

Table S1 Elemental analysis and aqueous phase product TC analysis results for SS and pretreated SS hydrochars (average value ± standard deviation)

Sample name	EA results of hydrochars (wt.%)					H/C	N/C	O/C	HHV (MJ/kg)	ER (%)	η_N (%)	Yield (wt.%)	C in liquid (g/L)			N in liquid (g/L)		
	C	H	N	S	O								TOC	TIC	TC	NH ₄ ⁺	NO ₃ ⁻	DON
SS -150	19.30±0.24	3.01±0.04	2.68±0.08	0.52±0.02	20.07±0.20	1.87	0.12	0.78	7.26	64.90	28.72	83.74±0.23	8.72±0.12	1.54±0.02	10.26±0.12	0.26±0.02	0.23±0.02	0.66±0.06
SS -180	17.70±0.22	2.39±0.01	2.09±0.02	0.32±0.02	17.63±0.17	1.62	0.10	0.75	6.30	52.00	44.41	77.29±0.13	7.84±0.07	2.85±0.02	10.69±0.14	1.36±0.06	0.3±0.02	0.46±0.03
SS -210	17.60±0.17	2.41±0.02	1.73±0.06	0.49±0.01	15.81±0.22	1.65	0.08	0.67	6.64	52.40	53.99	73.91±0.15	7.33±0.08	2.96±0.05	10.29±0.12	1.38±0.07	0.08±0.01	1.14±0.06
SS -240	17.37±0.18	2.33±0.06	1.60±0.03	0.47±0.02	14.75±0.24	1.61	0.08	0.64	6.63	47.14	57.45	66.66±0.18	11.25±0.11	1.55±0.03	12.80±0.09	0.99±0.05	0.14±0.02	0.91±0.04
SS -270	15.88±0.17	2.04±0.02	1.29±0.01	0.34±0.01	14.03±0.18	1.54	0.07	0.66	5.87	44.44	65.69	70.89±0.18	11.98±0.10	1.44±0.01	13.41±0.15	0.62±0.05	0.22±0.02	0.63±0.06
SDSA-150	18.08±0.21	2.92±0.03	2.05±0.03	0.35±0.01	18.08±0.26	1.94	0.10	0.75	8.11	78.24	18.33	88.64±0.20	4.48±0.03	2.45±0.03	6.93±0.06	0.28±0.03	0.15±0.02	0.38±0.02
SDSA-180	16.86±0.24	2.10±0.02	1.38±0.01	0.51±0.02	15.45±0.20	1.49	0.07	0.69	7.17	66.28	45.02	84.93±0.15	7.47±0.07	1.68±0.05	9.15±0.09	0.55±0.04	0.28±0.03	0.36±0.02
SDSA-210	16.37±0.12	1.98±0.06	1.09±0.06	0.48±0.02	13.89±0.22	1.45	0.06	0.64	6.90	59.40	56.57	79.05±0.17	8.33±0.11	1.64±0.03	9.97±0.11	0.67±0.04	0.11±0.02	0.48±0.03
SDSA-240	15.89±0.15	1.93±0.02	0.96±0.04	0.28±0.01	12.49±0.12	1.46	0.05	0.59	7.03	67.21	61.75	87.80±0.13	6.32±0.08	1.98±0.02	8.30±0.10	0.72±0.06	0.02±0.01	0.64±0.05
SDSA-270	15.63±0.11	1.79±0.03	0.86±0.03	0.26±0.01	11.80±0.17	1.37	0.05	0.57	6.68	54.94	65.74	75.51±0.15	5.08±0.03	1.68±0.01	6.76±0.07	1.05±0.06	0.06±0.01	0.36±0.02
UA-150	9.86±0.14	1.62±0.02	0.90±0.03	0.22±0.01	12.77±0.15	1.97	0.08	0.97	3.51	86.77	21.74	95.01±0.23	2.17±0.05	1.56±0.01	3.73±0.03	0.37±0.03	0.32±0.04	0.08±0.01
UA-180	9.74±0.12	1.49±0.01	0.75±0.04	0.27±0.01	11.75±0.24	1.83	0.07	0.91	3.46	80.34	34.78	89.29±0.20	6.44±0.03	1.39±0.03	7.83±0.07	0.52±0.06	0.08±0.01	0.1±0.01
UA-210	8.63±0.24	1.21±0.01	0.59±0.06	0.22±0.01	10.43±0.17	1.69	0.06	0.91	2.93	70.76	48.70	93.02±0.15	6.36±0.09	1.42±0.02	7.79±0.07	0.51±0.04	0.25±0.02	0.22±0.02
UA-240	8.93±0.15	1.22±0.06	0.56±0.04	0.16±0.01	8.92±0.16	1.64	0.05	0.75	3.27	74.80	51.30	87.90±0.25	5.49±0.07	1.61±0.02	7.10±0.09	0.57±0.06	0.05±0.01	0.27±0.02
UA-270	7.83±0.14	1.06±0.01	0.46±0.01	0.15±0.01	8.23±0.11	1.63	0.05	0.79	2.80	66.33	60.00	91.08±0.22	5.33±0.12	1.72±0.03	7.05±0.12	0.89±0.06	0.2±0.03	0.31±0.04
SDSU-150	12.73±0.11	2.03±0.04	1.17±0.04	0.37±0.01	12.94±0.24	1.91	0.08	0.76	4.99	89.86	19.86	97.19±0.26	4.42±0.03	1.64±0.01	6.06±0.05	0.14±0.02	0.23±0.03	0.11±0.02
SDSU-180	10.81±0.17	1.54±0.01	0.77±0.06	0.27±0.01	10.99±0.17	1.71	0.06	0.76	4.01	68.54	47.26	92.33±0.25	5.84±0.05	1.42±0.01	7.26±0.07	0.34±0.03	0.04±0.01	0.49±0.04
SDSU-210	12.07±0.24	1.66±0.01	0.76±0.01	0.25±0.01	10.25±0.24	1.65	0.05	0.64	4.72	78.18	47.95	89.38±0.23	6.30±0.07	1.61±0.03	7.91±0.05	0.38±0.03	0.1±0.02	0.49±0.04
SDSU-240	9.75±0.15	1.27±0.01	0.62±0.02	0.21±0.01	9.29±0.16	1.57	0.05	0.71	3.56	61.71	57.53	93.57±0.23	6.42±0.07	1.73±0.03	8.15±0.10	0.65±0.06	0.15±0.02	0.2±0.03
SDSU-270	9.46±0.14	1.18±0.01	0.57±0.02	0.27±0.01	8.71±0.11	1.50	0.05	0.69	3.42	55.55	60.96	87.56±0.14	5.11±0.05	1.93±0.05	7.04±0.09	0.97±0.06	0.32±0.03	0.12±0.02

