

Improving the recovery of phenolics and flavonoids from *Coriandrum sativum* L. leaves using microwave-enzymatic-assisted extraction.

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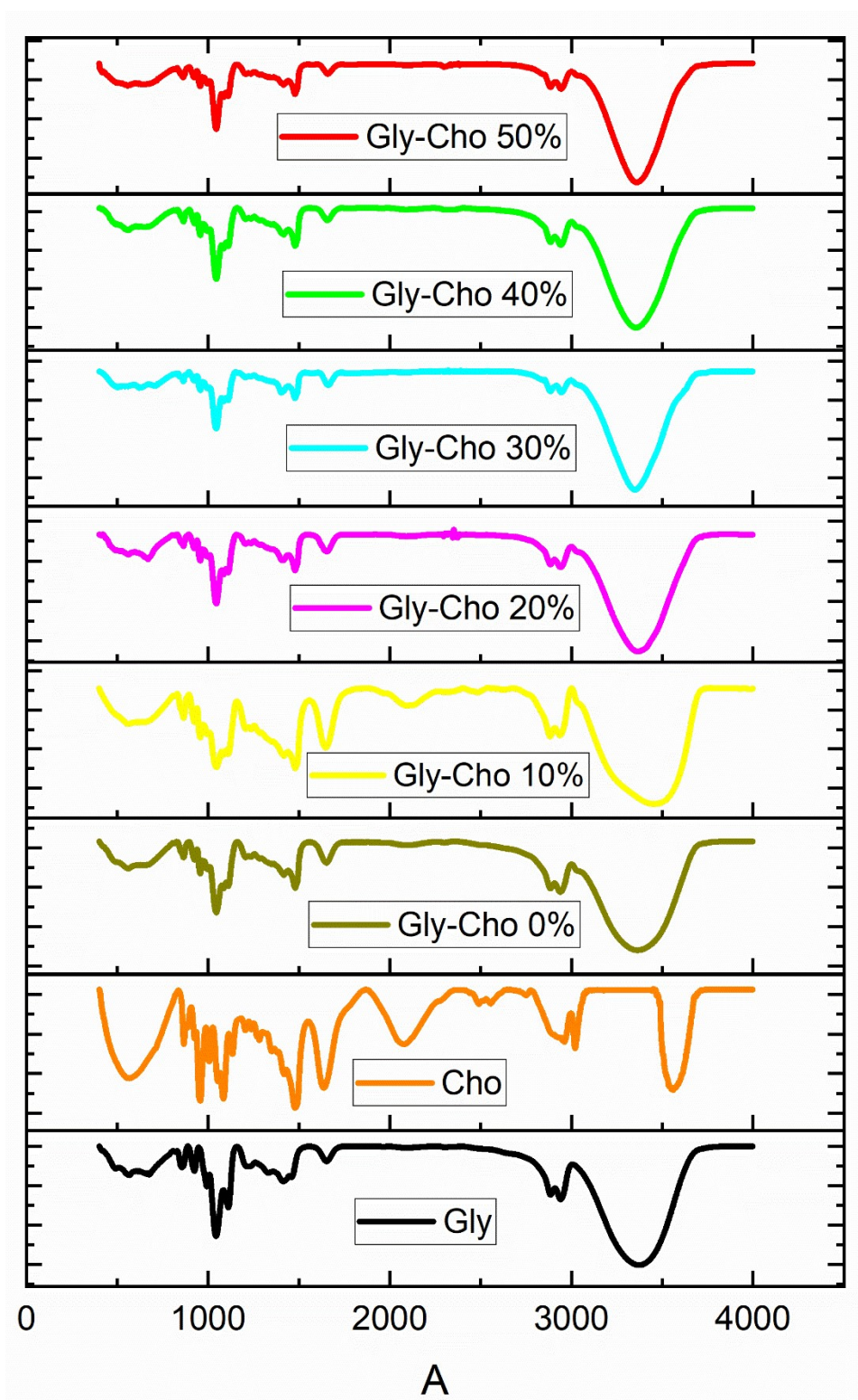


Figure S1. FTIR spectra of Gly-Cho Solvent with varying Water Content, alongside individual Glycerol and Choline Chloride Solvents

