Supporting Information

# Iron Magnetic Nanoparticle-Induced ROS Generation from Catechol-Containing Microgel for Environmental and Biomedical Applications

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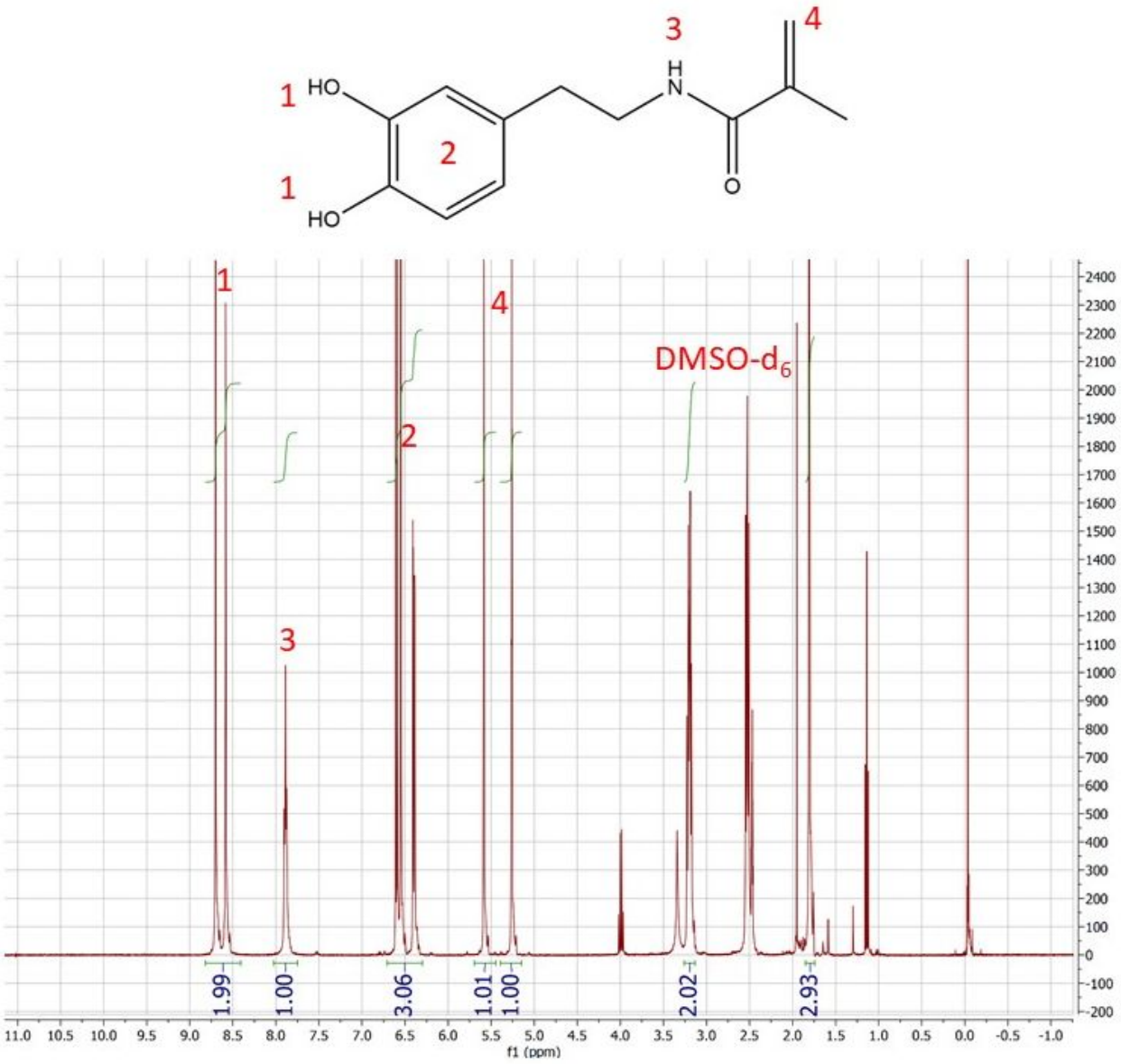


