CATALYTIC REDUCTIVE FRACTIONATION: EFFECTS OF ACIDIC AND ALKALINE ADDITIVES

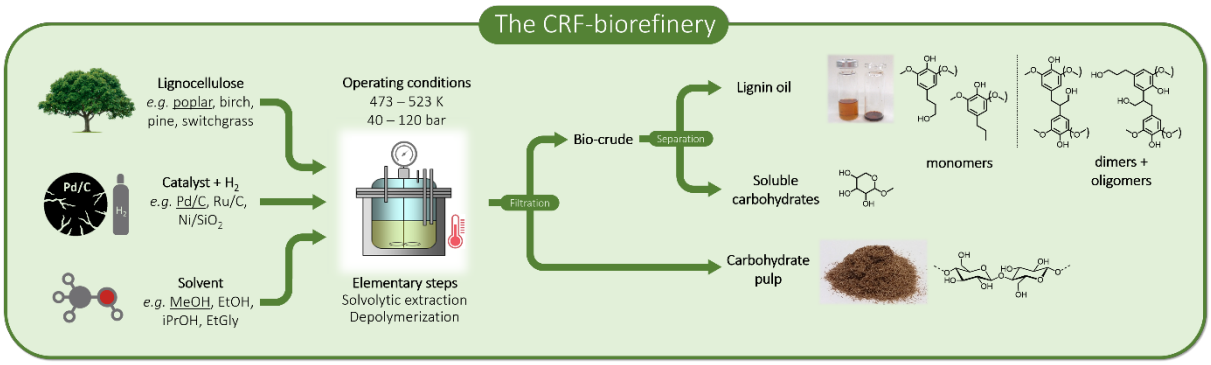
Tom Renders,[a] Wouter Schutyser, [a,b] Sander Van den Bosch, [a] Stef Koelewijn, [a] Bert F. Sels [a]

[a] Centre for Surface Chemistry and Catalysis, KULeuven, Celestijnenlaan 200F, 3001 Leuven, Belgium

[b] National Bioenergy Center, National Renewable Energy Laboratory, Golden, Colorado 80401, United States

Catalytic reductive lignocellulose processing encompasses a “lignin first” biorefinery strategy that enables the fractionation of lignocellulose biomass into a carbohydrate-rich pulp and a stable lignin oil consisting of mono-, di-, and oligomers.[1,2] In this contribution, we show the different influence of acidic (H_3PO_4) and alkaline (NaOH) additives on the Pd/C-catalyzed reductive processing of poplar wood in methanol (MeOH).[2] It was demonstrated that the addition of small quantities of H_3PO_4 assists the removal of lignin from the biomass, making it possible to operate the CRF process under milder operating conditions (T and P), advantageous from an industrial point of view. Furthermore, the acidic conditions also promote the selective and simultaneous removal of hemicellulose from the pulp, leaving behind a more pure cellulosic pulp. This acid-catalyzed fractionation of the carbohydrates into separate cellulose and hemicellulose streams provides opportunities for more efficient downstream conversion, as processing parameters can be tailored to the needs of both streams.

On the other hand, alkaline conditions (NaOH) also enhance the delignification process, but additionally cause (i) the formation of lignin products other than those obtained under neutral and acidic conditions, (ii) a hampered degree of lignin depolymerization, and (iii) substantial loss of cellulose from the pulp. Based on these observations, the implementation of alkaline additives (NaOH) is less favorable compared to acidic additives (H_3PO_4).



References

(1) Van den Bosch, S., Schutyser, W., Renders, T., Sels, B. F., *et al*., *Energy Environ. Sci.* 2015, 8 (6), 1748-1763.;

(2) Renders, T., Schutyser, W., Van den Bosch, S., Sels, B. F., *et al*., *ACS Catal.* 2016, 6 (3), 2055-2066.