

**Supplementary Information**  
**Direct Reuse of Cu-Laden Wastewater for Non-Edible Oil Hydrolysis -  
Basic Mechanism of Metal Extraction and Fatty Acid Production**

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Table S1. Effects of water/acylglycerides molar ratio on Cu-catalyzed oil hydrolysis

(CuSO<sub>4</sub> concentration: 500 mg/kg, T = 225°C, t = 8 h)

Water/acylglycerides molar ratio	m <sub>oil</sub> (g)	m <sub>CuSO<sub>4</sub></sub> solution (g)	Reactor		FA yield (%)	Acylglycerides conversion (%)	Cu in oil (mg/kg oil)	Cu removal (%)
			volume loading (%)	Acid value (mg KOH/g)				
60:1	35.02	41.9	43.02	177.76±0.14	80.89	92.36	237.74±0.59	89.57
	48.12	57.6	59.14	180.29±0.18	82.04	93.64	209.67±1.13	78.63
90:1	27.49	49.4	42.47	169.83±0.16	77.26	92.96	269.2±4.44	67.92
	48.12	86.6	74.40	171.30±0.51	77.99	94.25	260.7±3.51	65.86

Table S2. (A) FA yield and (B) acylglycerides conversion of catalyzed and non-catalyzed systems (water to acylglycerides molar ratio = 30:1)

System	Temperature (°C)	time (h)	FA yield (%)	Acylglycerides conversion (%)
Catalyzed	200	10	77.66	83.09
	225	8	77.61	83.09
	250	6	77.55	83.08
Non-catalyzed	200	10	68.14	74.70
	225	8	69.56	75.74
	250	6	77.22	82.79
Control (Dilute H <sub>2</sub> SO <sub>4</sub> , pH 5.0)	200	10	74.37	80.57
	225	8	77.52	82.93
	250	6	77.54	83.03