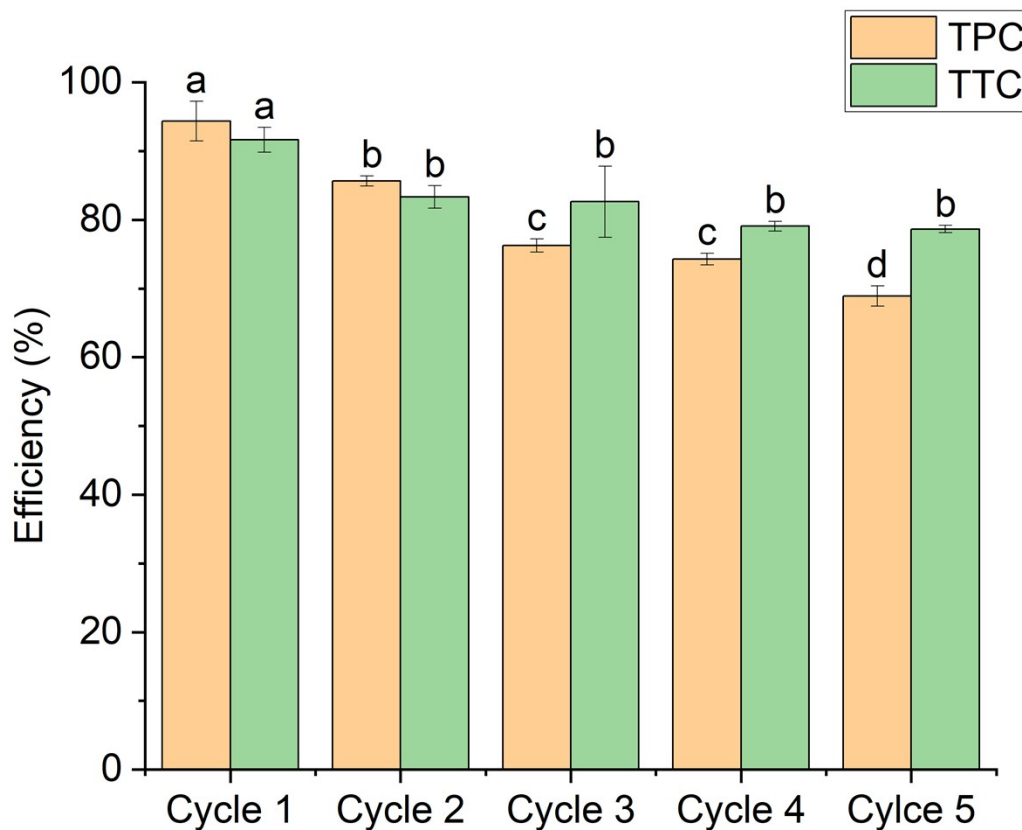


Figure S2. Examining the reusability of NDES. The letters a, b, and c represent statistically significant differences.

Table S1. Detailed parameters of single-factor experiment

Number	Variable factor	Fixed factor
1.1	SRL: 1/10, 1/20, 1/30, 1/40, and 1/50 g/mL	WC: 30%; MP: 728 W; MT: 2 minutes; EC: 30 U/g; EITem: 50 °C; EIT: 90 minutes
1.2	WC: 0, 10, 20, 30, 40, and 50%	SLR: the result of 1.1; MP: 728 W; MT: 2 minutes; EC: 30 U/g; EITem: 50 °C; EIT: 90 minutes
1.3	MP: 280, 728, 1022, 1232, and 1400 W	SLR: the result of 1.1; WC: the result of 1.2; MT: 2 minutes; EC: 30 U/g; EITem:

		50 °C; EIT: 90 minutes
1.4	MT: 30 seconds, 1, 2, 3, and 4 minutes	SLR: the result of 1.1; WC: the result of 1.2; MP: the result of 1.3; EC: 30 U/g; EITem: 50 °C; EIT: 90 minutes
1.5	EC: 10, 20, 30, 40, and 50 U/g	SLR: the result of 1.1; WC: the result of 1.2; MP: the result of 1.3; MT: the result of 1.4; EITem: 50 °C; EIT: 90 minutes
1.6	EIT: 0, 30, 60, 90, 120, 150, and 180 minutes	SLR: the result of 1.1; WC: the result of 1.2; MP: the result of 1.3; MT: the result of 1.4; EC: the result of 1.5; EITem: 50 °C

