, via both the force worm feeder and the blow-line, revealed large potential. Here also fibre hydrophobing occurred, with the consequence of lower insulation material moisture. In addition to that, an improvement in the stability of the wood-fibre insulating boards could be noticed. After successful impregnation by PF and EAH also the resistance towards wood-destructive basidomycetes, not towards mould, however, could be increased.

The results enable manufacturers of insulating wood-fibre materials to targetedly improve the properties of their products by manageable investments. With the help of the new products, growth can be generated by competitive advantages. As a result of the investigations, manufacturers are shown several ways of integrating chemical modification into the manufacturing process of wood-fibre-based insulating materials. By having rendered proof of implementing chemical modification in the manufacturing process of wood-fibre materials on a laboratory scale, transfer potential into the existing manufacturing technology opens up to manufacturers of other wood-fibre-based materials (MDF, HDF, fibrous mould parts).

Fig. 1: Insulating wood-fibre board of chemically modified fibres

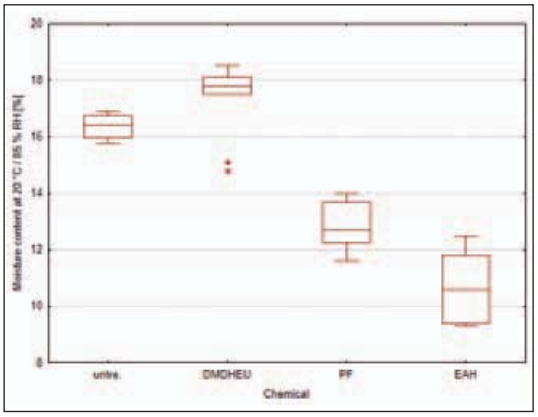

Fig. 2: Equilibration moisture of wood-fibre-based insulating materials of chemically modified fibrous material in damp climate (20/85) in contrast to the untreated reference