Table S1 Analysis of variance response variables and *p*-values for solid yield, moisture content, ash content, geometric mean diameter, bulk density, and particle density with the significance of the process variables (torrefaction temperature, sample, and residence time).

Response parameter	Sample	CV (%)	R^2			*p*-value		
			Actual	Predicted	Adjusted	TT (°C)	BB	RT (min)
Solid yield (%)	CS	2.82	0.989	0.949	0.979	<0.0001	<0.0001	<0.0001
	CS-C	3.74	0.986	0.946	0.973	<0.0001	<0.0001	<0.0001
Moisture content (% d.b.)	CS	3.30	0.971	0.882	0.945	0.0030	<0.0001	<0.0001
	CS-C	2.15	0.987	0.954	0.975	<0.0001	<0.0001	<0.0001
Ash content (% d.b.)	CS	5.45	0.958	0.845	0.921	0.0010	<0.0001	0.0010
	CS-C	6.13	0.970	0.891	0.943	<0.0001	<0.0001	0.0010
d_{gw} (mm)	CS	1.90	0.979	0.929	0.960	<0.0001	<0.0001	<0.0001
	CS-C	0.68	0.994	0.973	0.988	<0.0001	<0.0001	<0.0001
Bulk density (kg/m^3)	CS	3.11	0.997	0.986	0.993	0.7580	0.0040	0.6710
	CS-C	2.90	0.996	0.984	0.993	<0.0001	<0.0001	<0.0001
Particle density (kg/m^3)	CS	1.80	0.959	0.792	0.923	0.1250	0.0050	0.0420
	CS-C	1.80	0.969	0.856	0.941	<0.0001	<0.0001	0.5790

CS: camelina straw ground in 6.4 mm sieve; CS-C: chopped camelina straw; CV: coefficient of variation; R^2: correlation coefficient; TT: torrefaction temperature; RT: residence time; BB: biomass-biochar (the first number after torrefied biomass (T) is % CS, and the second is % of with or without biochar); and d_{gw}: geometric mean diameter.

Table S2 Multiple regression equations generated by RSM software for each response.

Response variables	Sample	Multiple regression equation	Adequate precision
SY (%)	CS	$56.35 – 3.62A – 11.60B – 4.46C – 1.71AB + 1.21AC – 0.77BC + 8.90B^2 – 0.53C^2$	31.93
	CS-C	$57.20 – 5.22A – 13.91B – 4.34C – 2.16AB + 1.27AC + 0.35BC + 10.66B^2 – 0.43C^2$	27.70
MC (% d.b.)	CS	$1.71 – 0.050A + 0.15B – 0.14C – 0.012AB + 0.00083AC – 0.051BC – 0.24B^2 + 0.078C^2$	19.03
	CS-C	$1.95 – 0.079A + 0.12B – 0.14C -0.029AB - 0.020AC – 0.030BC – 0.32B^2 + 0.0025C^2$	30.84
AC (% d.b.)	CS	$4.42 + 0.29A + 0.80B + 0.30C + 0.21AB – 0.075AC + 0.045BC – 0.18B^2 – 0.082C^2$	16.99
	CS-C	$4.05 + 0.66A + 0.85B + 0.35C + 0.31AB + 0.098AC + 0.10BC + 0.32B^2 – 0.015C^2$	20.17
d_{gw} (mm)	CS	$0.34 – 0.012A – 0.031B\ 0.011C + 0.011AB – 0.00075AC – 0.00438BC + 0.011B^2 + 0.00025C^2$	23.63
	CS-C	$0.48 – 0.010A – 0.030B – 0.012C + 0.0023AB + 0.00058AC + 0.00075BC + 0.0088B^2 – 0.00042C^2$	44.75
BD (kg/m^3)	CS	$177.27 + 6.38A + 42.74B + 8.40C + 2.26AB + 1.06AC + 3.39BC – 16.98B^2 – 0.11C^2$	52.40
	CS-C	$111.77 + 3.92A + 37.09B + 4.86C + 1.04AB + 1.01AC + 0.41BC – 20.04B^2 – 0.74C^2$	45.64
PD (kg/m^3)	CS	$1270.45 – 34.49A + 66.19B + 25.60C – 17.29AB – 17.55AC + 24.38BC – 50.28B^2 – 6.10C^2$	18.14
	CS-C	$1219.15 – 35.14A + 78.99B + 3.50C + 12.64AB – 16.62AC + 23.77BC – 62.34B^2 – 11.35C^2$	20.77

