Supporting Information

Title

Synthesis of morphology controllable Fe_3O_4 nanoparticles/hydrogel magnetic nanocomposite inspired by magnetotactic bacteria and its application in H_2O_2 detection

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1. Determination of swelling degree of hydrogels (*q*):

Ordinarily, *q* is measured as the degree of swelling of the hydrogel in pure water from its equilibrated state to its dried state, which is denoted as:[43]

$$q = \frac{W_{wet}}{W_{dry}} \times 100\% \quad \text{(S1)}$$

W_{wet} and W_{dry} is the weight of hydrogel in its equilibrated state in water and dried state after drying in oven for 24 h, respectively. Each value was averaged over at least three parallel measurements.

In our case, the weight of Fe_3O_4 nanoparticles residing in PNaAMPS hydrogel is eliminated from the total weight of the magnetic hydrogel and the calculation of *q* is as follows:

$$q = \frac{W_{wet} - W_{Fe_3O_4}}{W_{dry} - W_{Fe_3O_4}} \times 100\% \quad \text{(S2)}$$

Here the weight of Fe_3O_4 nanoparticles can be obtained from results of TG analysis.

2. Morphology evolution of Fe_3O_4 nanoparticles *in situ* synthesized in poly(PNaAMPS-*co*-PDMAAm) hydrogel:

