

## **Supporting Information for**

### **Microwave-enhanced catalytic wet peroxide oxidation of quinoline: The influence of pH and H<sub>2</sub>O<sub>2</sub> dosage and identification of reactive oxygen species**

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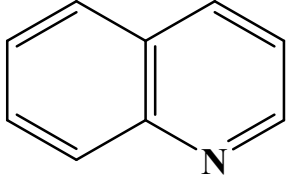
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## Table S1 Chemical structure and characteristics of quinoline

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Chemical structure	
$\lambda_{\max}$ (nm)	313
MW (g mol <sup>-1</sup> )	129.16
Chemical class	Analytical Reagents

## **Text S1 Preparation of catalyst**

Firstly, 40 g of carrier  $\gamma\text{-Al}_2\text{O}_3/\text{TiO}_2$  was added in 100 mL mixed solution to form solid-liquid mixed solution; secondly, the solid-liquid mixed solution was retained under shaking condition for 20 h in an oscillator followed by aging at 378 K for 16 h; thirdly, the as-synthesized products were dried at 383 K. Finally, the crystallization was carried out in a muffle furnace at a rate of 1 K/min to 773 K, holding for 5 h. Finally, a washing process was carried out by immersing 40 g of calcined samples in a 1000 ml of dilute  $\text{HNO}_3$  solution (pH 2 ~ 4) for 8 h to eliminate the loosely attached metal particles. The washed products were filtered and dried at 383 K for 1 h.

**Fig. S1 SEM images of the as-synthesized catalyst**

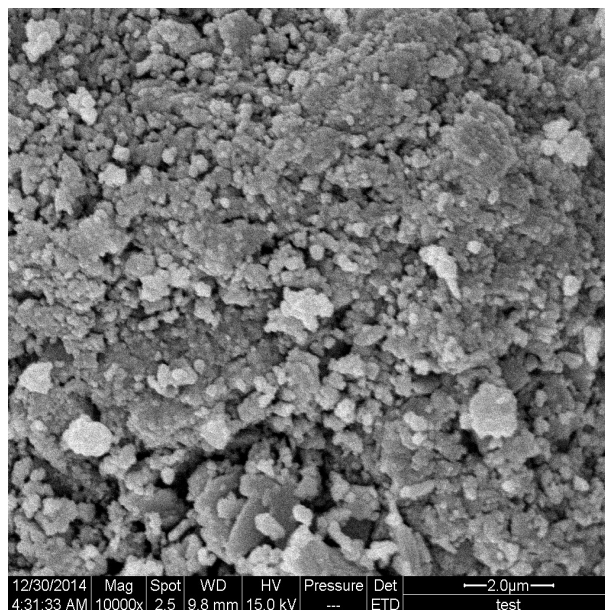


Fig. S1. SEM image of supported Cu/Ni bimetallic oxides.

**Fig. S2. EDX spectra and components ratio (inset) of supported Cu/Ni bimetallic oxides.**

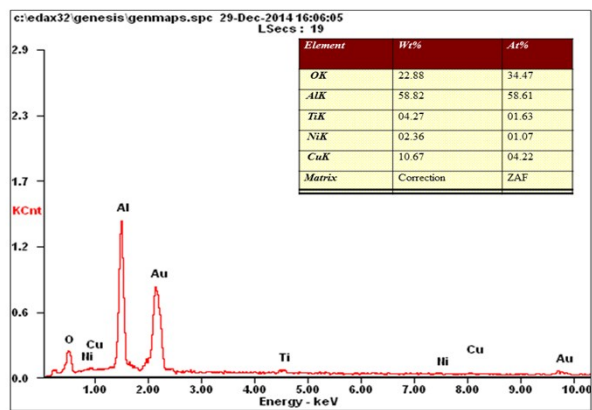


Figure S2. EDX spectra and components ratio (inset) of supported Cu/Ni bimetallic oxides.

