
**SYNTHESIS OF STRUCTURED TRYACYLGLYCEROLS (TAGS) ENRICHED
WITH OLEIC ACID FROM PALM STEARIN AND RAINBOW TROUT VISCERA
OIL USING ENZYMATIC CATALYSIS**

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Received: 02/05/2026; accepted: 05/13/2026; published online: 05/26/2026

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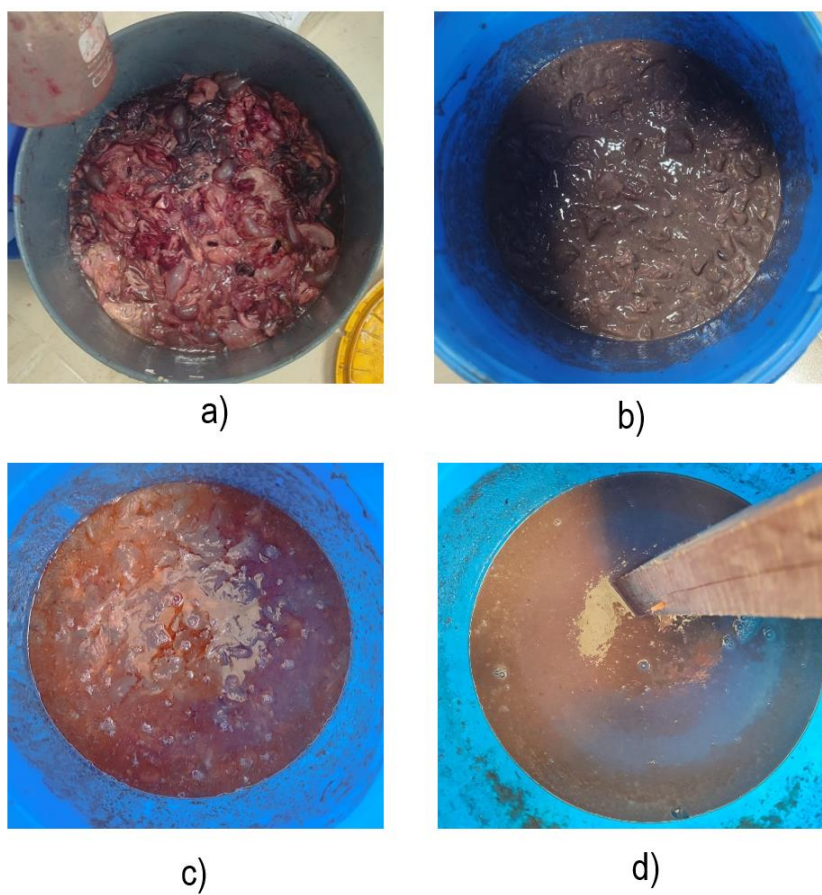


Figure 1S. *Physical changes of the viscera in chemical silage: (a) fresh viscera; (b) day 1; (c) day 2; (d) day 3*



Figure 2S. *Extraction of free fatty acids (FFA) from trout viscera oil*

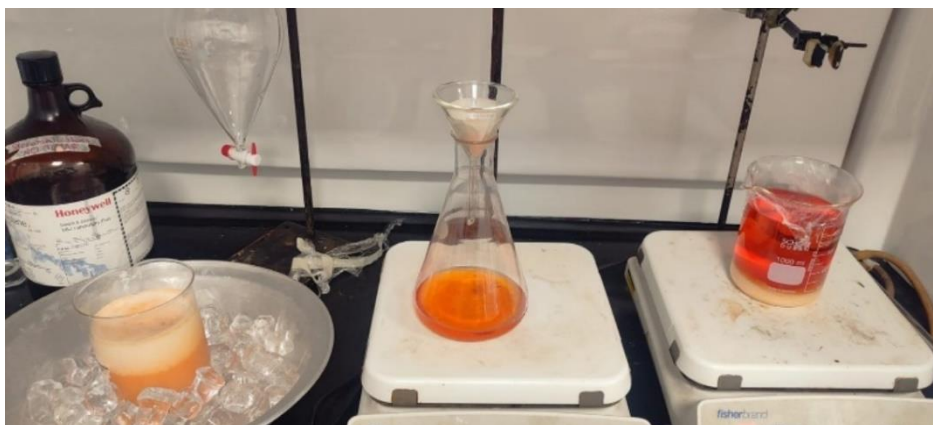


Figure 3S. Extraction process of unsaturated fatty acids (UFA) from trout viscera oil

