Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.
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Electronic Supplementary Information

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TITLE: Hydrolysis of Anhydrosugars Derived from Pyrolysis of Lignocellulosic Biomass for Integration in a Biorefinery

1. Design of experiments for optimization of hydrolysis

A matrix of coded factors was used for design of experiments in the study of optimization of hydrolysis. This is presented in Table S1 below. The same design of experiments table was implemented in case of hydrolysis of pure levoglucosan as well as of sugar fraction of SF1 bio-oil heavy ends. In this work, JMP Pro 16 statistical software used for making the below DOE table.

Table S1. Coded Factors Matrix for the Design of Experiments

Experiment	Reaction temperature (°C)	Reaction time (h)	Catalyst concentration (mM)
1	-1	-1	-1
2	-1	-1	0
3	-1	-1	1
4	0	-1	-1
5	0	-1	0
6	0	-1	1
7	1	-1	-1
8	1	-1	0
9	1	-1	1
10	-1	0	-1
11	-1	0	0
12	-1	0	1
13	0	0	-1
14	0	0	0
15	0	0	1
16	1	0	-1
17	1	0	0
18	1	0	1
19	-1	1	-1
20	-1	1	0
21	-1	1	1
22	0	1	-1
23	0	1	0
24	0	1	1
25	1	1	-1
26	1	1	0
27	1	1	1

For hydrolysis test, the independent key variables were X_1, X_2, and X_3 representing reaction temperature in °C, reaction time in hours and acid catalyst concentration in mM, respectively. Each variable was coded at three levels (-1, 0, 1) where these values were obtained according to Eq. (1) below.

$$CV = \frac{AV - M}{HR} \quad (1)$$

Where CV is coded value, AV is the actual value, M is the mean and HR is the half range. Here, the mean (M) values for temperature, reaction time and acid concentration were 105°C, 2 h, and 100 mM, respectively.