ELECTRONIC SUPPORTING INFORMATION

Vapor-phase assisted hydrothermal carbon from sucrose and its application in acid catalysis

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Table S1. Elemental and surface compositions of hydrothermal and sulfonated carbons.

Sample	Elemental composition					Surface composition		
	C (wt.%)	H (wt.%)	O (wt.)	H/C (at.)	O/C (at.)	C (at.%)	O (at.%)	O/C (at.)
Sucrose HT	69.1	5.2	25.4	0.899	0.275	78.8	21.2	0.269
Sucrose in H_2O HT	66.2	5.0	28.7	0.907	0.326	79.7	20.3	0.254
Sucrose HT SO_3H	54.1	3.0	41.1	0.672	0.570	72.6	27.1	0.374
Sucrose in H_2O HT SO_3H	51.9	3.1	43.6	0.726	0.631	73.0	26.8	0.367

Table S2. The yield of FMBM and conversion of furfural at 24 h for control experiments.

Catalyst	Yield of FMBM at 24 h (%)	Conversion of furfural at 24 h (%)
Blank	0.0	1.8
Sucrose HT	0.4	2.1
Sucrose in H_2O *HT*	0.2	1.7

A significant conversion should be measured in presence of the sulfonate-free carbon material in case the internal standard (naphthalene) strongly adsorbs on the carbon material. The data shows for both non-sulfonated carbon samples that the yield of FMBM is close to zero and the conversion of furfural is very low and similar to that of the reaction without solid carbon. These results therefore exclude the preferential adsorption of internal standard naphthalene over the other chemicals in the reaction system.

TGA FOR DRYING AT 100 °C OVERNIGHT

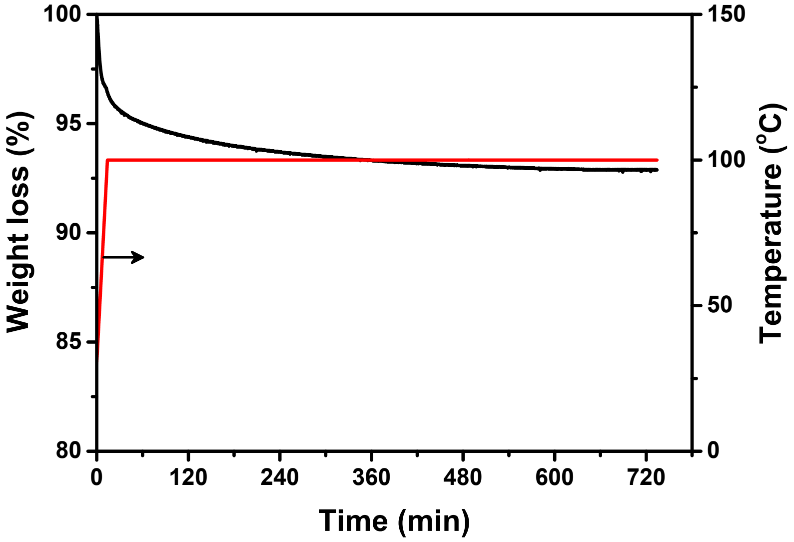

Figure S1. Weight loss of *Sucrose in H_2O HT* in air during the temperature program (red line).

The weight loss curve comes to a plateau after about 10 h, with 7.2 wt% loss of H_2O, which corresponds well with the weight loss around 150 °C during TGA measurement (5 °C min^{-1} from room temperature to 800 °C in O_2). This result confirms that drying 100 °C overnight in air is sufficient for the hydrothermal carbon to remove H_2O.