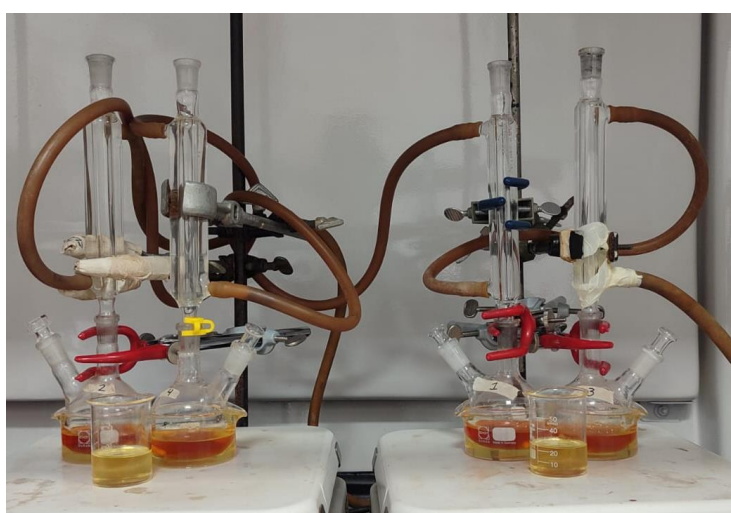


Figure 4S. Set-up performed for the design experiments

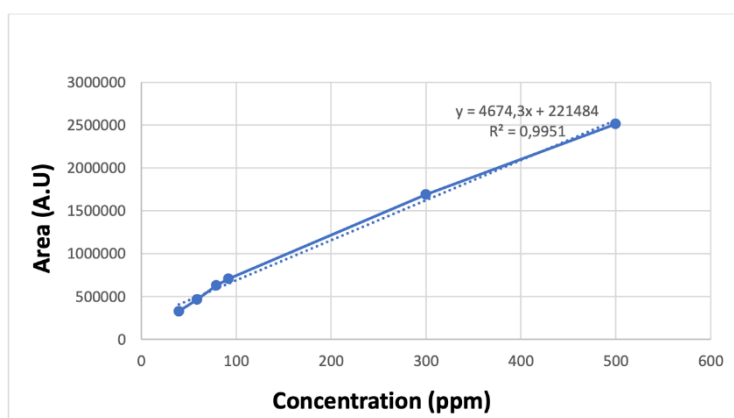


Figure 5S. Calibration curve for oleic acid

Table 1S. Quality analysis results of palm stearin oil

Parameter	Colombian regulations		Palm stearin (in this research)	Palm stearin by Bustamam <i>et al.</i> ¹
	Minimum	Maximum		
Apparent density / (g mL ⁻¹)	0.881	0.885	0.88365 ± 0.0016	0.8815 ± 0.0003
Refractive indices (ND 60°)	1.447	1.452	1.4483	1.4486 ± 0.0003
Saponification indices / (mg KOH g ⁻¹ of oil)	193	205	202.599 ± 0.044	–
Peroxide indices / (meqO kg ⁻¹)	≤ 5		3.859 ± 0.732	0.78 ± 1.44
Iodine indices / (g I ₂ per 100 g oil)	≤ 48		7.413 ± 0.156	34.3 ± 2.7
Unsaponifiable matter / (g kg ⁻¹)	≤ 9		0.374 ± 0.086	–

