Supplementary Information

Macroalgae-based biochar: preparation and characterization of physicochemical properties for potential applications

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S1 Calculation of biochar, bio-oil and gas obtained from five macroalgal biomasses.

The biochar, bio-oil and gas yield were calculated using the following equations: [1]

Yield of biochar ($Y_{biochar}$) = M_c/M_f X 100 (1)

Where, Y = Yield of biochar (%), M_c = Mass of biochar (g), M_f = Mass of biomass (g).

Yield of bio-oil ($Y_{bio\text{-}oil}$) = $M_{bio\text{-}oil}/M_f$ X 100 (2)

Where, Y = Yield of bio-oil (%), $M_{bio\text{-}oil}$ = Mass of bio-oil (g), M_f = Mass of biomass (g).

The weight difference was used to calculate the yield percentage of gas by substracting the mass of biomass with the mass of biochar and bio-oil. Subsequently, the yield of gases was estimated using the mass of gases obtained.

$M_g = M_f – (M_c + M_{bio\text{-}oil})$ (3)

M_g = Mass of gas (g)

$Y_g = M_g/M_f \times 100$ (4)

Where, Y_g = Yield of gas (biogas + syngas) (%).

Table S2

Name	*Ulva Sp.*	*Asparagopsis*	*Oedogonium Sp.*	*Kappaphycus alvarezii*	*Eucheuma denticulatum*
Biochar (%)	30.46	40.00	28.20	41.59	46.96
Bio-oil (%)	6.37	7.04	9.06	8.95	6.87
Gas (%)	63.17	52.96	62.74	49.46	46.17

Table S3 Comparison of biochar properties obtained from 5 macroalgal biomasses and biochar from other feedstocks.

Parameters	Yield (%)	Ash (%)	Volatile matter (%)	pH	FC	C	N	Reference
Wheat straw	-	20.8		10.4		46.70	0.59	[2]
Wood	23.3	1.30	6.40	9.10	93.6	92.3	-	[3]
Straw	25.2	24.5	7.40	11.3	92.6	90.3	-	[3]
Green waste	24.4	13.40	8.80	11.3	91.2	88.4		[3]
Conocarpus wastes	-	8.56	27.22	12.2	-	82.90	0.71	[4]
Peanut shell	21.9	8.9	32.7	10.6	-	83.8	-	[5]
Safflower seed	-	9.20	11.6	9.89	-	73.72	3.84	[6]
Forest residues	-	-	24	8.70	-	75.9	0.45	[7]
Pig manure	-	51.20	22.6		-	33.8	3.18	[8]
Chicken Manure	55.9	56.4	26.5	11.7	-	24.7	-	[9]
Dairy manure		39.5	27.7	9.9	-	56.7	-	[10]
Cow manure		-	-	9.2	-	33.6	1.51	[11]
Oil mallee		15.6	4.10	-	-	80.1	0.30	[12]
Wood Ponderosa pine	-	2.1	25.2	-	-	81.9	0.08	[13]
Coffee husk	31.6	19.6	17.6	9.9	-	66.0	-	[9]
Mulberry wood	26.2	9.8	-	10.6	-	77.0	-	[14]
Corn stover	17.0	32.8	-	7.2	-	57.3	-	[15]
Ulva Sp.	30.46	31.1	22.87	10.53	42.41	55.77	3.78	Current work
Asparagopsis	40.0	30.86	34.21	9.74	32.5	51.89	4.97	Current work
Oedogonium Sp.	28.2	12.6	14.57	10.95	68.86	70.23	7.91	Current work
Kappaphycus alvarezii	41.59	41.73	31.34	10.42	24.94	52.23	0.99	Current work
Eucheuma denticulatum	46.96	52.12	43.92	9.86	2.63	40.12	1.50	Current work

Table S4 Adsorption efficiency and adsorption capacity of five macroalgal biochar samples.

Adsorption	*Ulva Sp.*	*Asparagopsis*	*Oedogonium Sp.*	*Kappaphycus alvarezii*	*Eucheuma denticulatum*
Adsorption efficiency (%)	100.00	98.10	96.78	98.09	95.47
Adsorption capacity (mg/g)	0.5	0.24	0.10	0.05	0.008

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