

Wood K plus

WOOD: next generation materials and processes – from fundamentals to implementations

Programme: COMET – Competence Centers for Excellent Technologies

Programme line: COMET-Center (K1)

Type of project: Lignin and Hemicellulose Utilisation, 2018-2022, multi-firm



© Hoheneder: Valuable products from lignocellulosic biomass

MICROBIAL UPGRADING OF A SIDE STREAM FROM CELLULOSE FIBER PRODUCTION

LIGNOCELLULOSE DERIVED FEEDSTOCKS ARE KNOWN AS POTENTIAL CARBON SOURCES FOR INDUSTRIAL FERMENTATIONS. WOOD K PLUS DEVELOPED A WAY TO EFFICIENTLY CONVERT A SIDE STREAM FROM TEXTILE INDUSTRY INTO THE PLATFORM CHEMICAL LACTIC ACID.

On our way to a sustainable economy, substitution of fossil-based compounds by alternatives derived from renewable resources is of major importance. In this respect, not only the efficient conversion of bio-based feedstocks towards high value compounds is needed, but also the use of side streams, which do not compete with food and feed industry.

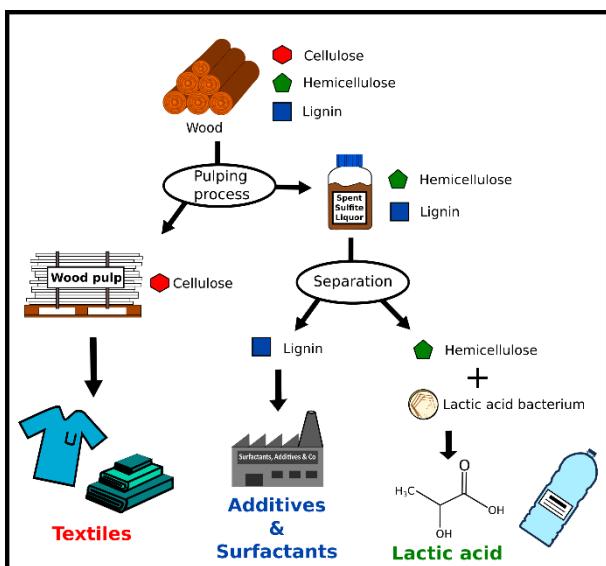
One of these potential side streams is formed during the textile fiber production from the renewable feedstock wood performed by the Lenzing AG biorefinery plants. Wood mainly consists of three different compounds: cellulose, hemicellulose and lignin. During

sulphite pulping, cellulose is separated from hemicellulose and lignin to form wood pulp, the basic material for cellulosic fibers. While these fibers are further processed towards textiles, hemicellulose and lignin remain in a side stream, the so-called spent sulfite liquor (SSL). Until now, this side stream is mainly burned for the production of energy. However, hemicellulose derived sugars can be used more efficiently in microbial fermentations, whereas lignin and its derivates can be used as additives for several products and applications.

Microbial conversion towards lactic acid

Within the COMET project “Lenz 1.9” the hemicellulose fraction of spent sulfite liquor from an industrial sulfite pulp mill (Lenzing Biocel Paskov, CZ) was converted towards lactic acid via microbial fermentation.

Lactic acid is an organic acid, which can be used as acidifier and flavouring agent in the food and pharmaceutical industry. Furthermore, it can be converted to polylactic acid (PLA), a biodegradable alternative to fossil-based plastics.



© Hoheneder: Sketch of the microbial valorisation of spent sulfite liquor (SSL)

To obtain this high-value product from SSL, in a first step, SSL was separated into a hemicellulose derived sugar syrup (HDSS) and a lignin fraction. In a next step, different bacteria were screened for their ability to grow on HDSS, resulting in a good growth performance of several lactic acid producing bacteria. Finally, yet importantly, different lactic acid bacteria were screened for the ability to convert all sugars present in HDSS, the absence of any by-product formation and their capability for optically pure L-lactic acid production. After optimising the fermentation setup, the complete conversion of sugars derived from HDSS to optically pure L-lactic acid was achieved using the lactic acid bacterium *Enterococcus mundtii*.

Benefits of the results for industrial processes

The process highlights the possibility of using all three major parts of wood. The cellulose is used directly for textile production, hemicellulose is converted towards lactic acid and lignin can be used as additive or surfactant in the form of lignosulfonates. Therefore, a highly efficient use of all available carbon within wood is possible, a prerequisite for sustainable production of goods. In addition, the reached lactic acid yields and productivities were in an economically relevant range and, thereby, highlighted the potential of this process for industrial implementation. This study is a convincing example for the upgrading of a complex raw educt to an optically pure valuable product, and is a model for the valorisation of industrial side streams.

Project coordination (Story)

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- Amalgamated Research LLC

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