**Figure S1.** NMR spectrum of dopamine methacrylamide (DMA).

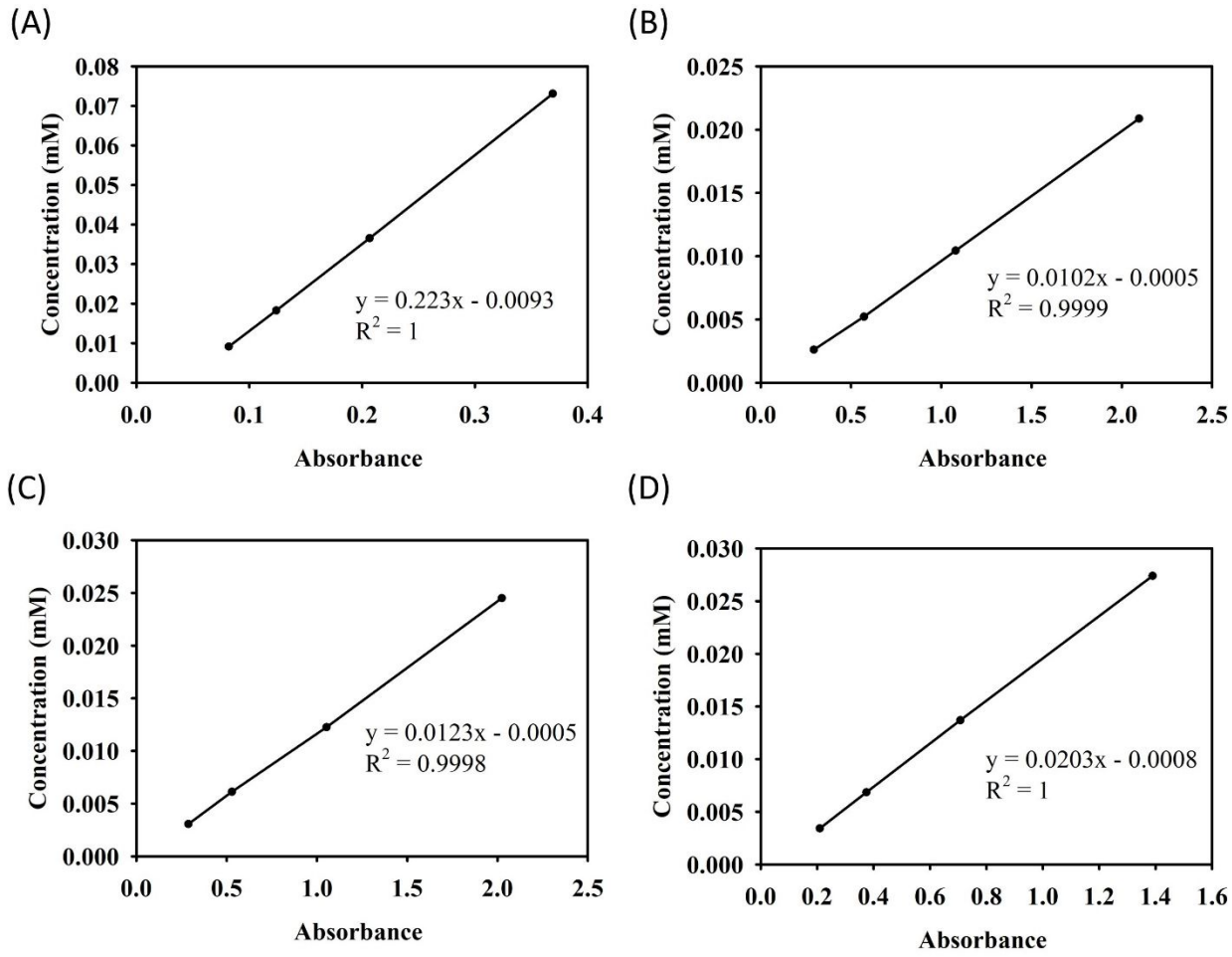


**Figure S2.** Concentration standard curve of (A) Alizarin Red S (peak at 422 nm), (B) Rhodamine B (peak at 536 nm), (C) Crystal Violet (peak at 591 nm), and (D) Malachite Green (peak at 617 nm) determined using UV-vis spectroscopy.

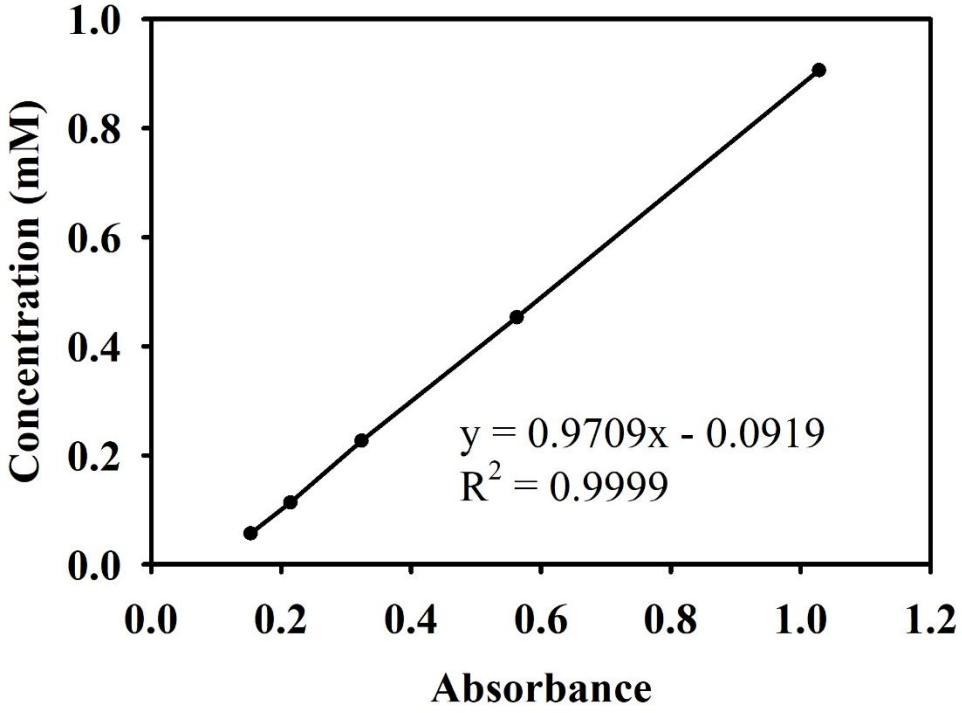


**Figure S3.** Concentration standard curve of ciprofloxacin determined using determined using UV-vis spectroscopy at a wavelength of 275 nm.

**Table S1.** Average particle sizes of microgels in dried and swollen states ($n$ = 5).

| | DMA content in microgels | | |
|---|---|---|---|
| | 0 mol% | 20 mol% | 40 mol% |
| Dried | 53.7 ± 3.2 μm | 23.9 ± 2.5 μm | 27.3 ± 4.7 μm |
| Swollen | 66.6 ± 6.0 μm | 51.3 ± 1.2 μm | 52.1 ± 1.7 μm |

