

Supplementary Materials

Citric Acid-Mediated Microwave Extraction Outperforms Conventional Heating for Recovery of Antidiabetic Polysaccharides from *Centella asiatica*

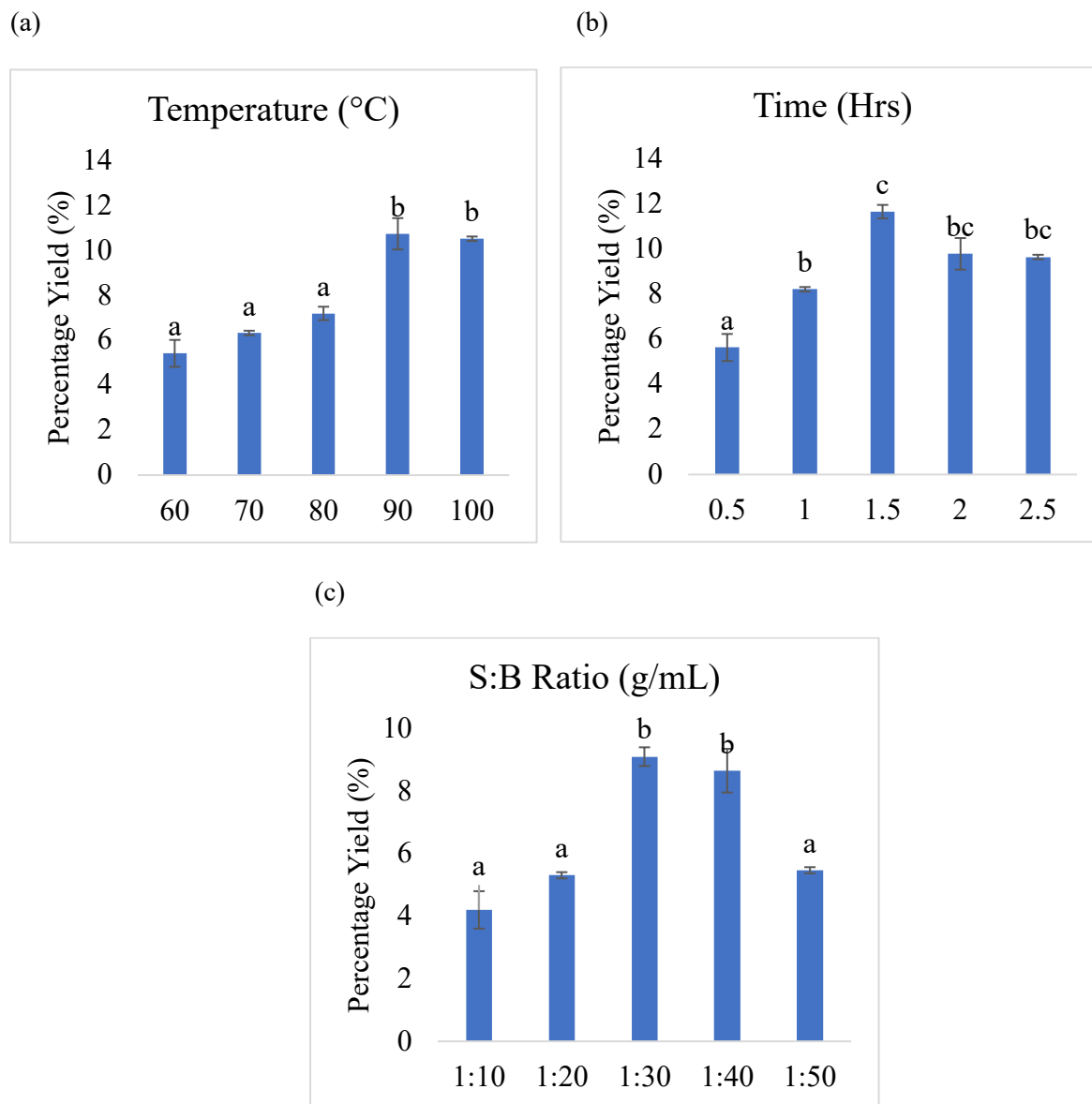


Figure S1. Effect of single-factor parameters on polysaccharide yield (% w/w) from *C. asiatica* using HWE: (a) extraction temperature (°C), (b) extraction time (h), and (c) solid-to-buffer ratio (g/mL). Data are mean $\pm$ SD (n = 3). Bars sharing the same letter are not significantly different (Duncan's multiple test, $p < 0.05$).

