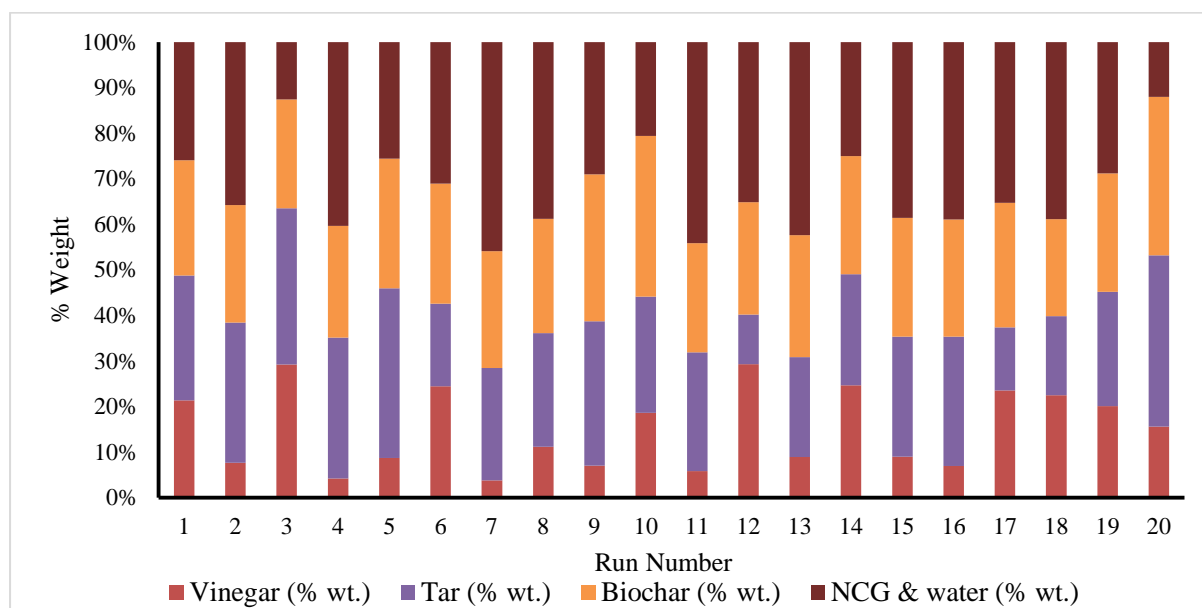


**Fig. S1.** Batch reactor set up used for the pyrolysis experiments. 1. Pressure relief valve, 2. Reactor, 3. Rocket stove, 4. Thermocouple, 5. Chimney, 6. Heavy gas condensation, 7. Tar, 8. Condenser (radiator), 9. Vinegar, 10. Flammable non-condensable gases, and 11. Banana wastes biomass.



**Fig. S2.** Quantified mass for 20 banana peels runs.

**Table S1.** Central Composite Design of Independent Variables for Process Optimization for Banana Peels

Std	Run	Coded values			Actual values		
		A	B	C	Temp. (°C)	Mass (g)	Time (min)
10	1	1.000	1.000	1.000	550.0	800.0	90.00
11	2	0.000	0.000	0.000	450.0	500.0	67.50
7	3	1.000	-1.000	-1.000	550.0	200.0	45.00
12	4	0.000	0.000	0.000	450.0	500.0	67.50
9	5	-1.000	-1.000	1.000	350.0	200.0	90.00
8	6	-1.000	1.000	-1.000	350.0	800.0	45.00
20	7	0.000	0.000	0.000	450.0	500.0	67.50
18	8	0.000	0.000	1.633	450.0	500.0	104.24
13	9	-1.633	0.000	0.000	286.7	500.0	67.50
15	10	0.000	-1.633	0.000	450.0	10.1	67.50
14	11	1.633	0.000	0.000	613.3	500.0	67.50
16	12	0.000	1.633	0.000	450.0	989.9	67.50
19	13	0.000	0.000	0.000	450.0	500.0	67.50
17	14	0.000	0.000	-1.633	450.0	500.0	30.76
5	15	0.000	0.000	0.000	450.0	500.0	67.50
3	16	1.000	-1.000	1.000	550.0	200.0	90.00
4	17	-1.000	1.000	1.000	350.0	800.0	90.00
2	18	1.000	1.000	-1.000	550.0	800.0	45.00
6	19	0.000	0.000	0.000	450.0	500.0	67.50
1	20	-1.000	-1.000	-1.000	350.0	200.0	45.00

**Table S2.** Experimental and Predicted Response for New Design Points Using Model for Banana Peels Vinegar, Tar, Biochar and NCG/Water (% wt.)

Run order	Experimental				Predicted			
	Vinegar*	Tar*	Biochar*	NCG & water*	Vinegar	Tar	Biochar	NCG & water
1	21.36	27.39	25.34	25.93	17.77	24.21	25.63	32.04
2	7.68	30.74	25.82	35.76	8.85	26.40	25.89	38.84
3	29.65	34.75	24.15	12.80	26.70	28.88	26.10	19.30
4	4.22	30.92	24.54	40.32	8.85	26.40	25.89	38.84
5	8.80	37.62	28.80	25.85	6.83	33.37	30.45	30.11
6	24.44	18.15	26.31	31.10	22.09	16.23	26.85	34.48
7	3.84	24.58	25.62	45.84	8.85	26.40	25.89	38.84
8	11.22	24.90	25.10	38.80	12.54	26.47	24.62	36.40
9	7.02	31.72	32.26	29.02	6.82	31.96	31.49	29.98
10	18.81	25.74	35.64	20.79	19.35	30.62	33.14	17.93
11	5.82	26.10	23.92	44.16	8.33	29.67	23.07	39.03
12	29.30	10.87	24.65	35.16	31.07	9.60	25.53	33.84
13	8.94	21.94	26.76	42.34	8.85	26.40	25.89	38.84
14	24.66	24.36	25.92	25.06	25.65	26.40	24.78	23.28
15	9.02	26.36	26.06	38.56	8.85	26.40	25.89	38.84
16	7.00	28.35	25.70	38.9	7.81	27.87	26.25	38.31
17	23.53	13.86	27.36	35.25	24.93	17.33	26.50	31.54
18	22.53	17.33	21.30	38.84	22.96	19.17	20.74	37.36
19	20.14	25.04	26.00	28.84	8.85	26.40	25.89	38.84
20	15.65	37.55	34.75	12.05	17.70	38.32	35.54	8.72

\*percentage weight dry basis