**Fig. S3. XRD pattern of supported Cu/Ni-catalyst.**

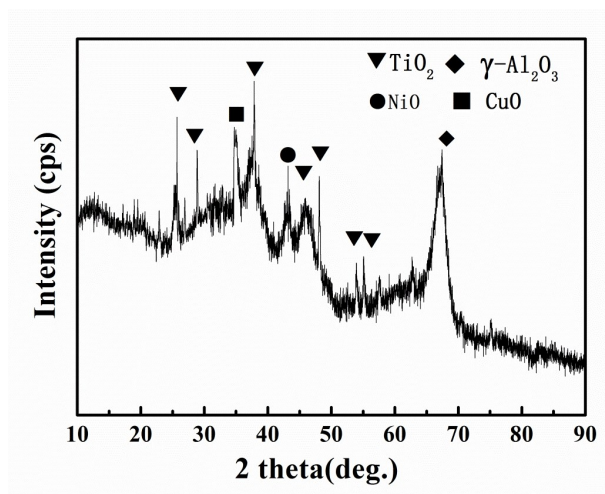


Fig. S3. XRD pattern of supported Cu/Ni-catalyst.

## Table S2 Consequences of AES analysis

Elemental analysis of the as-prepared catalysts was performed by the atomic absorption spectroscopy (AES) using an Analyst300, PerkinElmer. Before the chemical analysis, the as-samples were prepared using acid (a mixture of HNO<sub>3</sub> and HCl) digestion method under microwave irradiation. AES was also utilized to measure possible leaching of metal from the catalysts after each performed CWPO reaction under microwave irradiation.

Table S2 Consequences of AES analysis

<b>Sample</b>	<b>Al (wt %)</b>	<b>O (wt %)</b>	<b>Ti (wt %)</b>	<b>Cu (wt %)</b>	<b>Ni (wt %)</b>
$\gamma$ -Al <sub>2</sub> O <sub>3</sub> /TiO <sub>2</sub>	63.09	31.44	5.47	-	-
Bimetallic Cu/Ni-catalyst	58.31	22.51	4.18	12.11	2.89

## **Text S2 Degradation experiment**

To avoid the extreme conditions (high temperature and pressure) produced by the MW irradiation, and the buffer pool was linked with condenser tube which was connected to the atmosphere. Furthermore, the buffer pool was fixed in a constant-temperature bath, so the reaction is carried out in a mild temperature. 4 g/L Cu/Ni-catalyst were added into 500 mL quinoline aqueous solutions (100 mg/L). The reaction was initiated when MW was operated after H<sub>2</sub>O<sub>2</sub> was added. The reaction of CWPO was conducted following a similar procedure without MW operated.



### **Text S3 The calculated equation of H<sub>2</sub>O<sub>2</sub> utilization efficiency ( $\eta$ )**

The efficiency of utilization of H<sub>2</sub>O<sub>2</sub> ( $\eta$ ) is analyzed as the ratio of the amount of H<sub>2</sub>O<sub>2</sub> used for mineralization of quinoline ( $\Delta[\text{H}_2\text{O}_2]_{\text{mineralization}}$ ) with the total amount of the consumed H<sub>2</sub>O<sub>2</sub> ( $\Delta[\text{H}_2\text{O}_2]_{\text{decomposition}}$ ) in the reaction. The calculated equation was shown below :

$$\eta = \frac{\Delta[\text{H}_2\text{O}_2]_{\text{mineralization}}}{\Delta[\text{H}_2\text{O}_2]_{\text{decomposition}}} \quad (1)$$

**Fig.S4. Effect of initial pH on TOC abatement in heterogeneous MW-CWPO catalyzed by supported Cu/Ni bimetallic oxides.**

