Supporting Information

Hydrothermal Conversion of Spent Sugar Beets into High-Value Platform Molecules

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Abstract: The growing importance of bio-based products, combined with the desire to decrease the production of wastes, boosts the necessity to use wastes as raw materials for bio-based products. A waste material with a large potential is spent sugar beets, which are mainly used as animal feeds or fertilizers. After hydrothermal treatment, the produced chars exhibited an H/C ratio of 1.2 and a higher heating value of 22.7 MJ/kg, which were similar to that of subbituminous coal and higher than that of lignite. Moreover, the treatment of 25 g/L of glucose and 22 g/L of fructose by heating up to 160 °C led to a possible application of spent sugar beets for the production of 5-hydroxymethylfurfural. In the present study, the maximum concentration of 5-hydroxymethylfurfural was 3.4 g/L after heating up to 200 °C.

Keywords: agro-residues; sugar beets; biomass; hydrothermal carbonization; hydrolysis; sugars; HMF; hydrochar; biorefinery

Table S1: Concentration of the sugars in the process liquid, pH and dissolved organic carbon (DOC) after HT; the error is estimated to be 0.05 [g/L] due to dilution errors and the high concentrations.

Sample	Glucose [g/L]	Fructose [g/L]	Sucrose [g/L]	pH	DOC [$^{0}/_{00}$]
Raw	0.2	0.4	3.3	5.98	18.7
L_160_0	25.2	22.5	0	3.94	67.2
L_160_0.5	17.3	14.3	0.2	3.81	59.3
L_160_1	15.0	13.3	0.2	3.72	54.7
L_200_0	2.5	5.4	0.2	3.46	46.7
L_200_0.5	2.9	1.4	0.1	3.55	42.0
L_200_1	1.8	1.1	0.1	3.73	37.0

Table S2: Concentration of the acids, HMF and Furfural in the process liquid after HT; the error is estimated to be 0.05 [g/L] due to dilution errors and the high concentrations.

Sample	Levulinic Acid [g/L]	Acetic Acid [g/L]	HMF [g/L]	Furfural [g/L]
Raw	0	3	0	0
L_160_0	0.5	0.4	0.6	0
L_160_0.5	0.6	0.5	1.6	0.1
L_160_1	1.3	0.1	2.5	0.2
L_200_0	3.3	1.4	3.4	0.3
L_200_0.5	3.5	1.7	2.4	0.1
L_200_1	2.8	1.7	0.9	0

Table S3: O/C and H/C atomic ratios of the hydrochars and raw material.

Sample	O/C	H/C
Raw	0.8	1.8
S_160_0	0.7	1.5
S_160_0.5	0.6	1.5
S_160_1	0.5	1.3
S_200_0	0.4	1.2
S_200_0.5	0.4	1.2
S_200_1	0.4	1.2