Dry defibration of previously unused waste paper types and use of these for the production of white low-formaldehyde MDF

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Abstract

Because of the discussion about formaldehyde emission from wood-based materials and the use of dry-processed fibre materials for the production of boards and papers, investigations on the production of MDF out of waste paper fibres after dry defibration were carried out. The objective of the investigation was to reduce the formaldehyde emission of MDF by using fibres out of waste paper (compared to MDF from pine). Furthermore, an alternative for interior design with white MDF from waste paper should be presented.
The focus was on the development of a dry defibration process for the preparation of the waste paper fibres and the production of MDF there off.
As raw material previously non-recycled waste paper grades were used. This includes wet-strengthened or film-laminated papers.

The dry defibration of the waste paper was carried out on a horizontal turbo mill (type GWH 400) at the pilot plant of Gotic GmbH with variation of the speed (4.700 min-1 to 7.300 min-1).
Subsequently, MDF were produced at the pilot plant of the IHD. For this purpose the fibres were blended with 4% pMDI in a blender. Hot pressing was carried out at 220 °C and a pressing time factor of 10 s/mm board thickness in the dimensions 460 mm x 440 mm x 17.5 mm with a target density of 750 kg/m³.
The following waste paper grades were used:
- Label backing paper,
- Crepe paper wet-strength white,
- Wallpaper with laminated cellulose fleece,
- Wallpaper with cellulose fleece,
- drip cap paper and
- Countertraction paper.

Pine TMP was used as a reference.
On the one hand, 100% of the fibres were used in the MDF. On the other hand, blends of waste paper and pine fibre stock were used in 25 % increments.
Variations in the moisture content of the fibers before gluing and in the proportion of adhesive were also performed.
Among other things, the bending strength and modulus of elasticity (DIN EN 310), the internal bond (DIN EN 319), the thickness swelling after 24 h water storage (DIN EN 317) and the density profile (IHD-W 401) were determined. The formaldehyde emission was measured by modified gas analysis.
The results were compared to the specifications from table 3 of EN 622-5 (board type MDF) as requirements for MDF.

The investigation showed that defibration of the waste paper in the turbo mill leads to fibre qualities that can be used in MDF production.
As expected, the paper fibres had a shorter mean fibre lengths than the reference pine TMP. This resulted in a lower bending strength of the manufactured waste paper based MDF. By optimizing the density profile of the MDF by varying the press program, both the bending and internal bond of the waste paper based MDF were able to reach a level above the required values.
The thickness swelling after 24 h water storage of the paper based MDF could reach the requirements. With increasing amounts of paper fibers in the MDF, with pMDI, the bending strength decreased , while the internal bond increased. When UF resin was used, the strength and thickness swelling after water storage reduced with increasing amount of waste paper fibres.
Measurements of formaldehyde emission showed a small reduction in the values for MDF from waste paper fibres compared to MDF from pine TMP. Formaldehyde-free MDF could not be produced.
First tests for coating the waste paper MDF showed positive results compared to the reference out of pine TMP.
Selected results of the investigations will be presented in the presentation.

Project partners:
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