OR09

Experimental and Economical Case Study: Competitive Lignin Biorefinery by Combining High Pressure Hydrolysis and Extraction

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2nd Generation Biorefinery aims for the whole use of Lignocellulose with its main compounds cellulose, hemicellulose and lignin. Focus is based on lignin, with a large application potential as adhesives additive, adsorber, thermal insulant and polymer for molding processes. Byproducts of interest are phenolic compounds like vanillin and syringic acid. Byproducts of C5 and C6 sugars are Bio-ethanol and building blocks like HMF, Furfural, Xylitol and acids.

The proposed technology is a flow through fixed bed reactor using environmental sound, but compressed reacting partners like hot pressurized water, the fermentation gas carbon dioxide and enzymes. It has been shown that this combination of the high pressure techniques “Hydrolysis” and “Extraction” allows a complete selective product cascade, starting from the isolation of low polar compounds, up to the chemically non-modified and original Lignin. Within this sequence, the residues of one fraction – at lower pressure and temperature- will be used as substrate for the next separation step, hereby applying increased pressure and temperature.

The German research cluster “*Biorefinery 2021*”, consisting of universities, SME and international Industrial Companies has experimentally and theoretically validated this approach in a large number of case studies (resources from biogas digestate, wheat straw, hard- and softwood, vegetable, seed and alimentary side products).

The experimental and theoretical investigation on the economic perspectives and competivity has proven the industrial feasibility of the scenario, which consists of a mechanical pretreatment (particle size reduction, pelletization), thermal and biochemical conversion (hot water and enzymatic hydrolysis, optionally biogas pretreatment), thermal and mechanical subtreatment (decanting, supercritical extraction, spray drying and/or fine milling), as well as molding, extrusion and/or cross linking processes, by applying high pressure resp. unit operations. Experiments on biomass conversions have been performed by using fixed bed autoclaves in 100 mL, 3L and 40 L volume.

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