# Supporting material

# Microwave-hydrothermal synthesis of a novel recyclability, stability photocatalytic nanoreactor for orienting recognition and degrading of tetracycline

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## 1. Adsorption experiments.

The adsorption experiment was performed as following steps: 0.05 g photocatalyst was added to 100 ml TC solution (20 mg $L^{-1}$) and magnetic stirring 1 h in dark. During the stirring process, 6 ml suspension was extracted in a 10 min interval, and separated the suspension by magnet, then, and measured the concentration with the UV-vis spectrophotometer.

## 2. The photocatalytic activity test

The photocatalytic performance was evaluated by the degradation of TC, CIP, DMF under visible light (300 W xenon lamp, covered with a UV filter $\lambda > 420$ nm). After the suspension achieved adsorption-desorption equilibrium, turned on the light source, and 6 ml of the suspension was withdrawn in a 15 min interval, the absorbance of TC and CIP solutions was monitored by UV-vis spectrophotometer. And calculated the degradation rate (Dr) by $C_0$-$C/C_0$, $C_0$ was the concentration of TC (CIP, DFM) before illuminated, and C is the concentration of TC (CIP, DMF) after illuminated.

## 3. ICP-AES analysis

First, we have to prepare the standard solution of $Cd^{2+}$. And then used the solutions, which from the photocatalytic degradation experiments, and separated it by magnet, then centrifugal to confirm there were no sold. After that, the complete clarified solution was analyzed by inductively coupled plasma optical emission spectrometry (ICP-AES), and got the results.

## 4. HPLC-MS analysis

For the HPLC-MS experiments, first, we used the solution of initial TC solution (20mg $L^{-1}$), degradation of TC in 30 min and degradation of TC in 90 min. And then, separated then

supernatant solution by magnet, then centrifugal to confirm there were no sold, after that take 5 μl of the above solution in to mass spectrometer, and use the methanol as solvent.

## 5. EIS analysis

0.05 g of photocatalyst was scattered into ethanol (1.0 ml) and ethanol glycol (1.0 ml), then the dispersion was dip-coated on fluorine-doped tin oxide glass electrode (1 × 1 $cm^2$), and then the glass electrode was dried in air, and get the working electrodes. Then, the working electrodes were filled in $Na_2SO_4$ electrolyte. The platinum wire electrode and the Ag/AgCl electrode are used as counter electrode and reference electrode, respectively. The 150 W xenon lamp (47 $mW/cm^2$) was used as illumination source. In addition, the result of incident photon to current conversion efficiency was discussed by external quantum efficiency measurement, equipped with the electrochemical workstation (Newport/Oriel, QE-PV-SI).

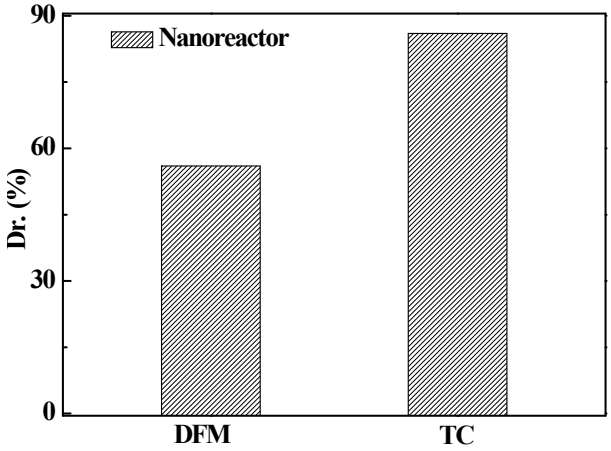


**Fig. S1** Degradation rate of DFM and TC by the nanoreactor

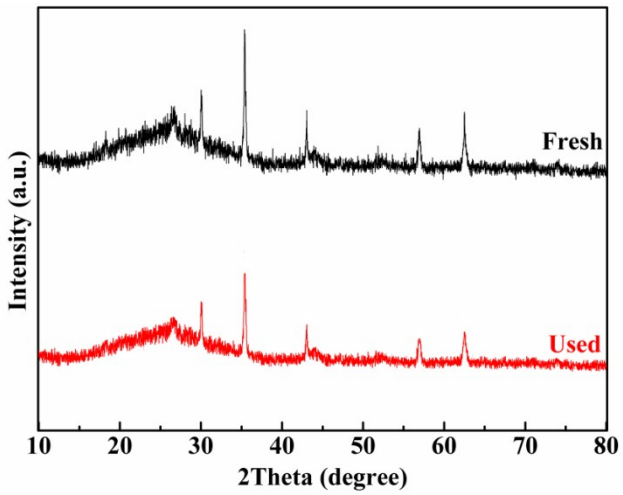


**Fig. S2** XRD patterns of the fresh and used nanoreactor

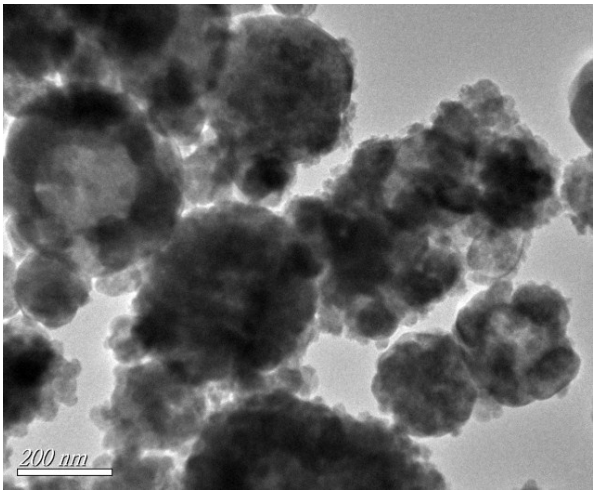


**Fig. S3** TEM images of the nanoreactor after five recycle experiments