Table S2 Final analysis of hydrochars (average value ± standard deviation)

Sample name	Proximate analysis (wt%)		
	Ash	VM	FC
SS	48.84±0.21	46.59±0.13	4.57±0.02
SS-150	50.52±0.13	43.65±0.17	5.83±0.04
SS-180	50.89±0.15	42.19±0.23	6.92±0.03
SS-210	51.53±0.14	40.65±0.22	7.82±0.06
SS-240	55.32±0.17	36.95±0.15	7.73±0.06
SS-270	58.58±0.14	32.61±0.22	8.81±0.03

Table S3 Elemental analysis and yield results for hydrochars (average value ± standard deviation)

Sample name	EA results of hydrochars (wt.%)					Yield (wt.%)	HHV (MJ/Kg)	η_N (%)
	C	H	N	S	O			
Temperature (°C) (PET loading proportion=20 wt.%, 2 h, water loading amount = 0.6 g/cm ³)								
SP-0.2-180-2-0.6	22.39±0.32	2.21±0.05	0.71±0.03	0.26±0.01	17.43±0.27	82.43±0.38	7.86	64.64
SP-0.2-210-2-0.6	17.86±0.22	1.80±0.02	0.57±0.01	0.17±0.01	16.13±0.23	75.92±0.36	5.97	71.61
SP-0.2-240-2-0.6	19.10±0.37	1.72±0.03	0.51±0.01	0.15±0.01	15.31±0.36	72.38±0.34	6.41	74.60
SP-0.2-270-2-0.6	18.55±0.22	1.90±0.02	0.54±0.02	0.37±0.02	15.58±0.27	71.49±0.41	6.44	73.11
SP-0.2-300-2-0.6	17.78±0.23	1.67±0.05	0.49±0.01	0.19±0.01	14.35±0.36	69.16±0.21	6.05	75.60
Reaction time (h) (PET loading proportion=20 wt.%, 240°C, water loading amount = 0.6 g/cm ³)								
SP-0.2-240-0.5-0.6	17.71±0.22	1.71±0.03	0.53±0.02	0.15±0.01	15.73±0.22	73.74±0.38	5.87	73.61
SP-0.2-240-1-0.6	17.90±0.23	1.71±0.05	0.55±0.01	0.17±0.01	15.50±0.36	75.44±0.18	5.97	72.61
SP-0.2-240-2-0.6	19.10±0.37	1.72±0.03	0.51±0.01	0.15±0.01	15.31±0.36	72.38±0.34	6.41	74.60
SP-0.2-240-3-0.6	18.23±0.22	1.70±0.03	0.62±0.02	0.30±0.02	14.58±0.22	71.89±0.23	6.19	69.12
SP-0.2-240-4-0.6	19.06±0.36	1.85±0.05	0.59±0.01	0.33±0.01	15.04±0.23	70.20±0.36	6.61	70.62
Water loading amount (g/cm ³) (PET loading proportion =20 wt.%, 240°C, 2h)								
SP-0.2-240-2-0.5	19.47±0.36	1.79±0.05	0.66±0.01	0.25±0.01	16.11±0.23	70.87±0.43	6.50	67.13
SP-0.2-240-2-0.6	19.10±0.37	1.72±0.03	0.51±0.01	0.15±0.01	15.31±0.36	72.38±0.34	6.41	74.60
SP-0.2-240-2-0.7	18.43±0.27	1.76±0.06	0.66±0.01	0.24±0.02	15.21±0.22	69.30±0.29	6.25	67.13
SP-0.2-240-2-0.8	18.38±0.33	1.84±0.03	0.57±0.01	0.17±0.01	15.89±0.27	67.30±0.38	6.24	71.61

