

Supporting Information

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Table S4. Experimental liquid–liquid equilibria data for the ternary systems containing waste oil biodiesel + methanol + glycerol at 323.15 K.

Table S1. The FAME composition of biodiesel produced from different feedstock.

Structure of Fatty acid methyl ester	Composition(wt%)										
	Sunflower oil	Palm oil	Cotton seed oil	Waste oil	Seasame oil	Sunflower oil	Soybean oil	Corn oil	Canola oi	Olive oil	Salad oil
C14:0	0.06	1.44	1.28	1.94	0.19	0.14	0.19	0.06	0.33	0.00	0.10
C16:0	10.87	26.95	24.04	16.83	11.42	7.91	11.09	11.96	9.35	11.60	6.90
C18:0	5.17	6.40	4.94	4.94	5.59	5.83	5.50	3.45	3.51	1.00	0.10
C20:0	2.55	0.72	0.41	0.49	0.65	0.47	0.60	0.91	0.79	3.10	4.00
C22:0	4.84	0.21	0.00	0.40	0.64	1.21	0.69	0.27	0.49	75.00	19.00
C24:0	2.47	0.14	0.00	0	0.21	0.38	0.22	0.33	0.22	7.80	69.10
Saturated fatty acid methyl ester	25.96	28.39	30.67	24.14	18.70	15.94	18.29	16.98	14.69	98.50	99.20
C16:1	0.16	0.42	2.15	2.03	0.22	0.19	0.26	0.29	0.44	0.60	0.30
C18:1	38.87	42.13	38.87	45.07	29.70	27.90	28.56	33.20	40.33	0.30	0.30
C20:1	1.63	0.34	0.61	1.02	0.45	0.32	0.41	0.66	3.05	0.00	0.00
C22:1	0.11	0.15	1.10	0.00	0	0	0.11	0.84	6.95	0.10	0.00
C18:2	32.09	18.20	23.32	24.82	41.30	52.96	42.95	45.8	25.25	0.00	0.00
C18:3	0.11	1.59	1.78	1.87	7.12	0.51	7.74	1.23	7.38	0.50	0.00
Unsaturated fatty acid methyl ester	72.97	62.83	67.83	74.81	78.79	81.88	80.03	82.02	83.40	1.50	0.60

Table S2. Experimental liquid–liquid equilibrium data for the ternary systems containing waste cooking oil biodiesel + methanol + glycerol at 303.15 K.

Temperature (K)	Raw material composition			Phase equilibrium data					
	(%)			Biodiesel rich phase			Glycerol rich phase		
	W1	W2	W3	W1	W2	W3	W1	W2	W3
303.15	0.2795	0.6203	0.1002	0.0004	0.9770	0.0226	0.8018	0.0015	0.1967
	0.2216	0.5791	0.1993	0.0009	0.9347	0.0644	0.5866	0.0064	0.4069
	0.2006	0.4993	0.3001	0.0012	0.9089	0.0899	0.4753	0.0098	0.5149
	0.1902	0.4103	0.3995	0.0025	0.9004	0.0971	0.3914	0.0163	0.5923
	0.1507	0.3495	0.4998	0.0010	0.8841	0.1149	0.2623	0.0295	0.7082

w₁ glycerol, w₂, waste oil biodiesel, w₃ methanol.

Table S3. liquid–liquid equilibria data for the ternary systems containing waste oil biodiesel + methanol + glycerol at 313.15 K.

Temperature (K)	Raw material composition			Phase equilibrium data					
	(%)			Biodiesel rich phase			Glycerol rich phase		
	W1	W2	W3	W1	W2	W3	W1	W2	W3
313.15	0.2802	0.6195	0.1003	0.0011	0.9786	0.0203	0.8010	0.0042	0.1948
	0.2203	0.5783	0.2014	0.0011	0.9509	0.0480	0.5903	0.0088	0.4009
	0.2024	0.4985	0.2991	0.0017	0.9278	0.0705	0.4551	0.0120	0.5329
	0.1908	0.4047	0.4044	0.0022	0.9078	0.0900	0.3662	0.0186	0.6152
	0.1502	0.3506	0.4992	0.0028	0.1267	0.8705	0.2841	0.0337	0.6802

w₁ glycerol, w₂, waste oil biodiesel, w₃ methanol.

Table S4. Experimental liquid–liquid equilibria data for the ternary systems containing waste oil biodiesel + methanol + glycerol at 323.15 K.

Temperature (K)	Raw material composition			Phase equilibrium data					
	(%)			Biodiesel rich phase			Glycerol rich phase		
	W1	W2	W3	W1	W2	W3	W1	W2	W3
323.15	0.2807	0.6193	0.1000	0.0021	0.9683	0.0296	0.8047	0.0088	0.1865
	0.2204	0.5796	0.1999	0.0039	0.9392	0.0568	0.6047	0.0181	0.3772
	0.1967	0.4892	0.3141	0.0065	0.8947	0.0989	0.4669	0.0238	0.5092
	0.1893	0.4105	0.4001	0.0080	0.8675	0.1244	0.3984	0.0272	0.5744
	0.1515	0.3498	0.4987	0.0099	0.8498	0.1403	0.3194	0.0363	0.6443

w₁ glycerol, w₂, waste oil biodiesel, w₃ methanol.