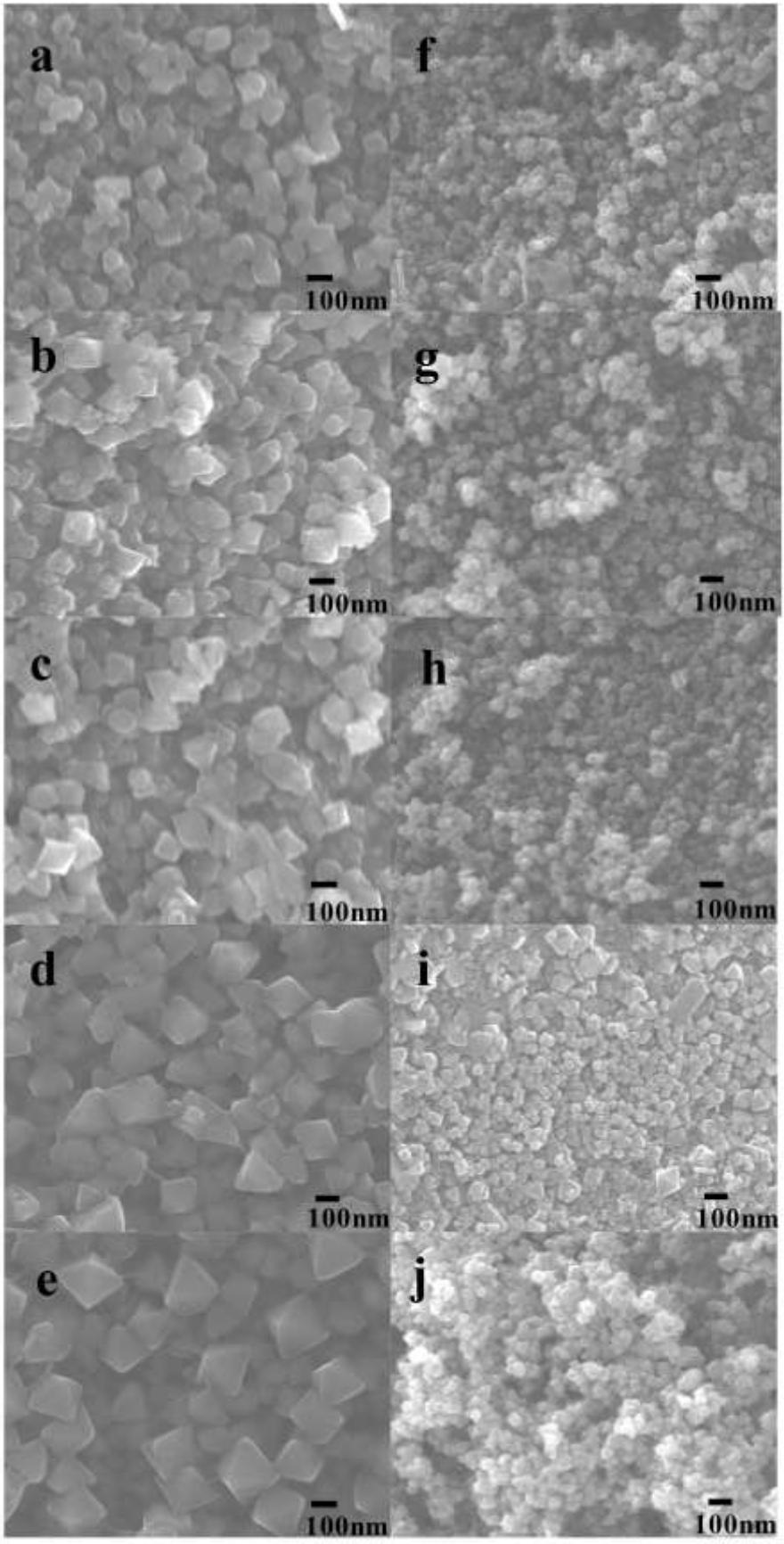

Figure S1. SEM images of Fe_3O_4 nanoparticles in situ synthesized in poly(PNaAMPS-*co*-PDMAAm) hydrogel with (a-e) *C* = 10 mol % and (f-j) *C* = 15

mol %; and the ratio of NaAMPS and DMAAm was (a, f) 5:5, (b, g) 6:4, (c, h) 7:3, (d, i) 8:2, (e, j) 9:1.

3. Determination of the content of Fe_3O_4 nanoparticles in dehydrated magnetic nanocomposites:

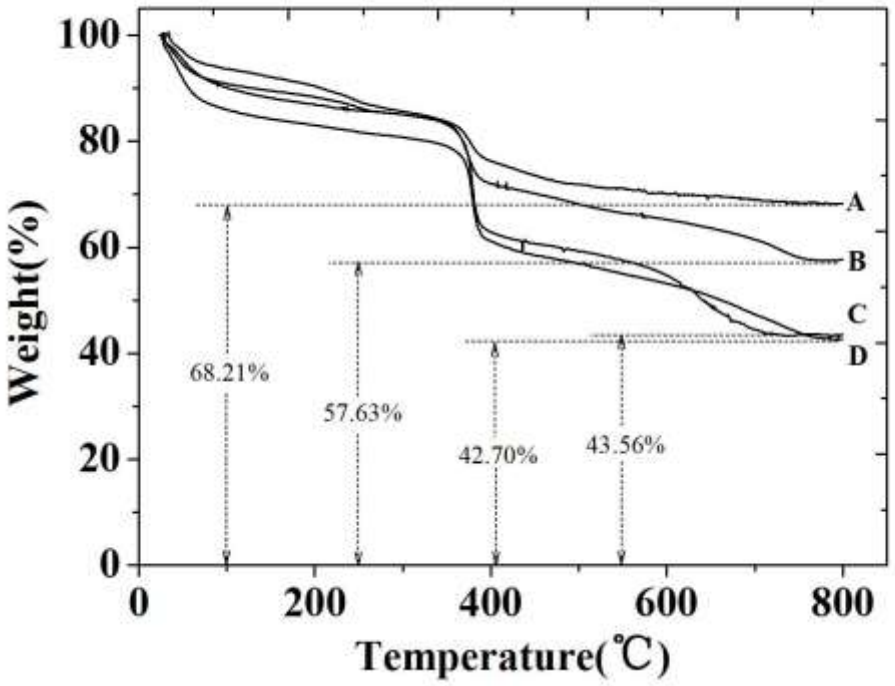

Figure S2. Thermo gravimetric curves of dehydrated magnetic hydrogels. The crosslinking concentration *C* = 1 mol% (A), 4 mol% (B), 10 mol%(C) and 15 mol% (D), respectively.

The first weight loss stage occurs below 100 °C, which can be ascribed to the evaporation of water molecules from hydrogel. The second weight loss stage occurs at around 370 °C, as a consequence of the decomposition of organic polymer. When increasing the temperature above 370 °C, the weight of the sample gradually decreases and levels off. These level off values can be used to determine the loading capacity of

Fe_3O_4 nanoparticles, which are 68.2%, 57.6%, 43.6% and 42.7% for the hydrogels with *C* = 1 mol%, 4 mol%, 10 mol% and 15 mol%, respectively.