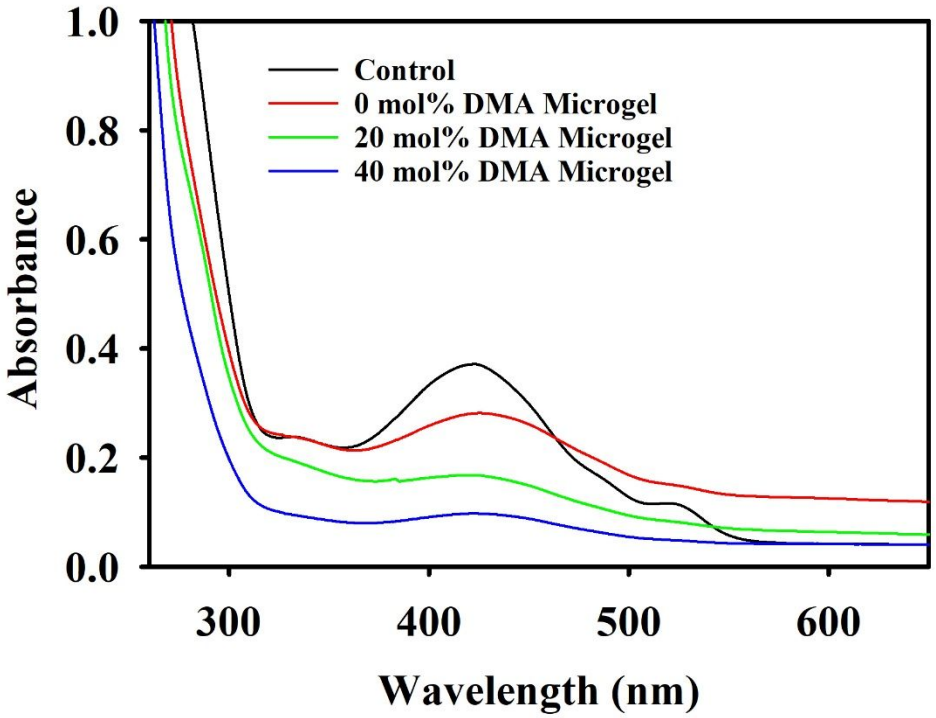


**Figure S4.** UV-vis spectra of Alizarin Red S (150 mg/mL) incubated with FeMNP (5 mg/mL) and microgel containing 0, 20, and 40 mol% of DMA (25 mg/mL) for 24 hours at 37 ˚C. Control is a mixture of Alizarin Red S and FeMNP incubated at the same concentration for 24 hours at 37 ˚C.