FTIR

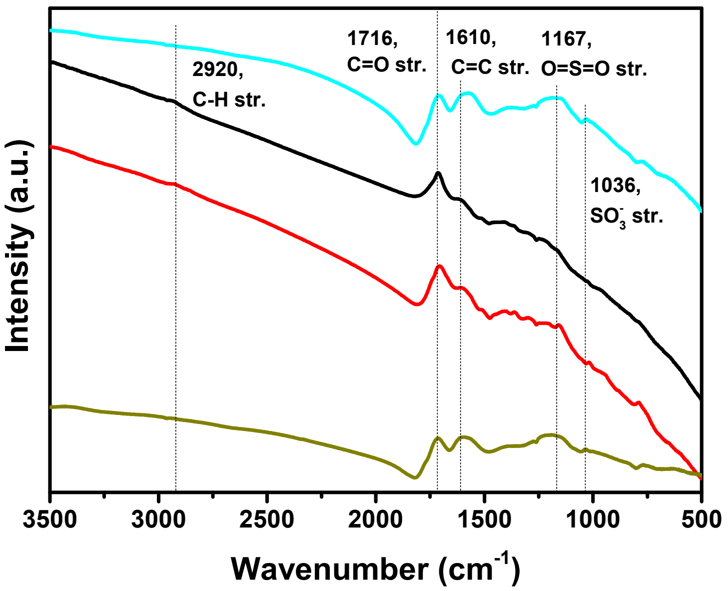

Figure S2. FTIR spectra of *Sucrose HT* (black), *Sucrose in* H_2O *HT* (red), *Sucrose HT* SO_3H (dark yellow) and *Sucrose in* H_2O *HT* SO_3H (cyan).

RAMAN

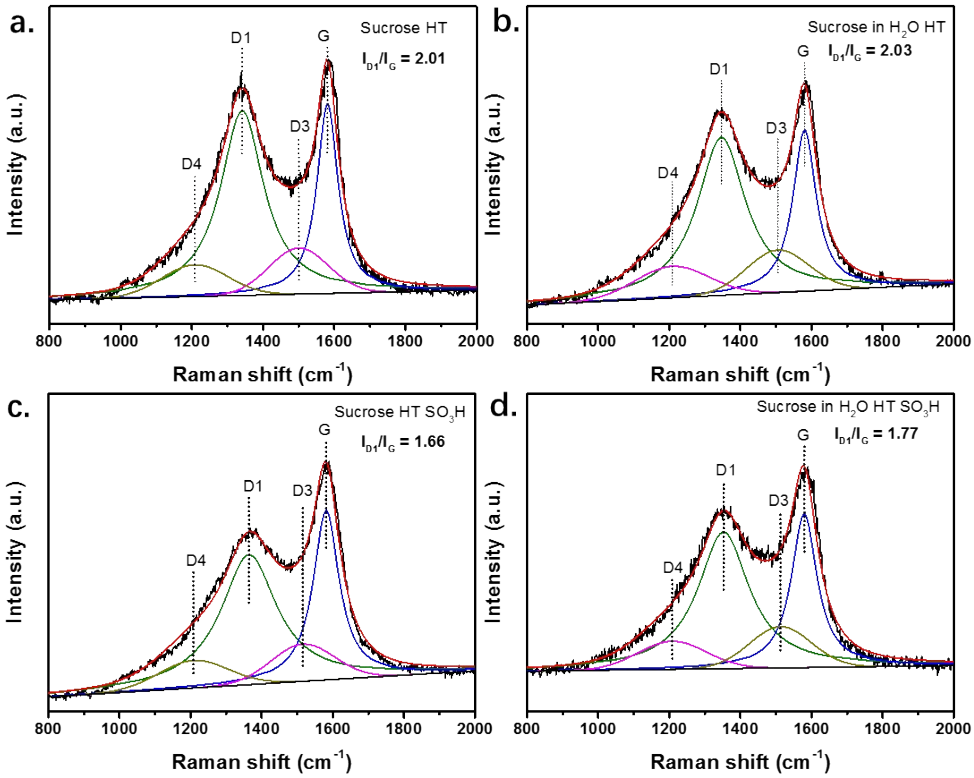

Figure S3. Raman spectra of (a) *Sucrose HT*, (b) *Sucrose in* H_2O *HT*, (c) *Sucrose HT* SO_3H and (d) *Sucrose in* H_2O *HT* SO_3H.