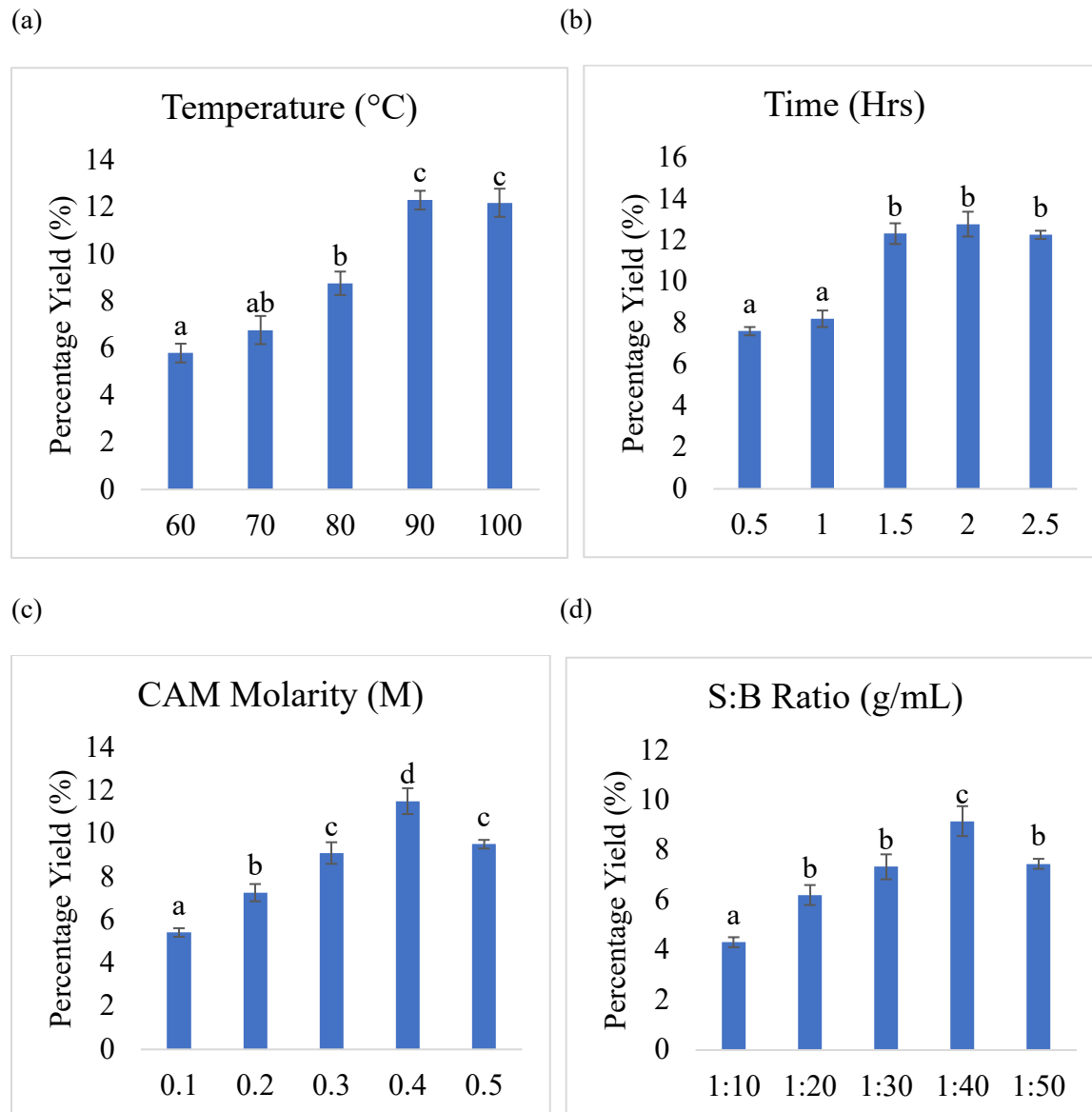


Figure S2. Effect of single-factor parameters on polysaccharide yield (% w/w) from *C. asiatica* using CAM-HWE: (a) extraction temperature (°C), (b) extraction time (h), (c) CAM concentration (M), and (d) solid-to-buffer ratio (g/mL). Data are mean $\pm$ SD ($n = 3$). Bars sharing the same letter are not significantly different (Duncan's multiple test, $p < 0.05$).

