Furfural manufacture and valorisation – recent developments and economic potential

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In its effort to mitigate climate change, the industry must develop new routes to produce 'low-carbon' fuels and chemicals from biomass. The preferred feedstock is arguably lignocellulose that can be produced sustainably, in large amount and at low price. To be affordable, these routes must valorise all biomass constituents. This includes the ~20 w% xylose that is present in the hemic cellulose of hard wood and grasses. One of its most promising derivatives is Furfural, which can further lead to a variety of fuels and chemicals.

This lecture will present some of the furfural manufacturing routes that we have been exploring at Shell and the university of Twente. Particular attention will be devoted to integrating biomass fractionation with xylose dehydration, e.g. using optimised biphasic medium, microwave and a yet-undisclosed breakthrough concept.

Preliminary economic considerations will then be applied to compare these various routes and to analyse the subsequent upgrading of furfural to selected fuels and chemicals.

Further reading

1. J.-P. Lange, *Lignocellulose conversion: an introduction to chemistry, process and economics,* Biofuels Bioprod. Bioref., **2007**, 1, 39-48
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3. J.-P. Lange; *Catalysis for biorefineries – performance criteria for industrial operation,* Catal. Sci. Technol., **2016**, 6, 4759 – 4767
4. L. Ricciardi, W. Verboom, J.-P. Lange, J. Huskens; *Local overheating Explains the Rate Enhancement of Xylose Dehydration under Microwave Heating*, ACS Sust. Chem. & Eng. 2019, 7, 14273-14279
5. J.-P. Lange; *Performance metrics for sustainable catalysis in industry,* Nature Catal. **2021**, 4, 186–192
6. L. Ricciardi, W. Verboom, J.-P. Lange, J. Huskens; *Selectivity switch by phase switch - The key to a high-yield furfural process*, submitted **2021**