XPS

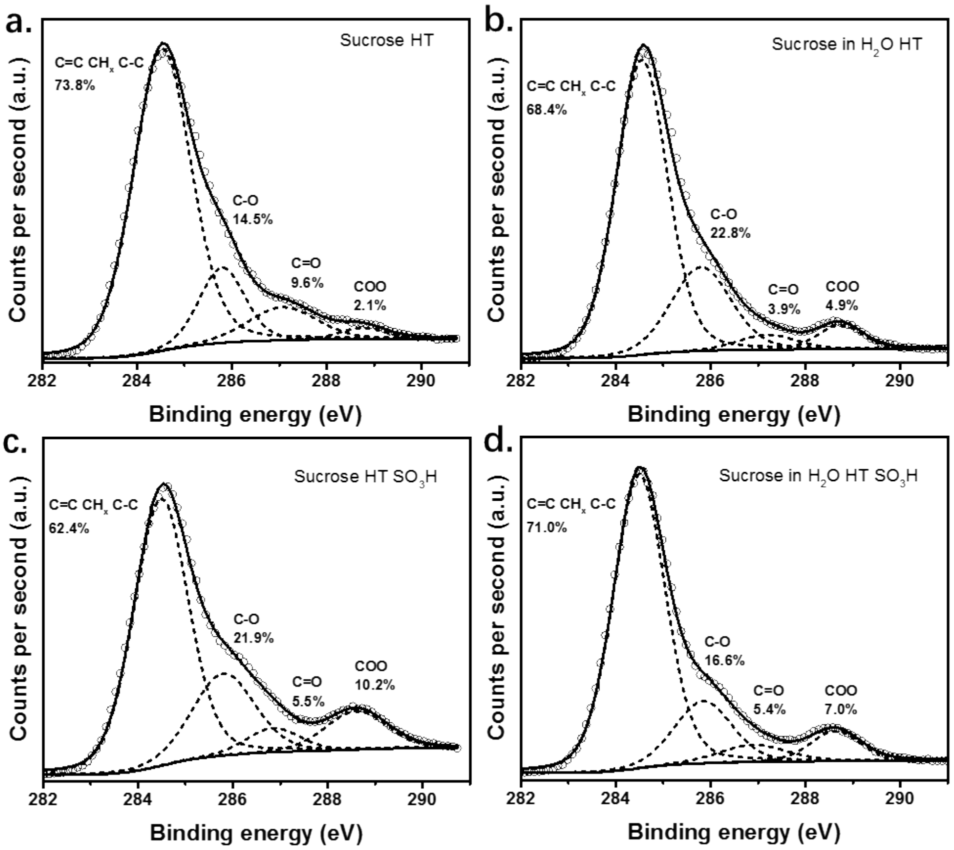

Figure S4. C 1s core-level spectra of (a) *Sucrose HT*, (b) *Sucrose in H_2O HT*, (c) *Sucrose HT SO_3H* and (d) *Sucrose in H_2O HT SO_3H*. The numbers are the area percentages of deconvoluted individual peaks in the overall peak area.