Table S4 Analytical results of TC, TOC, TIC and PH in liquid phase (average value \pm standard deviation)

Sample name	N/C	H/C	O/C	C in liquid (g/L)			ER (%)	PH in liquid
				TOC	TIC	TC		
SS-240-2-0.6	0.08	1.55	0.57	11.35 \pm 0.22	1.66 \pm 0.02	13.01 \pm 0.12	45.86	5.79 \pm 0.13
PET loading proportion (wt.%) (240°C, 2 h, water loading amount = 0.6 g/cm ³)								
SP-0-240-2-0.6	0.05	1.56	0.60	6.43 \pm 0.09	2.36 \pm 0.07	8.79 \pm 0.21	35.57	6.33 \pm 0.12
SP-0.2-240-2-0.6	0.02	1.08	0.53	3.54 \pm 0.11	11.84 \pm 0.28	15.38 \pm 0.26	48.42	5.06 \pm 0.07
SP-0.5-240-2-0.6	0.01	0.90	0.38	9.56 \pm 0.22	12.47 \pm 0.18	22.03 \pm 0.33	95.55	4.98 \pm 0.05
SP-0.8-240-2-0.6	0.00	0.80	0.37	10.27 \pm 0.18	12.28 \pm 0.17	22.55 \pm 0.20	127.97	4.62 \pm 0.02
SP-1-240-2-0.6	0.00	0.76	0.39	11.36 \pm 0.24	11.76 \pm 0.14	23.12 \pm 0.28	166.54	3.52 \pm 0.04
Temperature (°C) (PET loading proportion=20 wt.%, 2 h, water loading amount = 0.6 g/cm ³)								
SP-0.2-180-2-0.6	0.03	1.18	0.52	2.62 \pm 0.09	10.58 \pm 0.18	13.20 \pm 0.14	67.55	5.54 \pm 0.04
SP-0.2-210-2-0.6	0.03	1.21	0.60	3.41 \pm 0.05	12.12 \pm 0.11	15.53 \pm 0.17	47.30	5.36 \pm 0.04
SP-0.2-240-2-0.6	0.02	1.08	0.53	3.54 \pm 0.11	11.84 \pm 0.28	15.38 \pm 0.26	48.42	5.06 \pm 0.07
SP-0.2-270-2-0.6	0.02	1.23	0.56	4.34 \pm 0.03	12.31 \pm 0.12	16.65 \pm 0.34	47.98	5.22 \pm 0.07
SP-0.2-300-2-0.6	0.02	1.13	0.54	2.42 \pm 0.09	12.41 \pm 0.14	14.84 \pm 0.32	43.65	4.89 \pm 0.02
Reaction time (h) (PET loading proportion=20 wt.%, 240°C, water loading amount = 0.6 g/cm ³)								
SP-0.2-240-0.5-0.6	0.03	1.16	0.59	2.15 \pm 0.03	12.13 \pm 0.14	14.28 \pm 0.17	45.14	5.16 \pm 0.03
SP-0.2-240-1-0.6	0.03	1.15	0.58	1.91 \pm 0.05	12.00 \pm 0.11	13.91 \pm 0.14	46.96	5.12 \pm 0.04
SP-0.2-240-2-0.6	0.02	1.08	0.53	3.54 \pm 0.11	11.84 \pm 0.28	15.38 \pm 0.26	48.42	5.06 \pm 0.07
SP-0.2-240-3-0.6	0.03	1.12	0.53	4.12 \pm 0.09	12.17 \pm 0.18	16.29 \pm 0.32	46.44	5.19 \pm 0.03
SP-0.2-240-4-0.6	0.03	1.16	0.53	2.53 \pm 0.05	12.04 \pm 0.12	14.57 \pm 0.17	48.41	5.20 \pm 0.04
Water loading amount (g/cm ³) (PET loading proportion =20 wt.%, 240°C, 2h)								
SP-0.2-240-2-0.5	0.03	1.10	0.55	3.02 \pm 0.03	12.04 \pm 0.14	15.06 \pm 0.17	48.02	5.01 \pm 0.03
SP-0.2-240-2-0.6	0.02	1.08	0.53	3.54 \pm 0.11	11.84 \pm 0.28	15.38 \pm 0.26	48.42	5.06 \pm 0.07
SP-0.2-240-2-0.7	0.03	1.15	0.55	3.02 \pm 0.04	12.01 \pm 0.18	15.02 \pm 0.34	45.15	5.21 \pm 0.04
SP-0.2-240-2-0.8	0.03	1.20	0.58	3.18 \pm 0.05	11.89 \pm 0.11	15.07 \pm 0.26	43.80	5.17 \pm 0.04