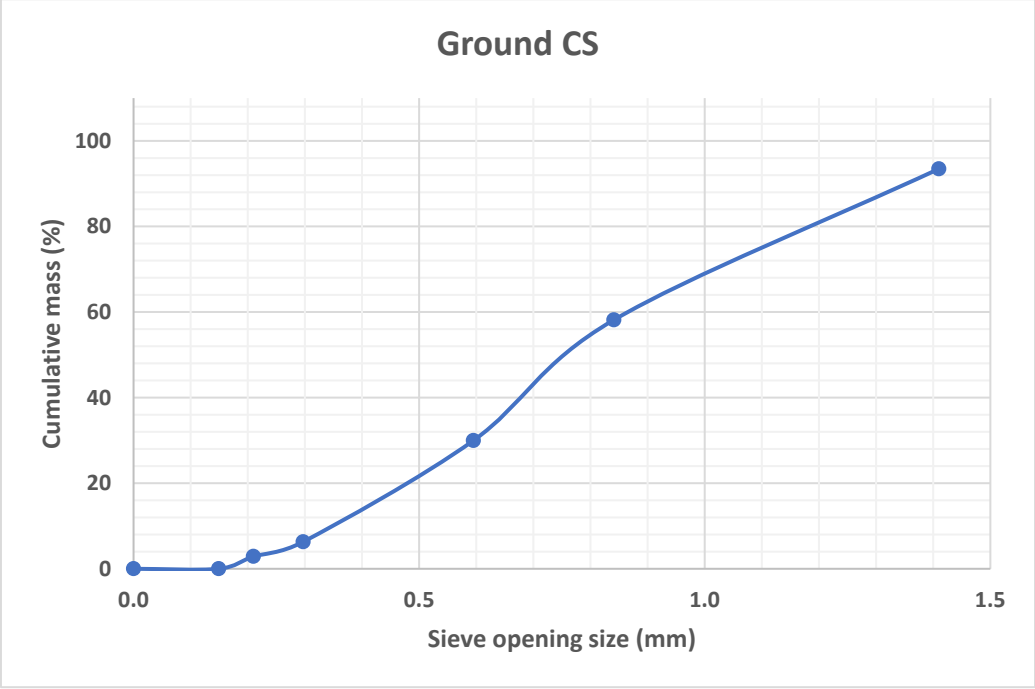
SY: solid yield; MC: moisture content; AC: ash content; BD: bulk density; PD: particle density; and d_{gw}: geometric mean diameter; RSM: response surface methodology; A: torrefaction temperature (°C); B: biomass-biochar (the first number after torrefied biomass (T) is % CS, and the second is % of with or without biochar); C: residence time (min).

Table S3 Validation results for the optimized responses for torrefied ground or chopped camelina straw with and without biochar.

Sample	TT (°C)		BB		RT (min)		SY (%)		AC (% d.b.)		MC (% d.b.)	
	AV	PV	AV	PV	AV	PV	AV	PV	AV	PV	AV	PV
CS	300	299.79	20	19.97	20	19.55	45.18	45.12	5.84	5.73	1.45	1.44
CS-C	300	299.61	20	19.90	20	19.96	44.63	44.42	6.83	6.72	1.47	1.47

AV: actual value; PV: predicted value; SY: solid yield; MC: moisture content; AC: ash content; BD: bulk density; PD: particle density; TT: torrefaction temperature; RT: residence time; and BB: biomass-biochar (the first number after torrefied biomass (T) is % CS, and the second is % of with or without biochar).

A.



B.