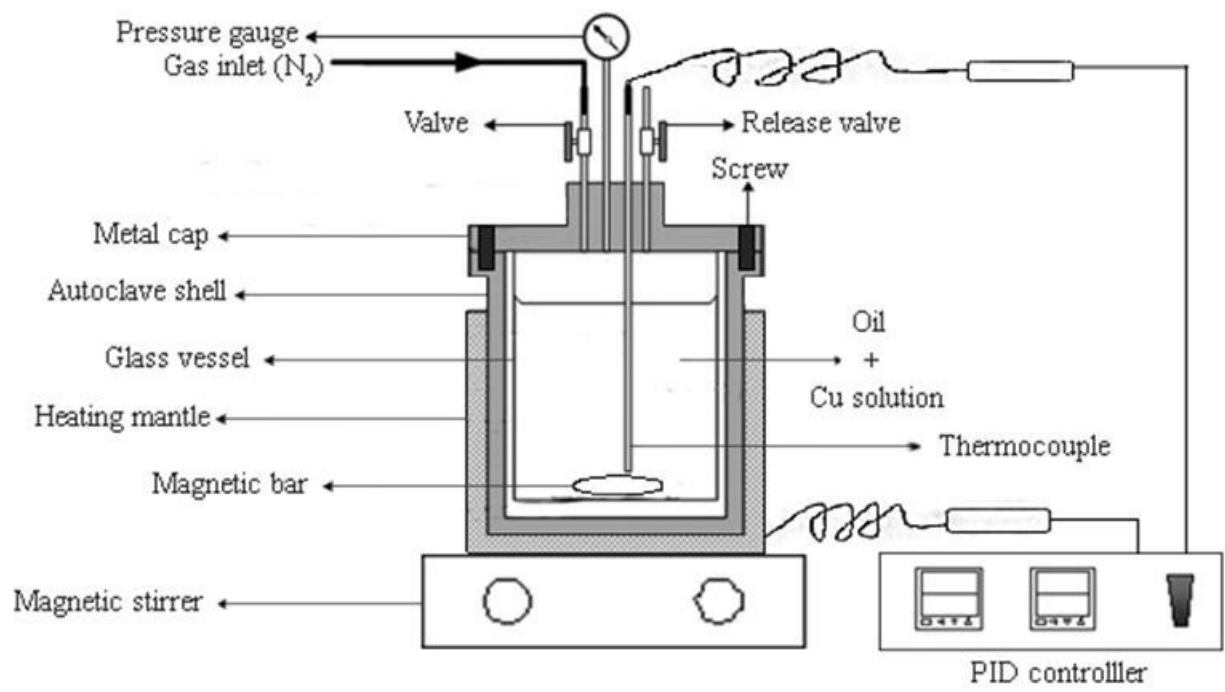


Figure S1. Schematic figure of reactor system

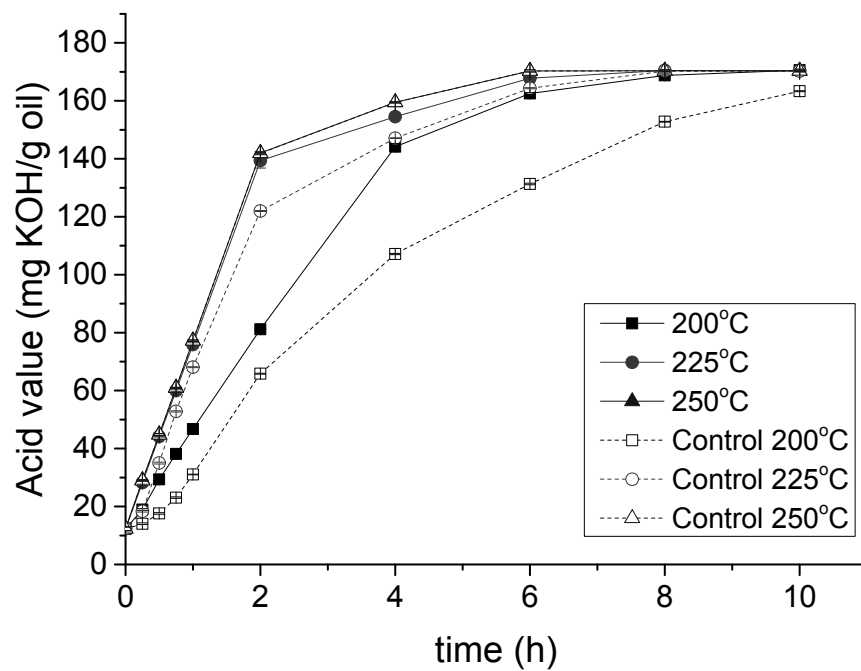
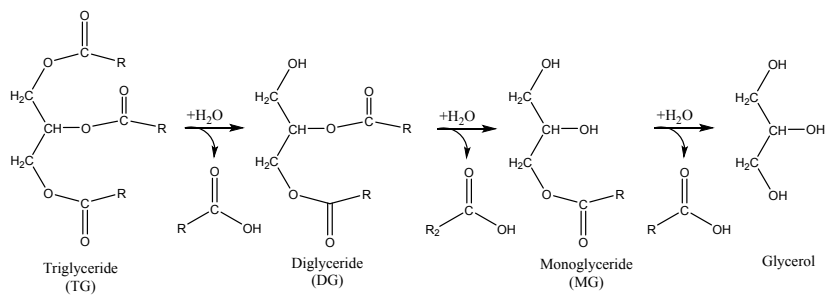
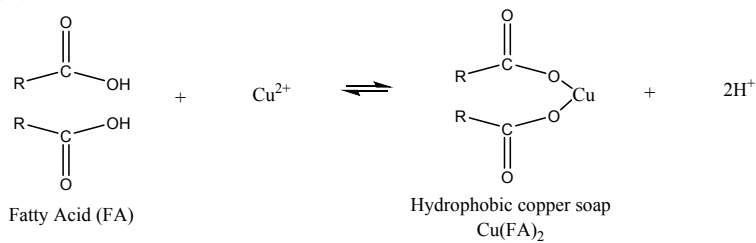


Figure S2. Effect of reaction temperature on acid value of synthetic copper wastewater-catalyzed hydrolysis of waste cooking oil (water to acylglycerides molar ratio = 30:1)