Table S5 Thermal behavior and combustion characteristics parameters of hydrochars

Sample name	Characteristic Temperature/°C			a_i	a_f	$(dw/dt)_{max}$ (%/min)	$(dw/dt)_{mean}$ (%/min)	$T_{mass\ residue}$	$M_{mass\ residue}$	S ($10^{-8}/(\text{min}^2 \times \text{C}^{-3})$)	
	T_i	T_f	T_m								
PET loading proportion (wt.%) (240°C, 2 h, water loading amount = 0.6 g/cm ³)											
0	SP-0-240-2-0.6	246.33	490.77	402.48	95.69	79.08	-1.95	1.36	75.30	75.30	-8.89
20	SP-0.2-240-2-0.6	300.78	437.94	367.00	91.28	74.41	-5.95	2.46	52.06	65.07	-36.95
50	SP-0.5-240-2-0.6	316.22	377.04	346.48	87.97	55.10	-18.02	10.81	18.42	36.84	-516.62
80	SP-0.8-240-2-0.6	334.99	389.31	363.58	84.17	31.26	-28.45	19.48	2.19	10.95	-1268.59
100	SP-1-240-2-0.6	343.58	385.74	371.54	77.36	8.76	-39.63	32.54	0.00	0.00	-2832.55
Temperature (°C) (PET loading proportion=20 wt.%, 2 h, water loading amount = 0.6 g/cm ³)											
180	SP-0.2-180-2-0.6	340.80	458.46	406.58	88.59	65.33	-10.12	3.95	52.06	61.07	-75.16
210	SP-0.2-210-2-0.6	333.19	417.68	377.73	87.92	72.44	-7.19	3.66	52.06	64.57	-56.80
240	SP-0.2-240-2-0.6	300.78	437.94	367.00	91.28	74.41	-5.95	2.46	52.06	65.07	-36.95
270	SP-0.2-270-2-0.6	317.92	420.50	369.66	87.86	75.49	-5.12	2.41	52.06	65.19	-29.05
300	SP-0.2-300-2-0.6	268.89	404.88	312.55	94.91	77.85	-4.41	2.51	52.06	67.51	-37.80
Reaction time (h) (PET loading proportion=20 wt.%, 240°C, water loading amount = 0.6 g/cm ³)											
0.5	SP-0.2-240-0.5-0.6	328.18	417.20	375.57	87.53	73.94	-5.77	3.05	52.06	65.46	-39.18
1	SP-0.2-240-1-0.6	296.79	448.13	376.87	90.56	72.79	-4.93	2.35	52.06	65.20	-29.30
2	SP-0.2-240-2-0.6	300.78	437.94	367.00	91.28	74.41	-5.95	2.46	52.06	65.07	-36.95
3	SP-0.2-240-3-0.6	325.98	415.39	370.83	88.51	76.63	-5.58	2.66	52.06	67.13	-33.56
4	SP-0.2-240-4-0.6	317.93	429.65	373.70	89.27	75.14	-6.01	2.53	52.06	65.90	-35.02
Water loading amount (g/cm ³) (PET loading proportion =20 wt.%, 240°C, 2h)											
0.5	SP-0.2-240-2-0.5	305.39	432.14	372.08	90.90	73.26	-6.37	2.78	52.06	64.88	-43.99
0.6	SP-0.2-240-2-0.6	300.78	437.94	367.00	91.28	74.41	-5.95	2.46	52.06	65.07	-36.95
0.7	SP-0.2-240-2-0.7	337.22	403.16	370.49	87.21	76.92	-5.43	3.12	52.06	66.06	-36.94
0.8	SP-0.2-240-2-0.8	308.03	443.89	378.73	90.15	72.74	-6.71	2.56	52.06	65.30	-40.84