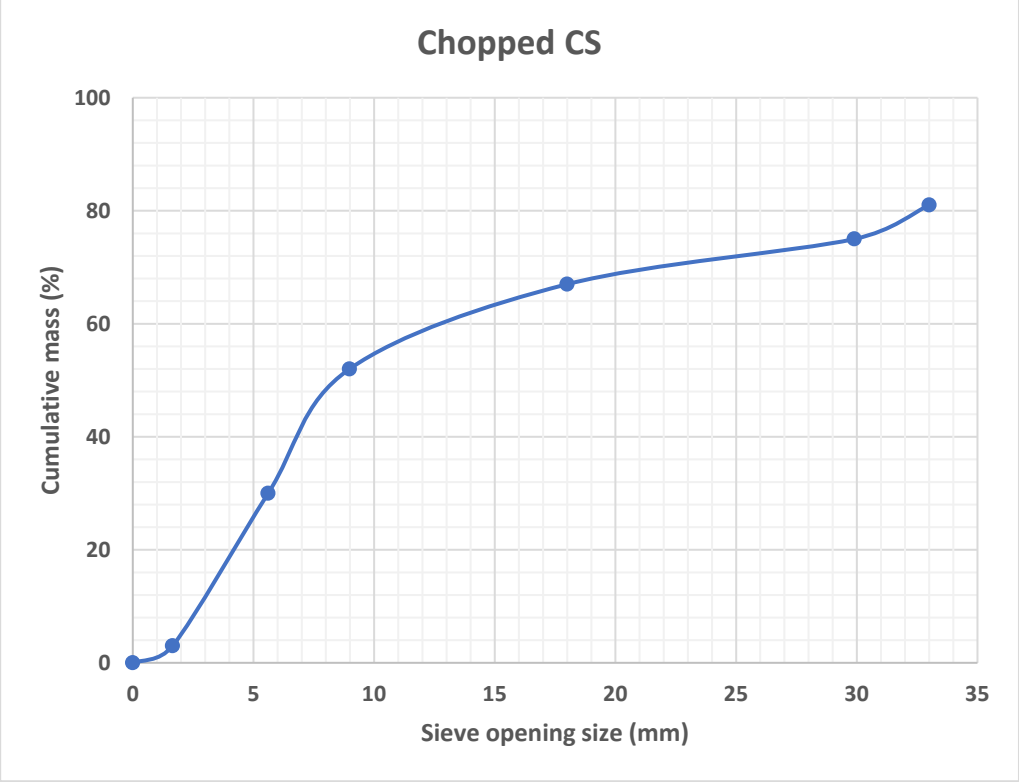


Figure S1. Cumulative passing plots of particle size for non-torrefied camelina straw (CS). (A) ground in 6.4 mm sieve size and (B) chopped.

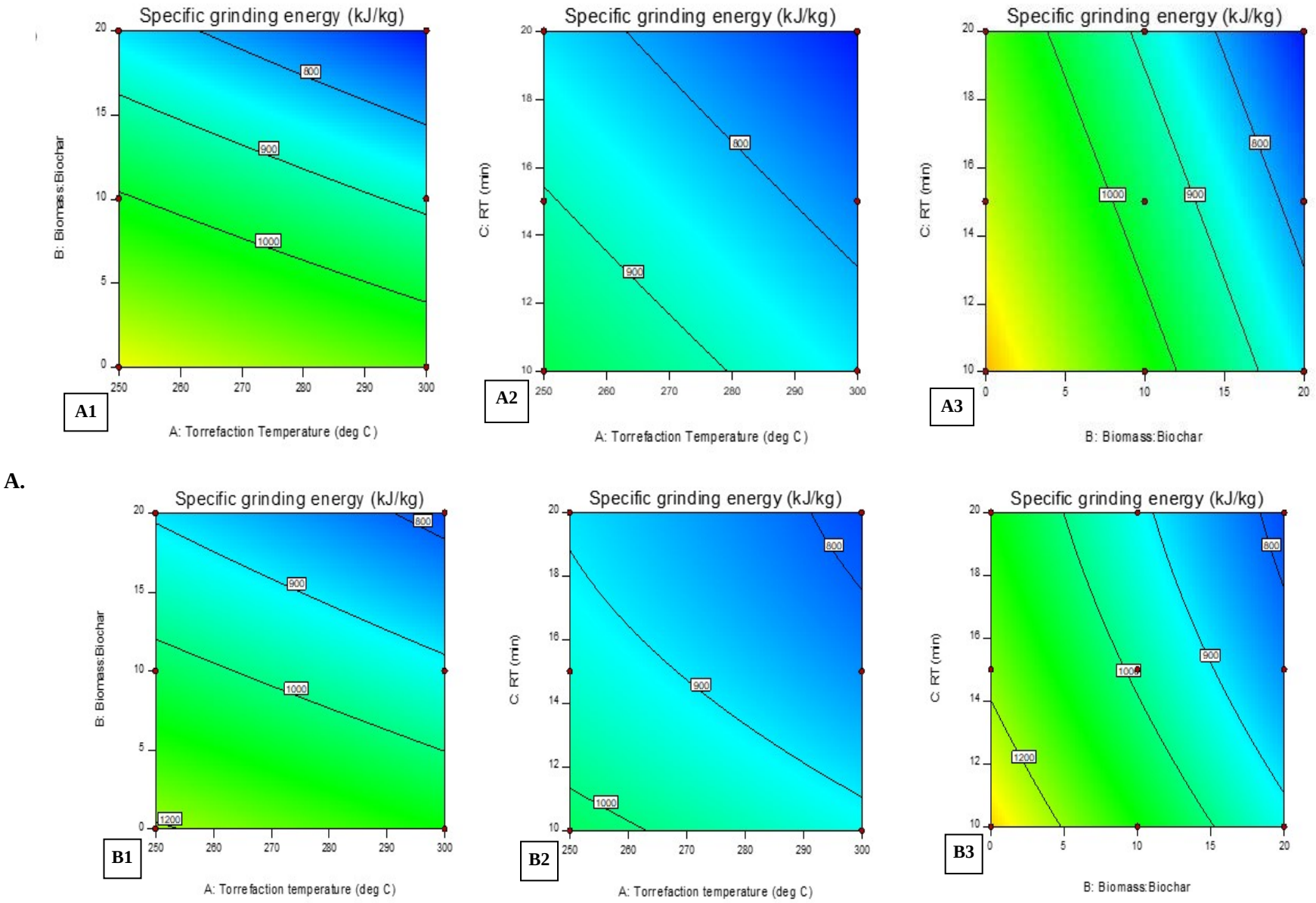


Figure S2. Contour plots specific grinding energy (kJ/kg) as a function of torrefaction temperature (°C) (A1 – B1), biomass-biochar (A2 – B2) and residence time (min) (A3 – B3) for torrefied ground camelina straw with and without biochar (A) and torrefied chopped camelina straw with and without biochar (B).