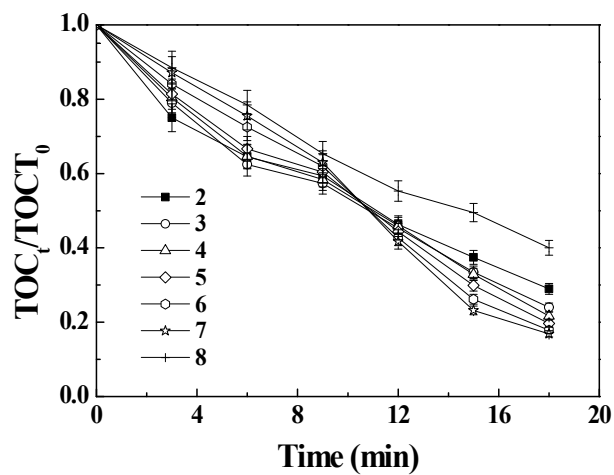


Fig.S4. Effect of initial pH on TOC abatement in heterogeneous MW-CWPO catalyzed by supported Cu/Ni bimetallic oxides.

**Fig.S5. Effect of H<sub>2</sub>O<sub>2</sub> dosage on quinoline mineralization in MW-CWPO catalyzed by supported Cu/Ni bimetallic oxides.**

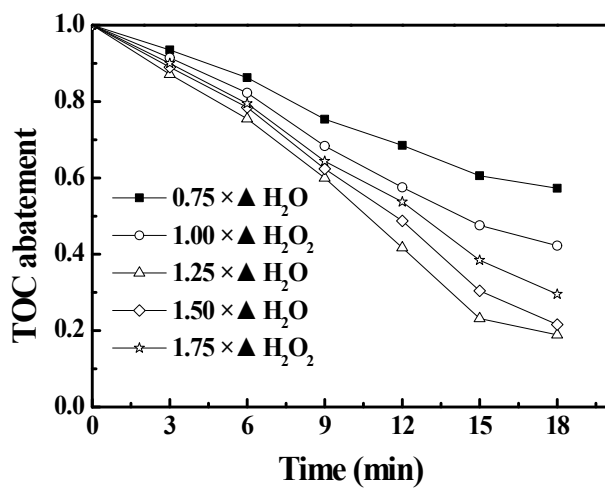


Fig.S5. Effect of H<sub>2</sub>O<sub>2</sub> dosage on quinoline mineralization in MW-CWPO catalyzed by supported Cu/Ni bimetallic oxides.

**Fig. S6. Reuse of Cu/Ni-catalyst after subsequent reaction**

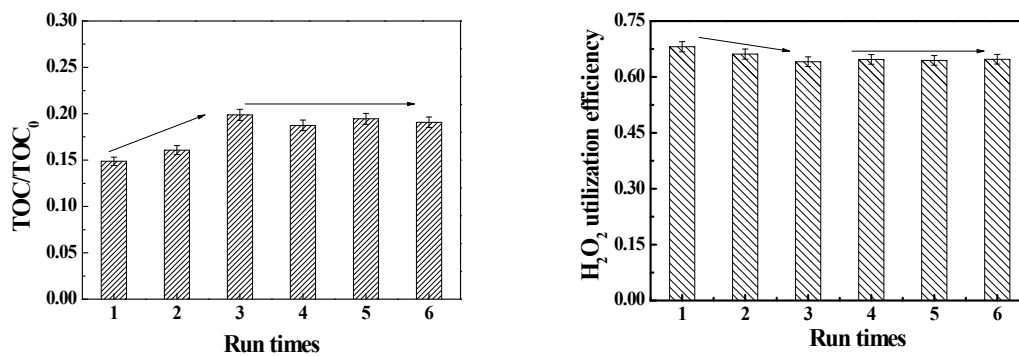


Fig. S6. Reuse of Cu/Ni-catalyst after subsequent reaction: (a) TOC abatement; (b) H<sub>2</sub>O<sub>2</sub> utilization efficiency. Reaction condition: H<sub>2</sub>O<sub>2</sub> dosage = 22.75 mmol/L, catalyst dosage = 4 g/L, reaction temperature = 333 K, MW = 500 W, initial quinoline concentration = 100 mg/L and pH = 7.