4. The magnetic nanocomposites used for catalytic experiment and H_2O_2 detection:

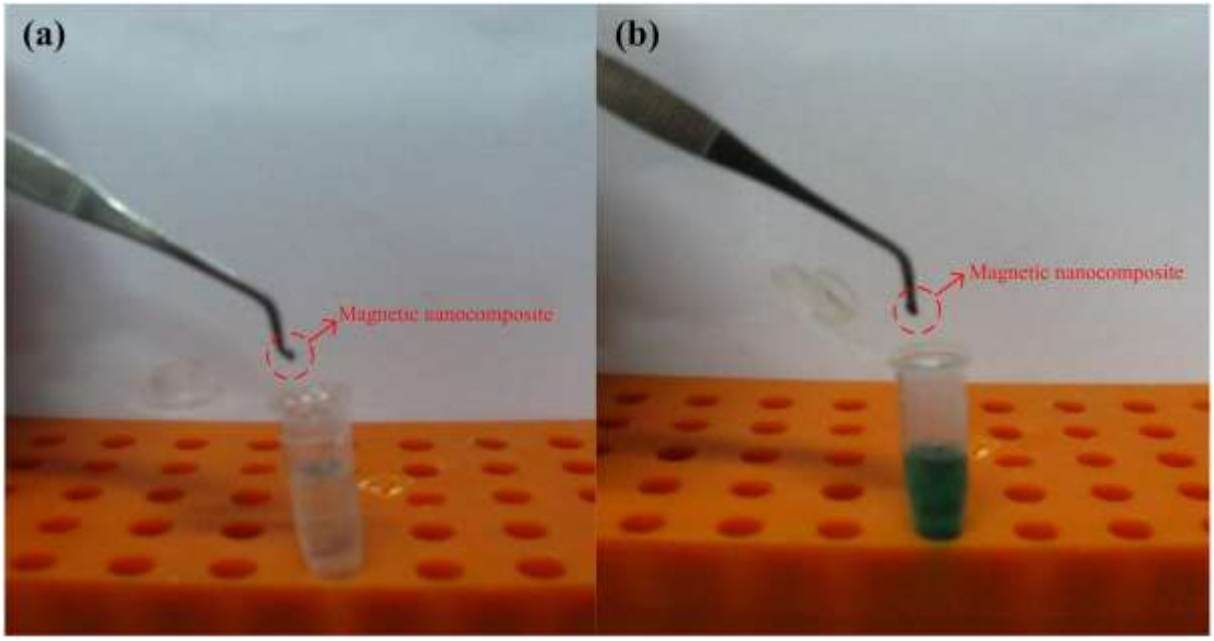

Figure S3. Photographs of the magnetic nanocomposites and the substrate solution: (a) before reaction, (b) after reaction.

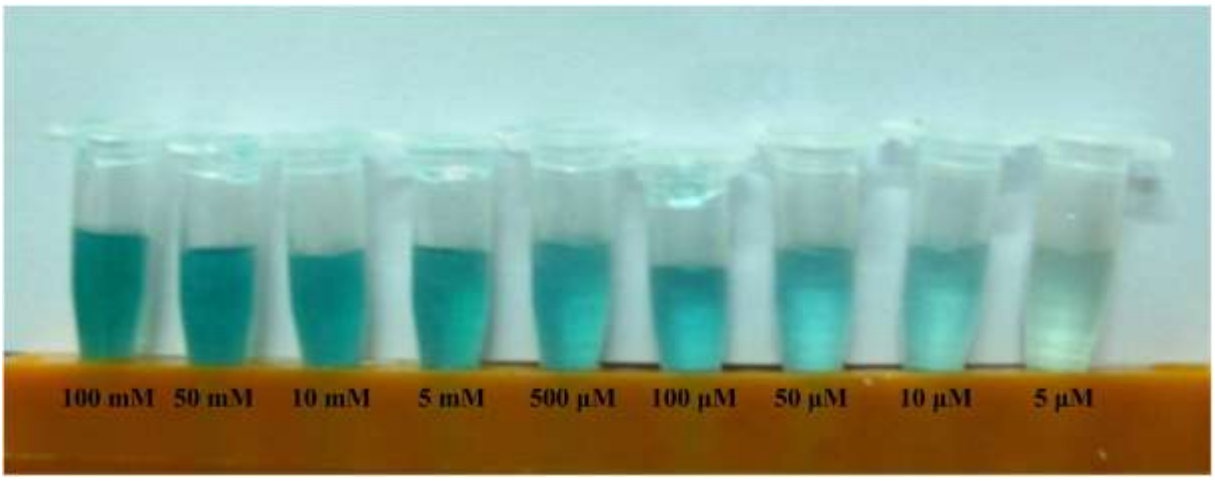

Figure S4. Photographs of the substrate solution with various H_2O_2 concentrations.