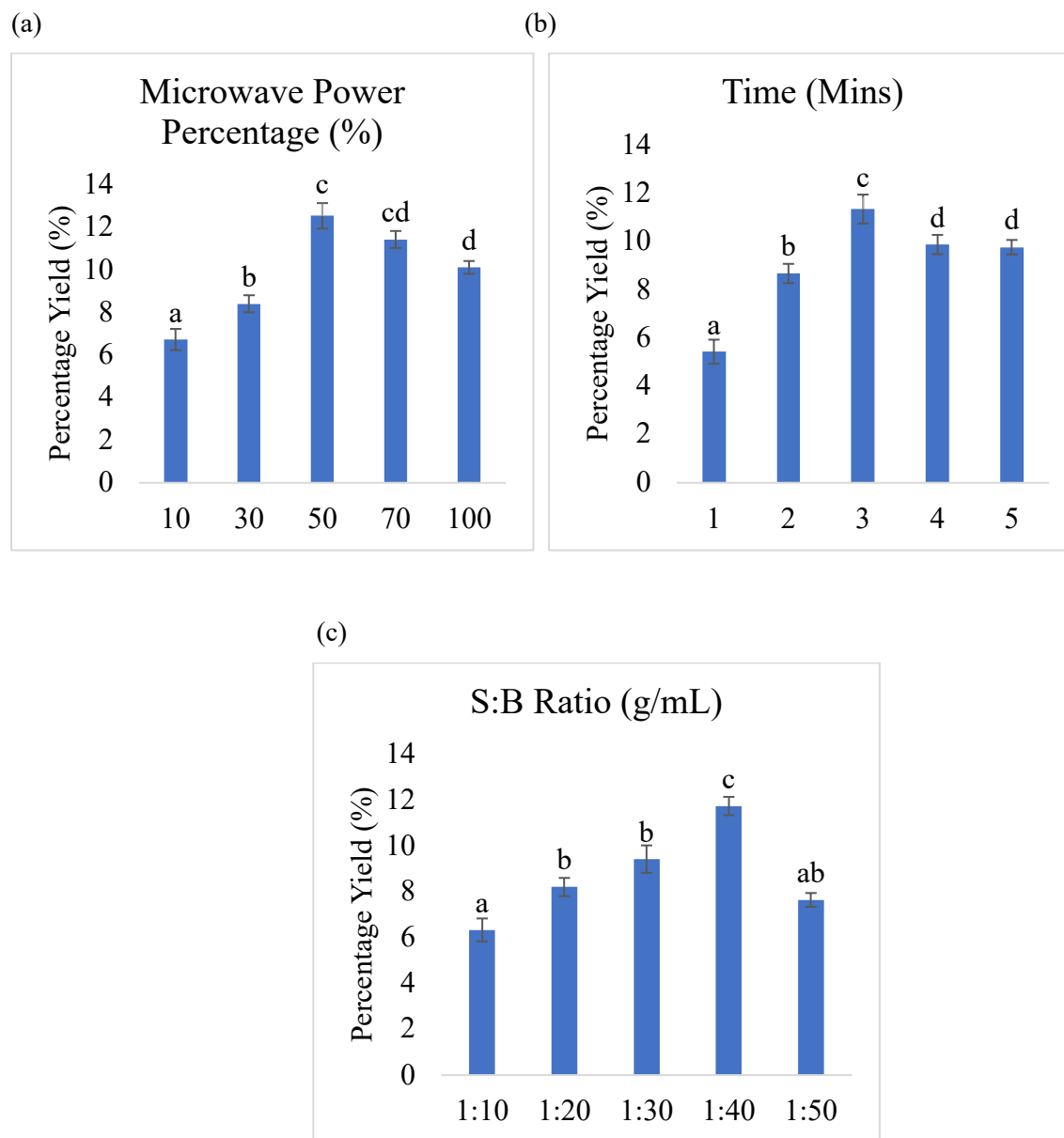


Figure S3. Effect of single-factor parameters on polysaccharide yield (% w/w) from *C. asiatica* using MAE: (a) microwave power (%), (b) extraction time (min), and (c) solid-to-buffer ratio (g/mL). Data are mean $\pm$ SD (n = 3). Bars sharing the same letter are not significantly different (Duncan's multiple test, $p < 0.05$).

