**Supplementary materials**

**Facile synthesis of Cu-doped manganese oxide octahedral molecular sieve for the efficient degradation of sulfamethoxazole viaperoxymonosulfate activation**

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1. Calculation of the steady state concentration of ROS

**Hydroxyl radicals (·OH)** [64]**:** A probe method was used to quantify **·**OH. The concentration of **·**OH was determined using terephthalic acid (TA) as a probe agent. Specifically, TA can react with **·**OH to form 2-hydroxyterephthalic acid (HTA), which can be measured and quantified using a fluorescence emission spectrometer (SHIMADZU, RF-6000A) at an excitation wavelength of 315 nm and an emission wavelength of 425 nm.

**Superoxide radicals (·O2-)** [65]**:** The amount of **·**O2- was determined by p-nitro-blue tetrazolium chloride (NBT) method. Specifically, 1 mol of NBT could be reduced by 4 mol of **·**O2- to generate formazan. Thus, the amount of **·**O2- could be calculated based on the variations of reduced NBT Amount:

Cumulative [**·**O2-]t= ([NBT]0 - [NBT]t)×4 S(1)

where the initial concentration of NBT is 2×10−5 mol L−1. The changes of NBT concentration were monitored by ultraviolet spectrophotometer at max = 259 nm.

**Singlet oxygen (1O2)** [66]**:** The amount of 1O2 was quantified by monitoring the decrease of furfuryl alcohol (FFA), which was used as probes for 1O2, 1O2 generation was quantified by the loss of FFA added at an initial concentration of around 0.5 mM. At this concentration, FAA is specific to 1O2.The remaining FFA in the filtered samples was analyzed by an HPLC equipped with a C18 column and a UV detector at 215 nm. The mobile phase comprised 40% methyl alcohol and 60% water and was run at 1 mL/min.

For the reaction between FFA and 1O2, the rate of FFA degradation can be expressed as:

[1O2] S(2)

Assume 1O2 concentration reaches steady state:

[1O2]ss= S(3)

where *kex* is the experimentally measured quasi-first order rate of FFA degradation.

Steady state 1O2 concentration can be determined as:

[1O2]ss= S(4)

The *kFFA* value is 1.2×108 mol−1 s−1.

2. Physical characterization of nanocatalysts (Figs. S1–S10, Table S1)



**Fig. S1.**  **Corresponding kinetics plots of M-OMS-2. *k* is degradation reaction rate constant.**



**Fig. S2.**  **XPS spectra of O 1s of M-OMS-2.**



**Fig. S3.** **Stability of Cu-OMS-2 in sulfamethoxazole degradation.**



**Fig. S4.** **XRD of 5th recycled and fresh Cu-OMS-2.**



**Fig. S5**.  **SEM images of 5th recycled Cu-OMS-2.**



**Fig. S6. (a) The relative contribution of different free radicals and quantitative detection of (b) ·OH, (c) ·O2- and (d) 1O2 corresponding steady-state over different systems.**



**Fig. S7.** **The TOC of SMX before and after degraded by Cu-OMS-2/PMS system.**



**Fig. S8. HRMS of sulfamethoxazole**



**Fig. S9. HRMS of degraded sulfamethoxazole solution.**



**Fig. S10. (a) Effects of FFA on SMX degradation in Cu-OMS-2/PMS/Cl- process; (b) The degradation of FFA; (c) The reaction kinetics of FFA degradation.**

**Table S1.** **Percentage of O 1s based on the XPS results of M-OMS-2 samples**

|  |  |  |
| --- | --- | --- |
| Sample | O 1s | |
| Olatt / % | Oads / % |
| Co-OMS-2 | 67.99 | 32.01 |
| Ni-OMS-2 | 55.36 | 44.64 |
| Fe-OMS-2 | 61.92 | 38.08 |
| Cu-OMS-2 | 61.46 | 38.54 |