Table S2. Experimental design parameters and their magnitudes for MEAE optimization

Variables	Independent factors	Units	The value of independent factors		
			Lower (-1)	Proper (0)	Higher (+1)
β_1	SLR	g/mL	1/3	1/2	1
β_2	WC	%	10	20	30
β_3	MP	W	280	728	1022
β_4	MT	Minutes	2	3	4
β_5	EC	U	20	30	40
β_6	EIT	Minutes	0	30	60

Table S3. Plackett-Burman Design data for TFC

No.	SLR	WC	MP	MT	EC	EIT	TFC
1	-1	-1	-1	-1	-1	-1	9.95
2	1	-1	1	1	-1	1	19.57
3	-1	1	1	-1	1	-1	11.91
4	1	1	-1	1	-1	-1	23.88
5	1	1	1	-1	1	1	18.24
6	1	1	-1	1	1	-1	26.56
7	-1	-1	1	1	1	-1	7.13
8	1	-1	-1	-1	1	1	17.63
9	-1	1	1	1	-1	1	9.71
10	1	-1	1	-1	-1	-1	19.76
11	-1	1	-1	-1	-1	1	10.93
12	-1	-1	-1	1	1	1	7.87

Table S4. Plackett-Burman Design data for TPC

No.	SLR	WC	MP	MT	EC	EIT	TPC
1	-1	-1	-1	-1	-1	-1	12.07
2	1	-1	1	1	-1	1	16.32
3	-1	1	1	-1	1	-1	17.02
4	1	1	-1	1	-1	-1	12.96
5	1	1	1	-1	1	1	15.04
6	1	1	-1	1	1	-1	15.54
7	-1	-1	1	1	1	-1	19.35
8	1	-1	-1	-1	1	1	14.39
9	-1	1	1	1	-1	1	14.34
10	1	-1	1	-1	-1	-1	14.00

11	-1	1	-1	-1	-1	1	10.51
12	-1	-1	-1	1	1	1	15.07

Table S5. The Plackett-Burman Design's ANOVA emphasizes how crucial extraction factors are in establishing the target compound's yield

Term	TFC			TPC		
	Coef	<i>t</i> -value	<i>p</i> -value	Coef	<i>t</i> -value	<i>p</i> -value
β_0 – Constant	17.608	32.21	0.000	17.659	73.22	0.000
β_1 – SLR-A	6.553	11.99	0.000	-0.009	-0.04	0.971
β_2 – WC-B	1.859	3.40	0.019	-0.579	-2.40	-0.062
β_3 – MP-C	-1.009	-1.85	0.124	1.553	6.44	0.001
β_4 – MT-D	0.606	1.11	0.318	1.055	4.37	0.007
β_5 – EC-E	-0.428	-0.78	0.469	1.623	6.73	0.001
β_6 – EIT-F	-1.465	-2.68	0.044	-0.527	-2.19	0.080
R^2		97.11%			95.88%	
Adjusted R^2		93.63%			90.94%	
Predicted R^2		83.33%			76.28%	

Table S6. TPC's data for optimization of MEAE with NDES solvent

No.	SLR	WC	MP	MT	EC	EIT	TPC
1	0	0	-1	0	1	0	14.15
2	0	0	0	1	1	0	12.73
3	0	0	-1	1	0	0	11.55
4	0	0	1	0	-1	0	15.98
5	0	0	1	1	0	0	17.13
6	0	0	0	-1	-1	0	14.28

7	0	0	0	0	0	0	18.48
8	0	0	0	0	0	0	16.30
9	0	0	1	0	1	0	17.78
10	0	0	0	-1	1	0	15.18
11	0	0	0	1	-1	0	13.40
12	0	0	1	-1	0	0	16.40
13	0	0	-1	-1	0	0	17.20
14	0	0	-1	0	-1	0	16.73

Table S7. TFC's data for optimization of MEAE with NDES solvent

No.	SLR	WC	MP	MT	EC	EIT	TFC
1	1	-1	0	0	0	0	16.88
2	1	0	0	0	0	1	14.51
3	0	-1	0	0	0	1	13.63
4	-1	1	0	0	0	0	10.98
5	0	1	0	0	0	1	15.90
6	-1	0	0	0	0	-1	6.64
7	0	0	0	0	0	0	18.13
8	0	0	0	0	0	0	19.76
9	1	1	0	0	0	0	25.44
10	1	0	0	0	0	-1	27.80
11	-1	0	0	0	0	1	16.58
12	0	1	0	0	0	-1	15.30
13	0	-1	0	0	0	-1	13.83
14	-1	-1	0	0	0	0	12.91