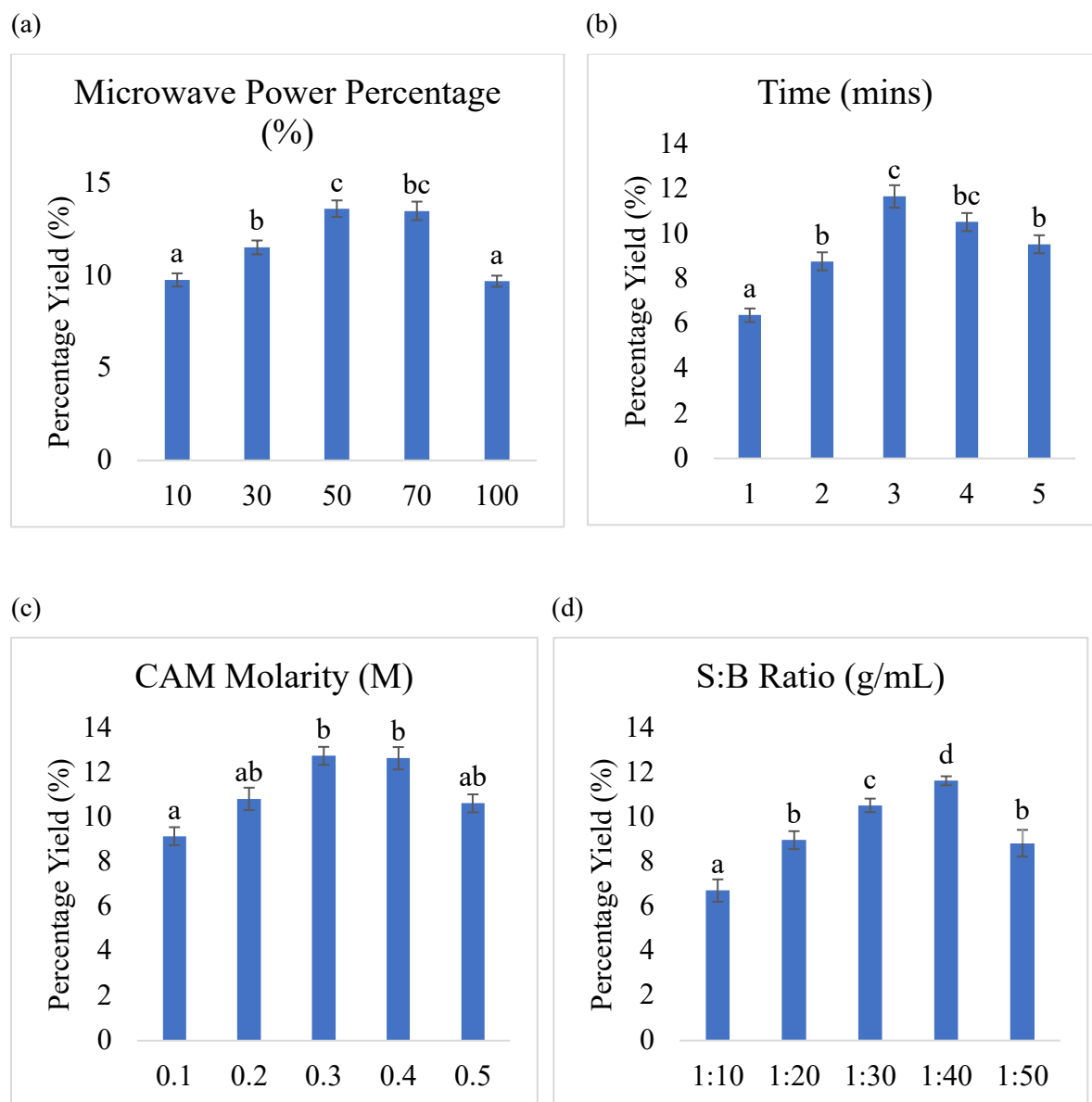


Figure S4. Effect of single-factor parameters on polysaccharide yield (% w/w) from *C. asiatica* using CAM-MAE: (a) microwave power (%), (b) extraction time (min), (c) CAM concentration (M), and (d) solid-to-buffer ratio. Data are mean $\pm$ SD (n = 3). Bars sharing the same letter are not significantly different (Duncan's Multiple Test, $p < 0.05$).

Table S1. ANOVA table for the quadratic response surface model of polysaccharide yield from HWE.