Table 2S. Quality analysis results of trout viscera oil

Parameter	Normative Codex Alimentarius	Trout oil extracted in this research	Trout oil extracted by Muñoz Velasco <i>et al.</i> ²
Peroxide indices / (meqO Kg ⁻¹)	≤ 5	0.9848 ± 0.001	0.88 ± 0.05
Acidity indices / (mg KOH g ⁻¹ of oil)	≤ 3	9.67 ± 0.156	2.05 ± 0.10

Table 3S. ANOVA data from the response surface for the parameters studied in the experimental design

Analysis of variance					
Source	DF	SS adjust.	MS adjust.	<i>F</i> -value	<i>p</i> -value
Model	9	5492.78	610.31	3.35	0.037
Linear	3	4619.57	1539.86	8.46	0.004
Temperature	1	15.63	15.63	0.09	0.775
Molar ratio	1	13.62	13.62	0.07	0.79
Time	1	4590.32	4590.32	25.22	0.001
Square	3	787.7	262.57	1.44	0.288
Temperature × temperature	1	426.22	426.22	2.34	0.157
Molar ratio × molar ratio	1	126.39	126.39	0.69	0.424
Time × time	1	378.66	378.66	2.08	0.18
Two-factor interaction	3	93.47	31.16	0.17	0.913
Temperature × molar ratio	1	0.35	0.35	0	0.966
Temperature × time	1	25.9	25.9	0.14	0.714
Molar ratio × time	1	67.22	67.22	0.37	0.557
Error	10	1820.22	182.02		
Residual	5	1743.93	348.79	22.86	0.002
Pure error	5	76.29	15.26		
Total	19	7313.01			
Model summary					
S	R-squared	Adjusted R-squared	Predicted R-squared		
13.4916	75.11%	52.71%	0.00%		

Coded coefficients					
Term	SE		<i>t</i> -value	<i>p</i> -value	VIF
	Coef.	Coef.			
Constant	46.63	5.57	8.37	0	
Temperature	−1.07	3.65	−0.29	0.775	1.01
Molar ratio	−1	3.66	−0.27	0.79	1.01
Time	18.39	3.66	5.02	0.001	1.01
Temperature × temperature	−5.51	3.6	−1.53	0.157	1.02
Molar ratio × molar ratio	−2.96	3.56	−0.83	0.424	1.02
Time × time	−5.13	3.56	−1.44	0.18	1.02
Temperature × molar ratio	0.21	4.75	0.04	0.966	1.01
Temperature × time	1.79	4.75	0.38	0.714	1.01
Molar ratio × time	−2.9	4.77	−0.61	0.557	1
Settings and diagnostics for unusual observations coefficients					
Obs	%insertion	Setting	Resid	Resid est.	
6	73.69	55.84	17.85	2.43	R
11	21.54	40.03	−18.49	−2.19	R
DF: degree of freedom; SS: sum of squares; MS adjust: mean square adjusted; S: standard deviation; R squared: R ² ; SE: standard error; VIF: variance inflation factor; Obs: observation; Resid: residual; Resid est: residual standard error.					

