Supplementary Information

Hydrothermal carbonization of cane molasses as a waste-valorization route: product recovery, structure, and the limits of adsorption assessment

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The values below are derived from absorbances that, for most points, lie above the absorbance range of the calibration standards (0.044–0.171; Section 3.6 and Fig. 6 of the main text). They are listed for completeness and are not validated concentrations, removals, or capacities. Concentrations follow from the calibration $A = 0.0319C + 0.0119$ (standards 1–5 mg L^{-1}); removal and q refer to the nominal initial concentration. Tables S1 and S2 are set in landscape on the following pages.

Table S1: Contact-time series: 0.1 g adsorbent, 500 mL, nominal C_0 20 mg L^{-1}, 250 rpm. Duplicate means ± SD ($n = 2$).

Adsorbent	Time (min)	A_{450}	Nominal C (mg L^{-1})	Nominal removal (%)	Nominal q (mg g^{-1})
MH10-400	5	0.455 ± 0.042	13.87 ± 1.31	30.6 ± 6.5	30.56 ± 6.44
MH10-400	10	0.415 ± 0.015	12.65 ± 0.47	36.7 ± 2.3	36.66 ± 2.22
MH10-400	15	0.391 ± 0.023	11.88 ± 0.71	40.6 ± 3.5	40.49 ± 3.43
MH10-400	30	0.422 ± 0.025	12.87 ± 0.78	35.6 ± 3.9	35.57 ± 3.77
MH10-400	45	0.420 ± 0.010	12.79 ± 0.31	36.0 ± 1.6	35.96 ± 1.45
MH10-400	60	0.424 ± 0.043	12.93 ± 1.35	35.3 ± 6.8	35.25 ± 6.65
MH10-400	75	0.406 ± 0.019	12.37 ± 0.60	38.2 ± 3.0	38.07 ± 2.88
MH10-400	90	0.410 ± 0.059	12.50 ± 1.84	37.5 ± 9.2	37.44 ± 9.08
MH10-400	120	0.423 ± 0.007	12.89 ± 0.22	35.6 ± 1.1	35.49 ± 1.21
MH10-400	150	0.415 ± 0.004	12.65 ± 0.11	36.7 ± 0.6	36.67 ± 0.66
MH10-400	180	0.444 ± 0.054	13.55 ± 1.68	32.3 ± 8.4	32.20 ± 8.32
MH15-400	5	0.456 ± 0.033	13.92 ± 1.02	30.4 ± 5.1	30.30 ± 5.08
MH15-400	10	0.471 ± 0.049	14.39 ± 1.55	28.0 ± 7.8	27.96 ± 7.74
MH15-400	15	0.455 ± 0.018	13.89 ± 0.58	30.5 ± 2.9	30.46 ± 2.87
MH15-400	30	0.442 ± 0.003	13.48 ± 0.09	32.6 ± 0.4	32.49 ± 0.44
MH15-400	45	0.441 ± 0.012	13.44 ± 0.38	32.8 ± 1.9	32.72 ± 1.88
MH15-400	60	0.434 ± 0.013	13.25 ± 0.42	33.8 ± 2.1	33.66 ± 2.10
MH15-400	75	0.432 ± 0.016	13.18 ± 0.51	34.1 ± 2.5	33.97 ± 2.54
MH15-400	90	0.465 ± 0.041	14.20 ± 1.29	29.0 ± 6.4	28.89 ± 6.41
MH15-400	120	0.419 ± 0.017	12.76 ± 0.53	36.2 ± 2.7	36.08 ± 2.65
MH15-400	150	0.438 ± 0.054	13.36 ± 1.68	33.2 ± 8.4	33.11 ± 8.40
MH15-400	180	0.422 ± 0.028	12.87 ± 0.86	35.6 ± 4.3	35.54 ± 4.31
MH20-400	5	0.466 ± 0.060	14.22 ± 1.88	28.9 ± 9.4	28.85 ± 9.40
MH20-400	10	0.451 ± 0.022	13.75 ± 0.69	31.3 ± 3.4	31.19 ± 3.43
MH20-400	15	0.435 ± 0.003	13.26 ± 0.09	33.7 ± 0.4	33.62 ± 0.44
MH20-400	30	0.449 ± 0.006	13.70 ± 0.18	31.5 ± 0.9	31.43 ± 0.88
MH20-400	45	0.420 ± 0.001	12.79 ± 0.04	36.0 ± 0.2	35.96 ± 0.22
MH20-400	60	0.462 ± 0.006	14.11 ± 0.18	29.5 ± 0.9	29.39 ± 0.88
MH20-400	75	0.412 ± 0.078	12.54 ± 2.44	37.3 ± 12.2	37.21 ± 12.17
MH20-400	90	0.433 ± 0.071	13.20 ± 2.22	34.0 ± 11.1	33.93 ± 11.06
MH20-400	120	0.414 ± 0.013	12.62 ± 0.42	36.9 ± 2.1	36.82 ± 2.10
MH20-400	150	0.425 ± 0.000	12.95 ± 0.00	35.3 ± 0.0	35.18 ± 0.00
MH20-400	180	0.415 ± 0.017	12.64 ± 0.53	36.8 ± 2.7	36.74 ± 2.65