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	62.23	9	6.91	396.09	< 0.0001	significant
A-Temp	1.49	1	1.49	85.23	< 0.0001	
B-Time	5.49	1	5.49	314.76	< 0.0001	
C-SB ratio	0.13	1	0.13	7.45	0.0294	
AB	0.354	1	0.354	20.28	0.0028	
AC	4.16	1	4.16	238.4	< 0.0001	
BC	0.5329	1	0.5329	30.53	0.0009	
A²	24.34	1	24.34	1394.25	< 0.0001	
B²	15.11	1	15.11	865.48	< 0.0001	
C²	5.83	1	5.83	334	< 0.0001	
Residual	0.1222	7	0.0175			
Lack of Fit	0.0875	3	0.0292	3.36	0.1362	not significant
Pure Error	0.0347	4	0.0087			
Cor Total	62.35	16				
R²	0.9980					
Adjusted R²	0.9955					
C.V. %	1.22					

Table S2. ANOVA table for the quadratic response surface model of polysaccharide yield from CAM-HWE.

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	65.81	14	4.70	405.49	< 0.0001	significant
A-Temperature	0.6211	1	0.6211	53.57	< 0.0001	
B-Time	1.93	1	1.93	166.31	< 0.0001	
C-Conc Citric Acid	1.02	1	1.02	87.55	< 0.0001	

D-SB ratio	0.0007	1	0.0007	0.0582	0.8128	
AB	6.84	1	6.84	589.85	< 0.0001	
AC	1.59	1	1.59	136.94	< 0.0001	
AD	0.8100	1	0.8100	69.87	< 0.0001	
BC	2.98	1	2.98	256.67	< 0.0001	
BD	0.8742	1	0.8742	75.41	< 0.0001	
CD	5.20	1	5.20	448.40	< 0.0001	
A²	4.76	1	4.76	410.93	< 0.0001	
B²	39.64	1	39.64	3419.06	< 0.0001	
C²	9.14	1	9.14	788.34	< 0.0001	
D²	4.52	1	4.52	389.64	< 0.0001	
Residual	0.1623	14	0.0116			
Lack of Fit	0.1338	10	0.0134	1.88	0.2852	not significant
Pure Error	0.0285	4	0.0071			
Cor Total	65.98	28				
R²	0.9975					
Adjusted R²	0.9951					
C.V. %	0.8876					

Table S3. ANOVA table for the quadratic response surface model of polysaccharide yield from MAE.

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	69.31	9	7.70	723.26	< 0.0001	significant
A-Power	22.31	1	22.31	2095.51	< 0.0001	
B-Time	7.37	1	7.37	692.47	< 0.0001	
C-SB ratio	2.23	1	2.23	209.07	< 0.0001	
AB	2.04	1	2.04	192.06	< 0.0001	
AC	0.1024	1	0.1024	9.62	0.0173	
BC	0.0676	1	0.0676	6.35	0.0398	
A²	11.73	1	11.73	1101.58	< 0.0001	
B²	10.23	1	10.23	961.16	< 0.0001	
C²	9.52	1	9.52	894.54	< 0.0001	
Residual	0.0745	7	0.0106			
Lack of Fit	0.0423	3	0.0141	1.75	0.2959	not significant
Pure Error	0.0323	4	0.0081			
R²	0.9989					
Adjusted R²	0.9975					
C.V. %	0.8450					

Table S4. ANOVA table for the quadratic response surface model of polysaccharide yield from CAM-MAE.

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	88.68	14	6.33	302.15	< 0.0001	significant
A-Power	1.09	1	1.09	51.80	< 0.0001	
B-Time	12.30	1	12.30	586.79	< 0.0001	
C-Conc	1.09	1	1.09	51.80	< 0.0001	
D-SB ratio	2.28	1	2.28	108.73	< 0.0001	
AB	0.4830	1	0.4830	23.04	0.0003	
AC	0.0156	1	0.0156	0.7453	0.4025	
AD	0.4422	1	0.4422	21.09	0.0004	
BC	5.02	1	5.02	239.34	< 0.0001	
BD	1.39	1	1.39	66.42	< 0.0001	
CD	0.2809	1	0.2809	13.40	0.0026	
A²	59.31	1	59.31	2829.05	< 0.0001	
B²	11.89	1	11.89	567.09	< 0.0001	
C²	5.51	1	5.51	262.64	< 0.0001	
D²	1.34	1	1.34	63.73	< 0.0001	
Residual	0.2935	14	0.0210			
Lack of Fit	0.2388	10	0.0239	1.75	0.3113	not significant
Pure Error	0.0547	4	0.0137			
Cor Total	88.97	28				
R²	0.9967					
Adjusted R²	0.9934					
C.V. %	1.12					