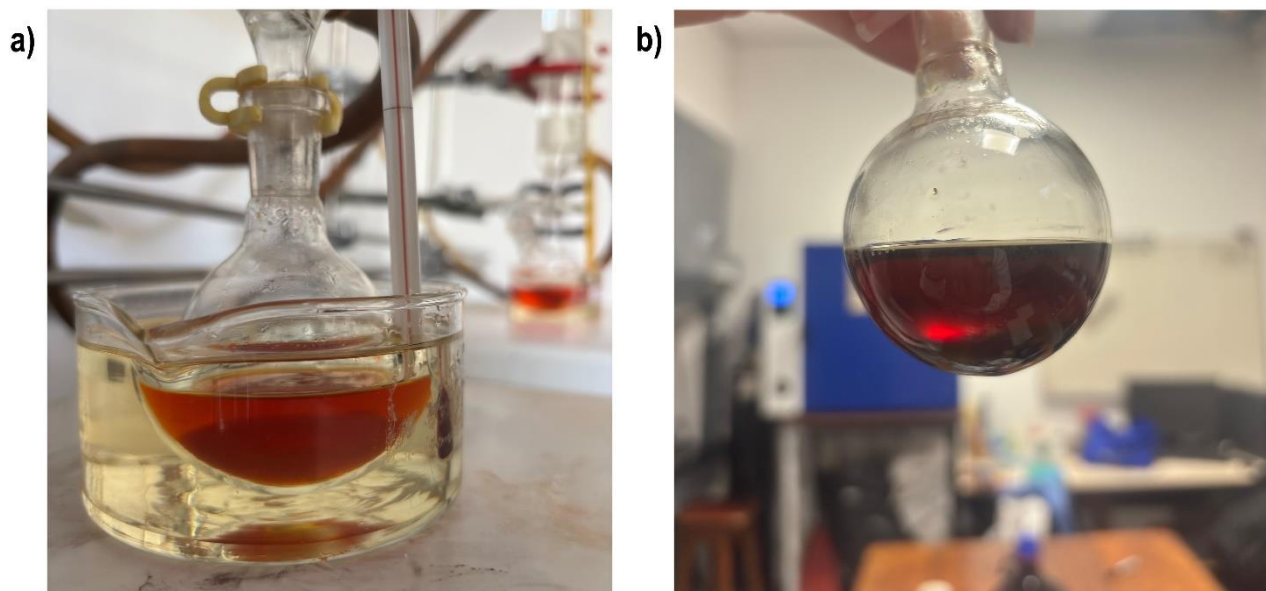


Figure 6S. Optimal point: (a) before starting the reaction; (b) after the reaction is finished

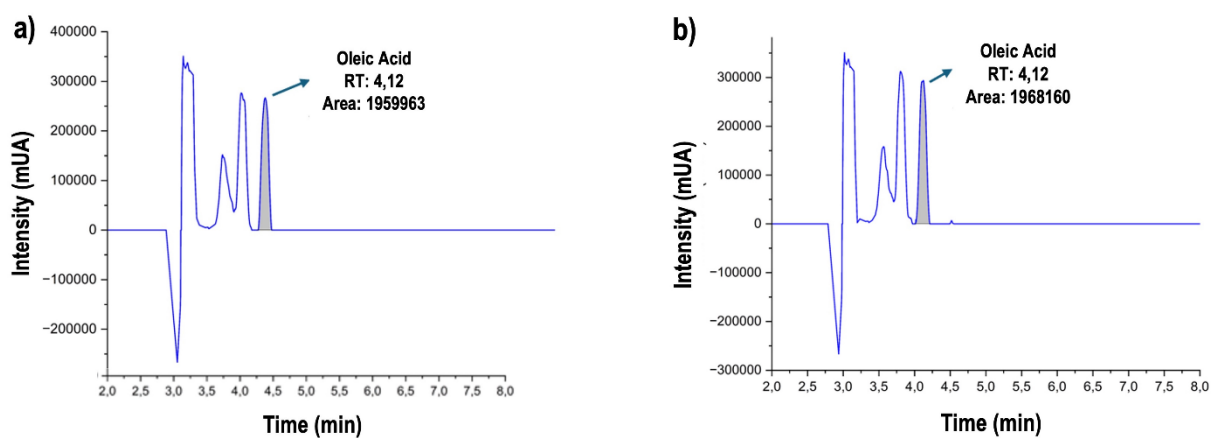


Figure 7S. HPLC chromatogram (a) optimal point 1, (b) optimal point replicate

Table 4S. Optimal point results

	Optimal point 1	Optimal point replicate
Temperature / °C	76	76
Time / h	29	29
Molar relation (stearine:UFA)	0.333	0.333
Area	1959963	1968160
IOA / %	68.40	68.25
IOA average / %	68.32 ± 0.0114	

UFA: unsaturated fatty acid; IOA: oleic acid insertion.

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