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Development of a Demonstration Facility for the Production of LNS Core Materials

Improvement of Production Techniques for Stalk Core Materials (Light Natural Sandwich)

Within the scope of a project sponsored by the DBU, the production techniques for manufacturing stalk core materials for LNS were improved to make continuous production possible. Due to lacking comparable procedures, many process innovations had to be developed to demonstrate an economically and environmentally friendly production technique on an industrial scale.

Plant stalk core materials are a material that can be differentiated clearly from other light sandwich core materials, in its technical properties as well as in its processing method and in the raw materials used. During the project it became clear that it was not possible to reach back often on proven techniques. Even the adaptation of available techniques that can be found on the market to the requirements of stalk core production was not possible in every case.

Development and construction of a bundle saw

To make an optimal exploitation and a quick processing of the plant material possible it was necessary to construct a facility for the conditioning of the Triarrhena stalks. Aim was the cutting of a whole stalk bundle in one process, as well as the separation of the stalk into the upper, middle and lower stalk segments. Thereby a separate processing of the different stalk parts was possible and different stalk core materials can be produced from one stalk type. For the cutting of a stalk bundle with a length of 2400 mm into pieces with a length of 720 mm in one process step four circular saw blades were necessary. The height of the cut was determined to 200 mm. A circular saw with four displaceable blades on one driveshaft was designed and constructed (*Fig. 1*). Based on the possibility to adapt the blades on the driveshaft, other stalk lengths than the currently chosen 720 mm can be selected. Perhaps this could be necessary, if larger form boxes were used in the process. With this device up to 15 m^3 / h stalks bundles can be processed.

Development and construction of a production carousel for the manufacturing of stalk core material blocks

Starting with a discontinuous device, a production carousel was developed that makes a continuous and with that a more effective procedure possible. The production carousel (*Fig. 2*) for the manufacturing of stalk core material blocks was composed of following main components:

- Four heatable vacuum-tight form boxes made from aluminium with a mechanism for the demoulding of the stalk core material block
- A heatable stamper
- A round table with the electric equipment
- A glue foam producer
- A foam injection module
- A vaccum pump

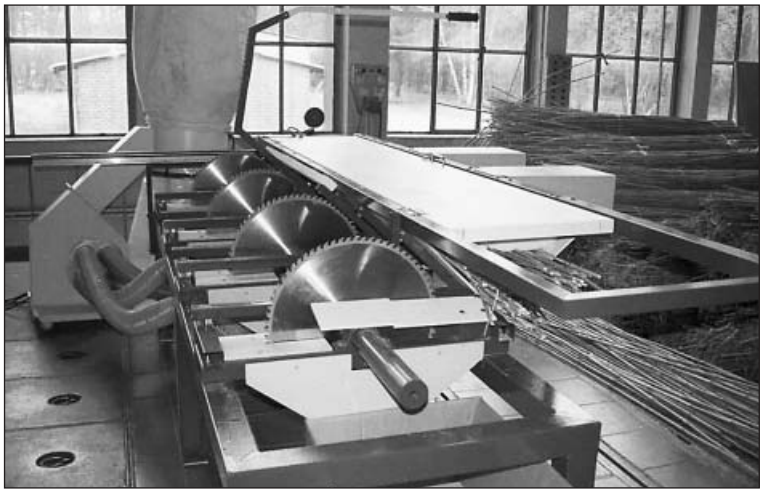

Fig. 1: Stalk bundle saw with variable blade adjustments

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Keywords

Renewable raw materials, stalk core materials, manufacturing technique

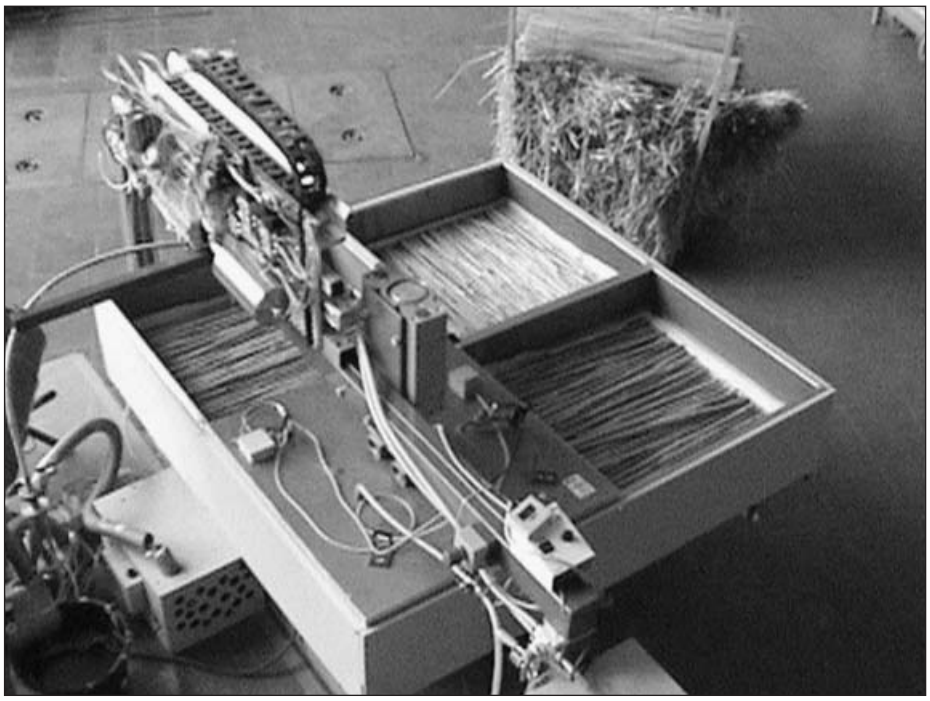

Fig. 2: Design of the production carousel for the manufacturing of stalk core blocks

The way of production includes several steps which can be described as follows:

1. Put a release paper into the form to avoid the sticking of the glue at the walls of the form.
2. Put the stalks in.
3. Injection of the glue foam made from vegetable oil
4. Compact the stalk/glue mixture (bring down of the heatable stamper).
5. Evacuation of the heatable form to support the expansion of the glue foam.
6. Venting of the form with hot air to accelerate the hardening of the glue foam.
7. Hardening of the glue foam.
8. Demoulding of the stalk core material blocks

The blocks must cool down after demoulding before they can be used in the following process. The facility can be handled by one person. The time for one cycle is about seven minutes. So a production volume of up to 0.4 m^3/h is possible.

Stalk core material production

The dimensions of the stalk core material blocks are 720 mm • 720 mm • 100 mm. The blocks must be cut very exactly (±0.15 mm) right angel to the direction of the stalks in slices. These slides were stick with the same glue between the cover plates made from plywood. The low tolerance of the thickness of the cores is necessary to guarantee a faultless aerial sticking of core material and cover plates. Tests with customary blade saws showed too great inaccuracies in the cut and the occurrence of too high forces onto the core block. Further tests with a plate chop saw led to better results because they have only one blade, what reduces the force onto the core block. With the additional use of a stop and positioning system the necessary exactness for the cut could be attained. *Figure 3* shows the stalk core material saw during cutting. The cut slices were pushed forward onto the saw table automatically and stacked by hand on a pallet. The production volume of the stalk core material saw accounts to approx. 2.5 m^3/h. This device can be handled by one person including sorting and stacking of the slices.

Fig. 3: Cutting of stalk core blocks with a plate chop saw

Result

Due to the clear improvements in production techniques and in the course of production it is now possible to produce larger amounts of stalk core materials. Thereby more LNS construction materials can be manufactured at an industrial scale now.