Furfural manufacture at high yield

J.-P. Lange
Shell Global Solutions International B.V., Amsterdam, The Netherlands
Sustainable Process Technology, University of Twente, Enschede, The Netherlands
e-mail: jean-paul.lange@shell.com

To mitigate climate change, the industry must develop new routes to produce fuels and chemicals based on renewable carbon resources. Some of those routes include furfural as platform molecule to valorize the ~20 wt% xylose present in the hemicellulose of hard wood and grasses. However, Furfural production processes presently achieve low yield of valuable products (10-15 wt% on biomass intake, mainly furfural) and burn the rest of the feed to power the process. This lecture will present a few novel routes that promise high biomass utilisation by extracting the xylose from the biomass for furfural manufacture, and leaving the rest undeteriorated for alternative valorisation options.

A first approach integrates biomass fractionation with xylose extractive dehydration by (i) using a high-boiling aromatic solvent to extract furfural and (ii) returning the acidic aqueous phase to the fractionation step. It thereby achieves a furfural yield of 70 mol% (based on xylose).

A second approach selectively extracts the dilute xylose as boronate ester and, subsequently, dehydrates it to furfural either in a water-organic homogeneous phase or under biphasic saline conditions [1,2]. These processes achieve 90% furfural yield (based on xylose) and are designed for efficient recycling of all components, i.e. the boronic acids, the organic solvents and/or the saline solution.

References

1. L. Ricciardi, W. Verboom, J.-P. Lange, J. Huskens; Green Chemistry **2021**, 23, 8079 – 8088
2. L. Ricciardi, W. Verboom, J.-P. Lange, J. Huskens; ACS Sustainable Chem. Eng. **2022** 10, 3595-3603