Sawdust valorisation through development of different sawdust-based green and versatile chemicals and materials

Master thesis project to be carried out within a Södra Research Foundation financed project at RISE

Aim: to establish a biorefinery procedure to fully fractionate and process all softwood sawdust major building components into green and versatile products for value added applications.

Procedure: conduct and optimize the following steps

- Alkaline extraction of softwood sawdust (SD) to obtain glucomannan (GM)
- Delignification to obtain isolated lignin and minuscule size's cellulose (MS-cell)
- Modification of the MS-cell into hydrophobic MS-cell
- Modification of the isolated lignin to improve fire retardant property
- Blending the GM and MS-cell to prepare biofilm

Background

Generally, sawmills experience a low profit margin; only ca. 50% of sawlogs ends up as sawnwood, leaving several side stream products of low value especially the sawdust (SD) that amounts to ca. ¼ of the sawnwood quantities. There is an industrial demand to improve sawmills' profitability. This Master thesis project is therefore focused on SD's valorisation by exploration of better and new applications. Spruce wood, the primary species for the sawlogs used by Södra group, contains 28% lignin and 20-35% glucomannan (GM) in addition to > 40% cellulose. An ideal biorefinery process could separate SD into its building components, namely lignin, GM and cellulose, and convert them further to value-added products in an integrated way so as to maximize the economic value of SD while reducing waste production. So far, however, no biorefinery process of SD, neither for component isolation, nor for component processing, is yet commercially running in Sweden.

Your task will be to investigate and establish a biorefinery process including isolations of GM, lignin and MS-cell and their further processing into hydrophilic MS-cell for paper mill application, hydrophobic MS-cell for thermoplastic composite production, modified lignin for fire-retardant wood preparation and GM blended MS-cell biofilm for food and pharmaceutical packaging utilization.

The techniques to use include mainly extraction and modification of chemical components by autoclave heating with or without microwave assistance, characterizations of the extracted and modified structures by for example different chromatographic and spectroscopic methods, and preparations and advanced determinations of the paper, thermoplastic composite, fire-retardant wood and biofilm. You will be trained or assisting other persons in the mentioned techniques but a fundamental knowledge of and interests in the mentioned techniques as well as an interest to combine experimental work with a creative way of thinking are advantageous.

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