Table S8. ANOVA analysis results of the MASE and EASE

Term	TPC			Term	TFC		
	Coef	<i>p</i> -value	<i>F</i> -value		Coef	<i>p</i> -value	<i>F</i> -value
β_0	17.39			β_0	18.95		
β_3 – MP	0.9562	0.0401	8.97	β_1 – SLR	4.69	0.0002	168.16
β_4 – MT	-1.03	0.0320	10.43	β_2 – WC	1.30	0.0231	12.83
β_5 – EC	-0.0687	0.8400	0.0464	β_6 – EIT	-0.3669	0.3678	1.03
β_{34}	1.59	0.0242	12.46	β_{12}	2.62	0.0069	26.26
β_{53}	1.09	0.0726	5.87	β_{16}	-5.81	0.0003	128.88
β_{54}	-0.3938	0.4324	0.7606	β_{26}	0.2006	0.7149	0.1538
β_3^2	0.2219	0.6830	0.1932	β_1^2	-0.3369	0.5875	0.3470
β_4^2	-2.04	0.0156	16.34	β_2^2	-2.05	0.0229	12.90
β_5^2	-1.45	0.0451	8.29	β_6^2	-2.23	0.0176	15.15
Lack of fit	3.26			Lack of fit	2.87		
Pure Error	0.0000			Pure Error	0.0000		
P-value of Model	<0.0001*			P-value of Model	<0.0001*		
R ²	0.9395			R ²	0.9890		
Adjusted R ²	0.8032			Adjusted R ²	0.9644		
Predicted R ²	0.5582			Predicted R ²	0.8662		

Table S9. Predicted and experimental results of phenolics and flavonoids at the ideal condition of DCP

Measurement	Conditions	Predicted values	Experimental values	Prediction error (%)
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TPC (mg GAE/g)	SLR: 1/20 g/mL	18.61	18.15 ± 0.25	2.51
	WC: 10% (w/w)			
	MP: 1022 W			
	MT: 2.6 minutes			
	EC: 40 U/g			
	EIT: 90 minutes			
	EITem: 50°C			
	Antioxidant Activity			
	ABTS (mg TAE/g)		30 ± 1	
	DPPH (mg TAE/g)		0.7 ± 0.4	
	·OH scavenging activity (mg TAE/g)		2.46 ± 0.05	
	FRAP (mg TAE/g)		9.8 ± 0.1	
TFC (mg RE/g)	SLR: 1/30 g/mL	27.89	26.36 ± 0.41	5.80
	WC: 23.7% (w/w)			
	MP: 728 W			
	MT: 2 minutes			
	EC: 30 U/g			
	EIT: 30 minutes			
	EITem: 50°C			
	Antioxidant Activity			
	ABTS (mg TAE/g)		28.5 ± 0.8	
	DPPH (mg TAE/g)		0.61 ± 0.01	
	·OH scavenging activity (mg TAE/g)		0.74 ± 0.02	
	FRAP (mg TAE/g)		6.0 ± 0.9	

Table S10. The production cost of TPC and TFC by water-based and NDES9-based MEAE processes

	Raw materials	Amount of materials required for 1 kg solvent	Cost estimation (\$USD)	Total cost for 5 cycle used (\$USD)	Total weight of phenolic compounds
NDES9	Choline Chloride 90% (China)	0.388 kg	6.35	18.73	TFC: 21.59 g RE/ kg TPC: 14.86 g GAE/ kg
	Glycerine (China)	0.512 kg	4.031		
	Distilled water (Vietnam)	0.1 kg	0.152		
	Electricity (Vietnam)	74.5 kWh	8.2		
	AB-8 Macroporous resin (China)	0.8 kg	2.328		
Distilled water	Distilled water	5 L	7.6	9.3	TFC: 9.60 g RE/ kg TPC: 5.78 g GAE/ kg
	Electricity	15.41 kWh	1.7		