Table S2: Initial-concentration series: 0.1 g adsorbent, 100 mL, 60 min, 250 rpm. Duplicate means ± SD ($n = 2$).

Adsorbent	Nominal C_0 (mg L^{-1})	A_{450}	Nominal C (mg L^{-1})	Nominal removal (%)	Nominal q (mg g^{-1})
MH10-400	5	0.123 ± 0.013	3.50 ± 0.42	30.0 ± 8.4	1.50 ± 0.42
MH10-400	10	0.231 ± 0.008	6.88 ± 0.24	31.2 ± 2.4	3.11 ± 0.25
MH10-400	20	0.401 ± 0.025	12.20 ± 0.80	39.0 ± 4.0	7.79 ± 0.80
MH10-400	30	0.538 ± 0.004	16.51 ± 0.11	45.0 ± 0.4	13.45 ± 0.15
MH10-400	40	0.521 ± 0.064	15.97 ± 2.02	60.1 ± 5.0	23.97 ± 2.06
MH10-400	50	0.494 ± 0.001	15.11 ± 0.04	69.8 ± 0.1	34.71 ± 0.00
MH10-400	80	0.716 ± 0.033	22.07 ± 1.02	72.4 ± 1.3	57.67 ± 0.97
MH15-400	5	0.129 ± 0.006	3.66 ± 0.20	26.9 ± 4.0	1.34 ± 0.20
MH15-400	10	0.269 ± 0.000	8.06 ± 0.00	19.4 ± 0.0	1.94 ± 0.00
MH15-400	20	0.440 ± 0.019	13.40 ± 0.60	33.0 ± 3.0	6.59 ± 0.59
MH15-400	30	0.445 ± 0.129	13.56 ± 4.06	54.8 ± 13.5	16.38 ± 4.05
MH15-400	40	0.557 ± 0.310	17.10 ± 9.73	57.2 ± 24.3	22.78 ± 9.65
MH15-400	50	0.564 ± 0.069	17.31 ± 2.17	65.4 ± 4.3	32.58 ± 2.14
MH15-400	80	0.653 ± 0.057	20.10 ± 1.77	74.9 ± 2.2	59.63 ± 1.72
MH20-400	5	0.126 ± 0.011	3.56 ± 0.33	28.8 ± 6.6	1.43 ± 0.33
MH20-400	10	0.270 ± 0.016	8.11 ± 0.51	18.9 ± 5.1	1.89 ± 0.51
MH20-400	20	0.425 ± 0.011	12.97 ± 0.33	35.2 ± 1.7	7.01 ± 0.34
MH20-400	30	0.542 ± 0.069	16.62 ± 2.17	44.6 ± 7.2	13.32 ± 2.15
MH20-400	40	0.582 ± 0.110	17.86 ± 3.44	55.4 ± 8.6	22.09 ± 3.38
MH20-400	50	0.402 ± 0.012	12.24 ± 0.38	75.5 ± 0.8	37.59 ± 0.40
MH20-400	80	0.662 ± 0.101	20.39 ± 3.17	74.5 ± 4.0	59.49 ± 3.33