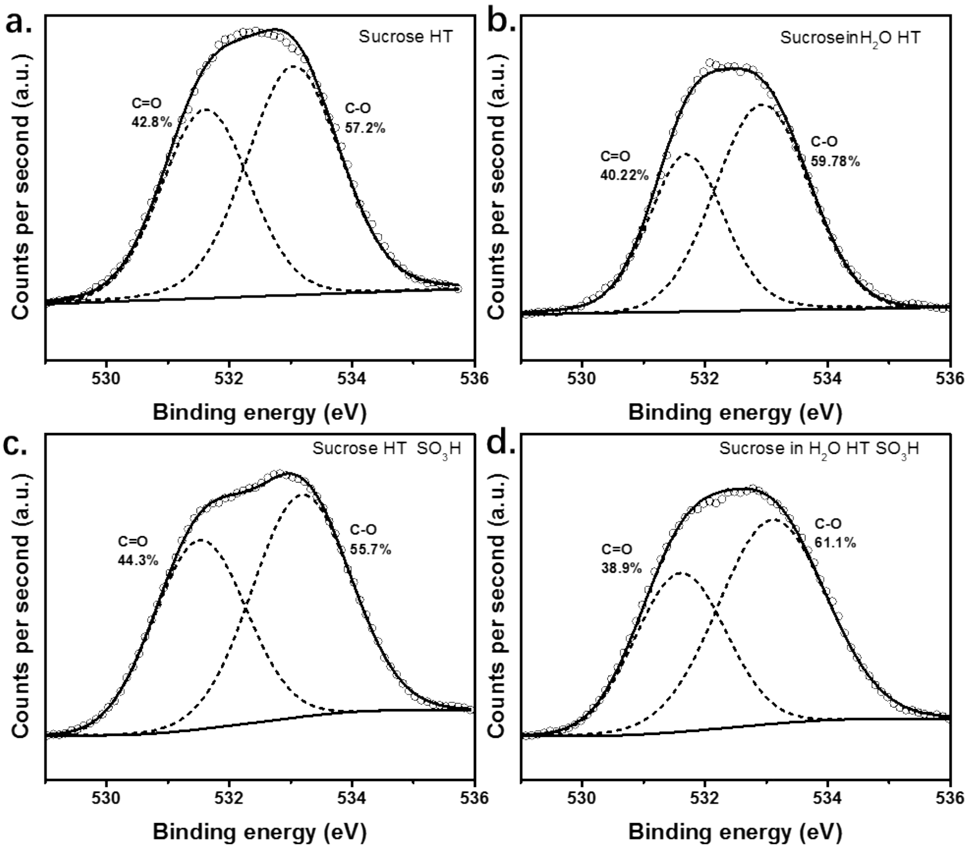

Figure S5. O 1s core-level spectra of (a) *Sucrose HT*, (b) *Sucrose in H_2O HT*, (c) *Sucrose HT SO_3H* and (d) *Sucrose in H_2O HT SO_3H*. The numbers are the area percentages of deconvoluted individual peaks in the overall peak area.

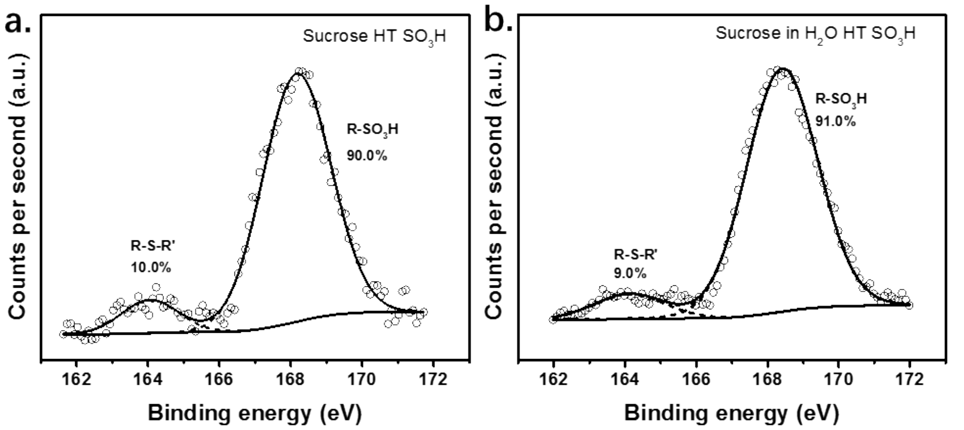

Figure S6. S 2p core-level spectra of (a) *Sucrose HT SO_3H* and (b) *Sucrose in H_2O HT SO_3H*. The numbers are the area percentages of deconvoluted individual peaks in the overall peak area.