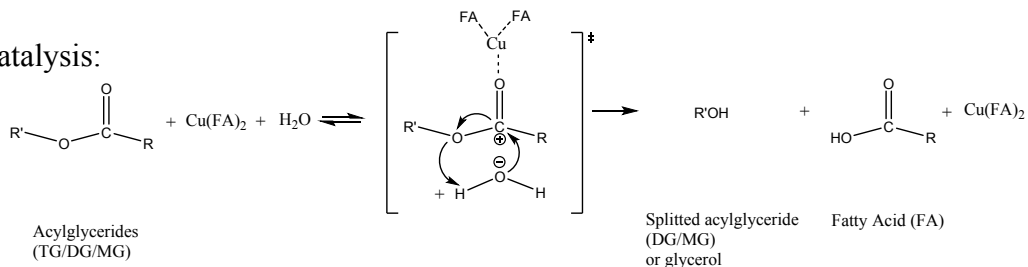
Hydrolysis of oil (3 steps):



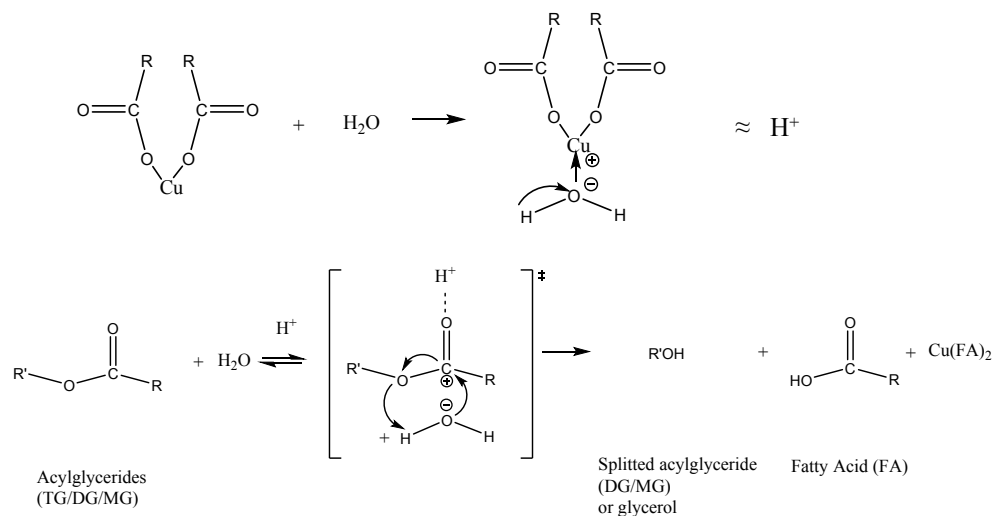
Copper soap formation:



Direct Cu soap catalysis:



(Lewis) acid catalysis:



R: alkyl chain

Figure S3. Mechanism of formation and catalytic ability of hydrophobic copper in waste cooking oil hydrolysis

