

Full Conversion of Tobacco Leaf Powder in a High Pressure Biorefinery Sequence

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A High Pressure Biorefinery Cascade at TUHH, as being shown in Figure 1, is an integrated one-stop process allowing the full use of any kind of biomass as material resource, especially agricultural residues. In the given scenario dealing with tobacco leaf powder, its separation into lipids, proteins, hemicellulose and cellulose as well as lignin in a sequence of at least two high pressure /supercritical operation steps has been investigated: Carbon dioxide extraction and liquid hot water hydrolysis.

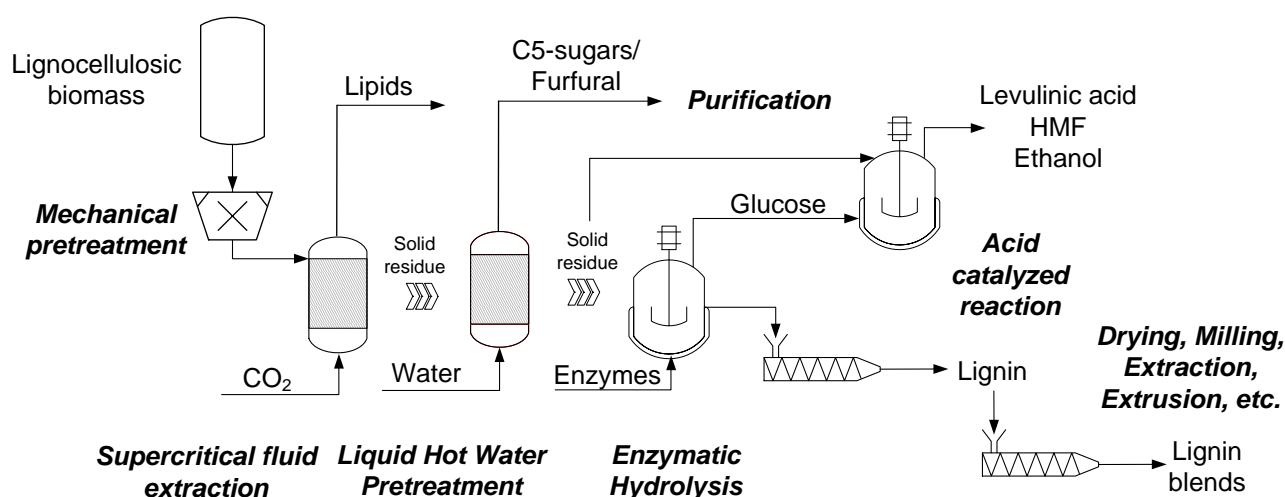


Figure 1 : Flow sheet of the High Pressure Biorefinery Process Line at Hamburg University of Technology

Tobacco leaves are a source of the drug nicotine (approx. 3 %). This and the other aforementioned compounds, -whereas all fractions are in a scale of partly far above 5 % -, are of interest for downstream applications in life sciences as well as consumables and fashion industry.

Supercritical Extraction has been investigated and modelled at pressures between 350 and 550 bar, exceeding the state of the art. Nicotine reduction, without the use of co-solvents, was only successful to a residue level of 66 %, whereas ethanol addition as co-solvent lead to a level of 55 %.

Liquid Hot Water Hydrolysis has been investigated in a temperature range between 90 – 140 °C (for protein precipitation), and at 220 °C (for cellulose pre-treatment) , reaction time in both cases was 20 min. Downstream to the hydrolysis, an enzymatic conversion with 2 mg cellulases /g dry mass has been added.

Protein recovery was successful up to a residue level of 75 % , hemicellulose and cellulose removal was nearly complete. Finally, it was possible to achieve a lignin residue with a more than 15fold purity (64 %) compared to the initial substrate input

The experiments were used as proof of principle and may now be implemented for a basic design of an industrial process line.