NMR

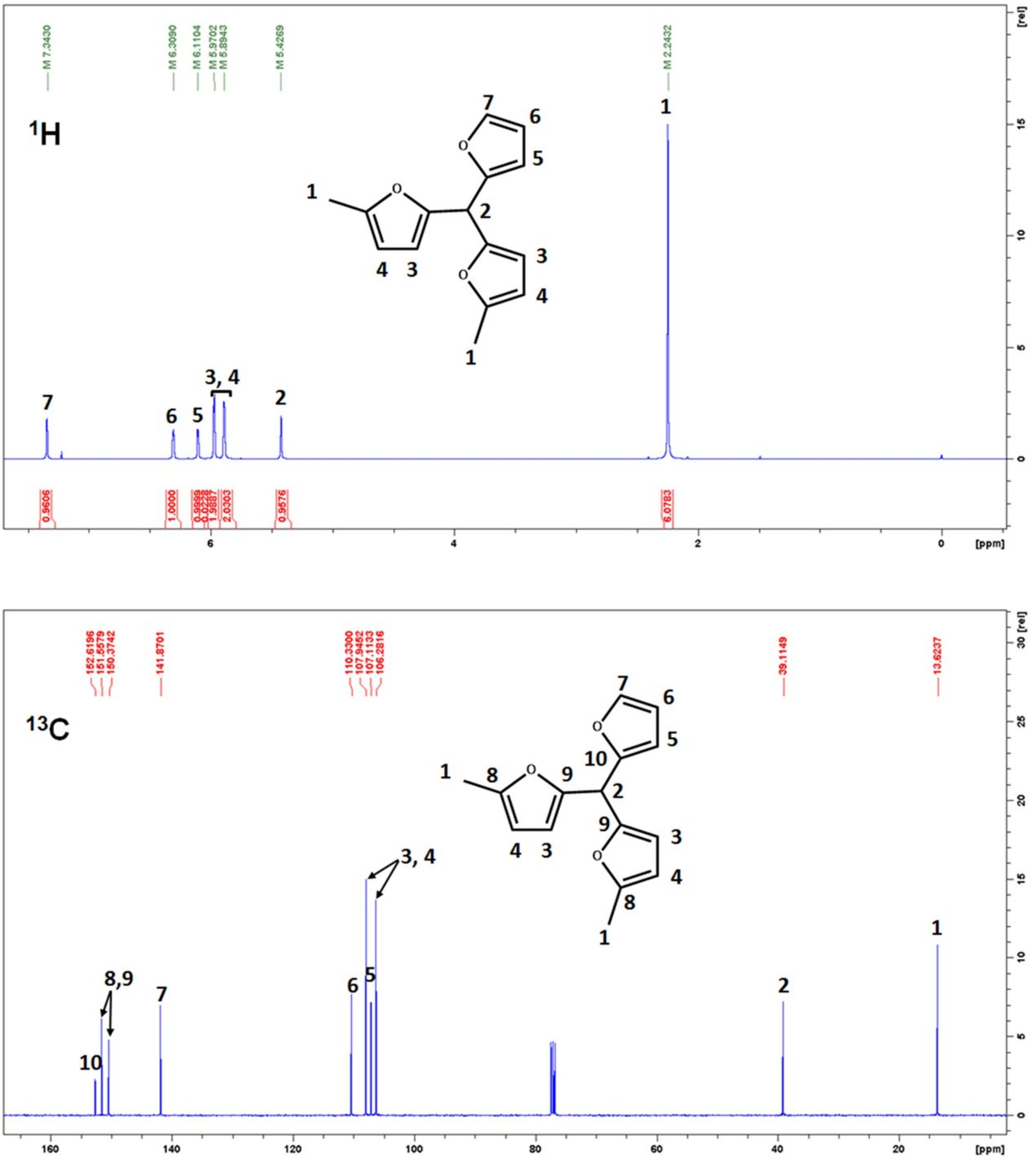

Figure S7. ^{1}H and ^{13}C NMR spectra of the product of 2-methylfuran condensation with furfural over Amberlyst 15 (dry form) at 50 °C for 24 h, after evaporating the lights (mainly unreacted reagents) with a rotary evaporator under 35 mbar at 65 °C to remove the excess 2-methyl furan and formed H_2O.