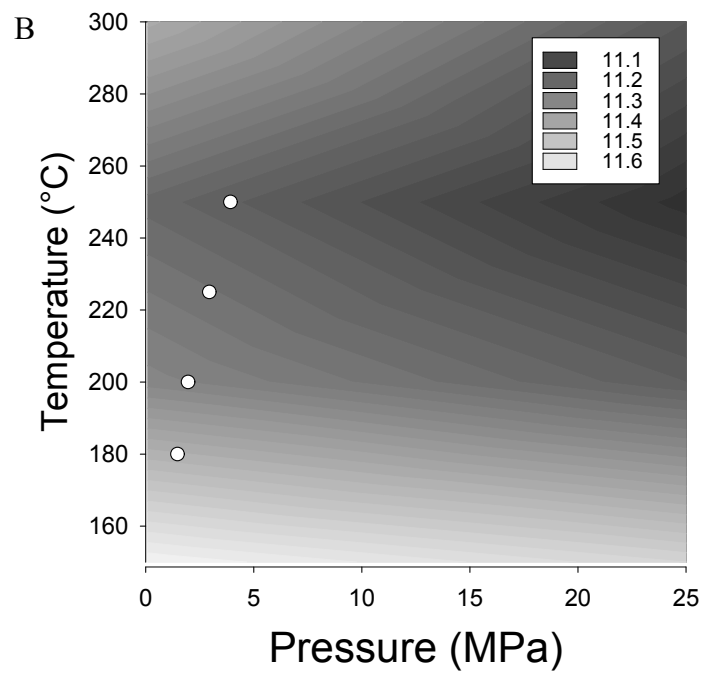
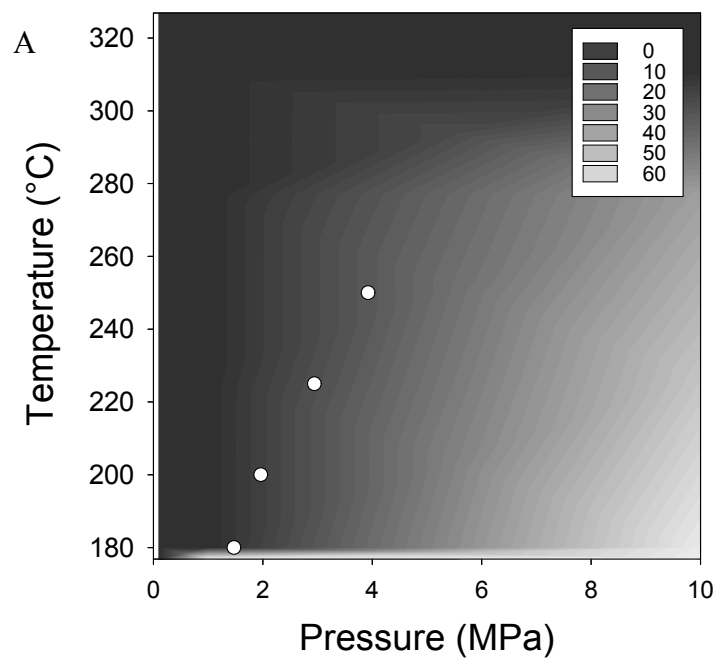


Figure S4. Effects of temperature and pressure on (A)  $\epsilon$  and (B)  $-\log(K_w)$  of water (plotted based on data from *CRC Handbook of Chemistry and Physics. 90th ed.* 2010, CRC Press, Florida)

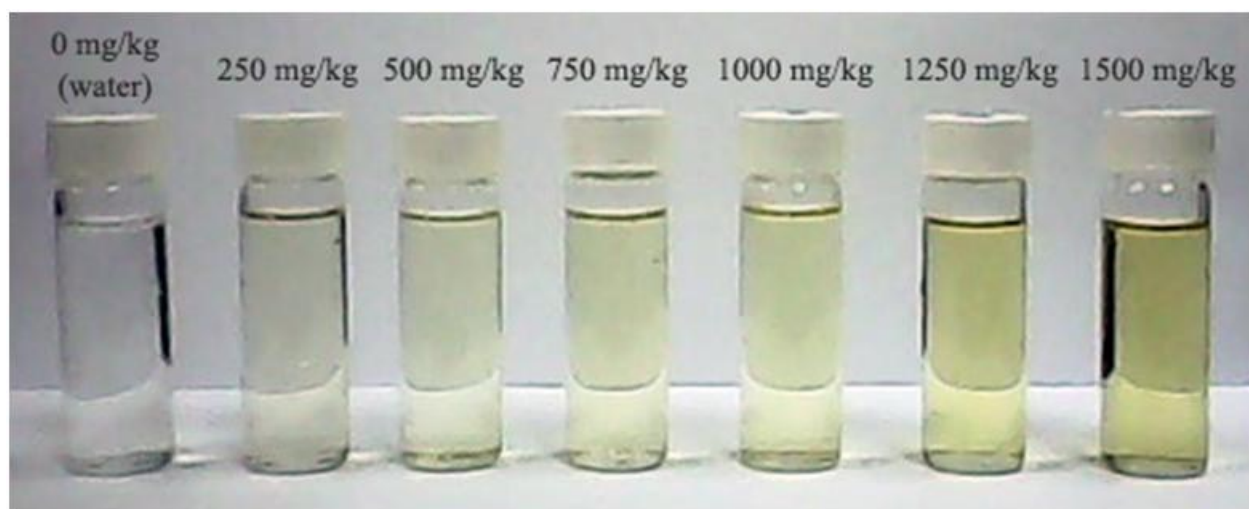


Figure S5. Aqueous phase taken after hydrolysis reaction using water and  $\text{CuSO}_4$  solution with various concentrations (0-1500 mg/kg)