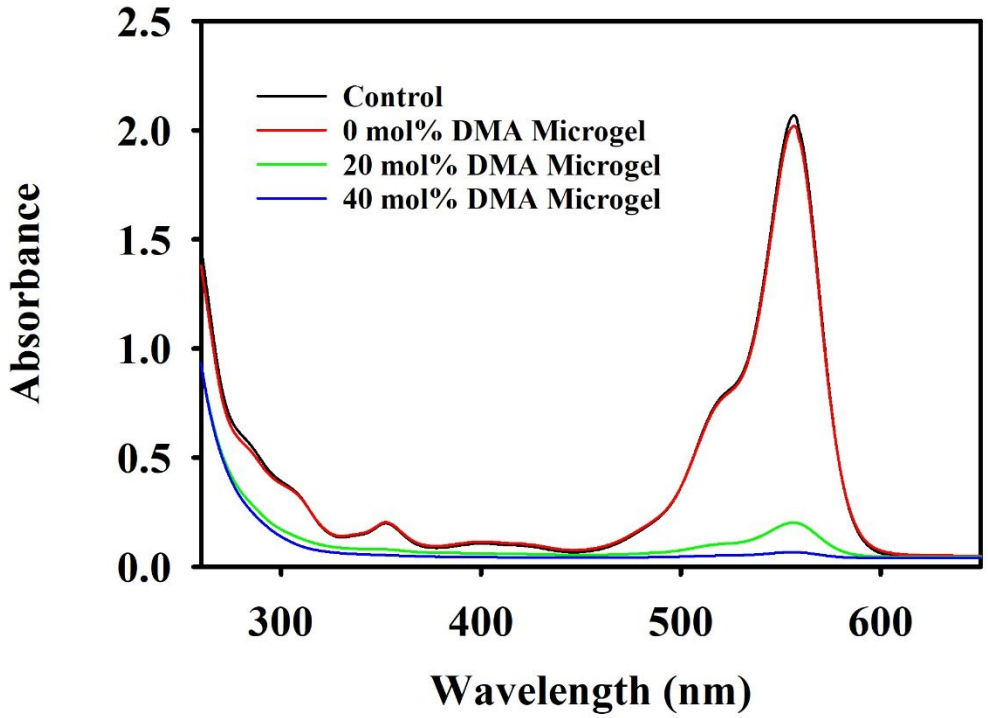


**Figure S5.** UV-vis spectra of Rhodamine B (150 mg/mL) incubated with FeMNP (5 mg/mL) and microgel containing 0, 20, and 40 mol% of DMA (25 mg/mL) for 24 hours at 37 ˚C. Control is a mixture of Rhodamine B and FeMNP incubated at the same concentration for 24 hours at 37 ˚C.

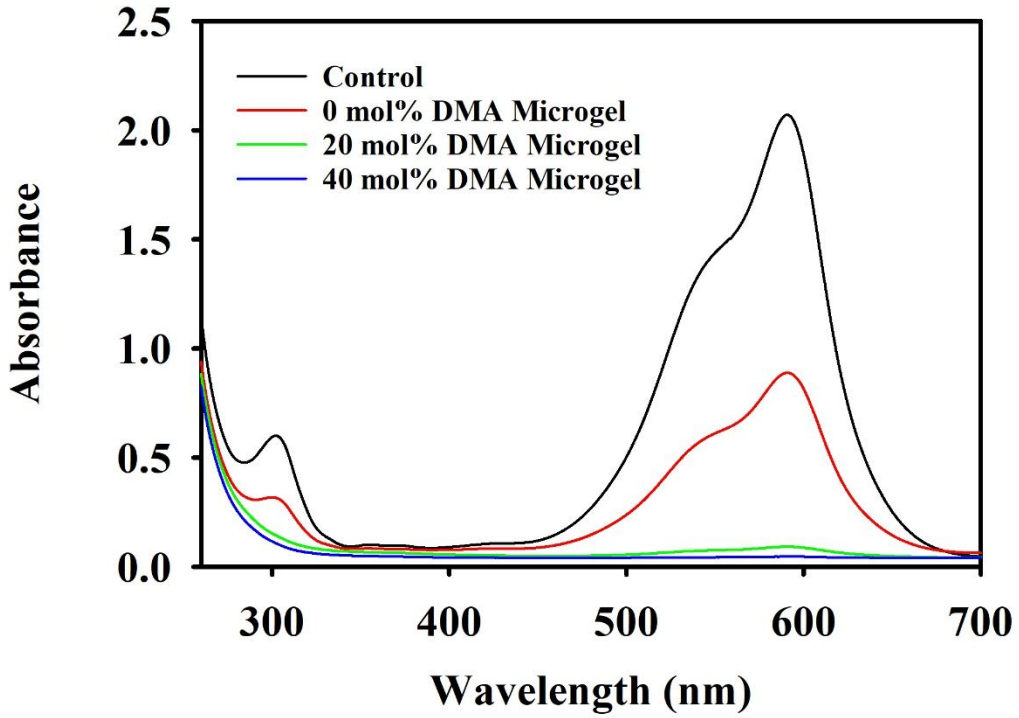


**Figure S6.** UV-vis spectra of Crystal Violet (150 mg/mL) incubated with FeMNP (5 mg/mL) and microgel containing 0, 20, and 40 mol% of DMA (25 mg/mL) for 24 hours at 37 ˚C. Control is a mixture of Crystal Violet and FeMNP incubated at the same concentration for 24 hours at 37 ˚C.

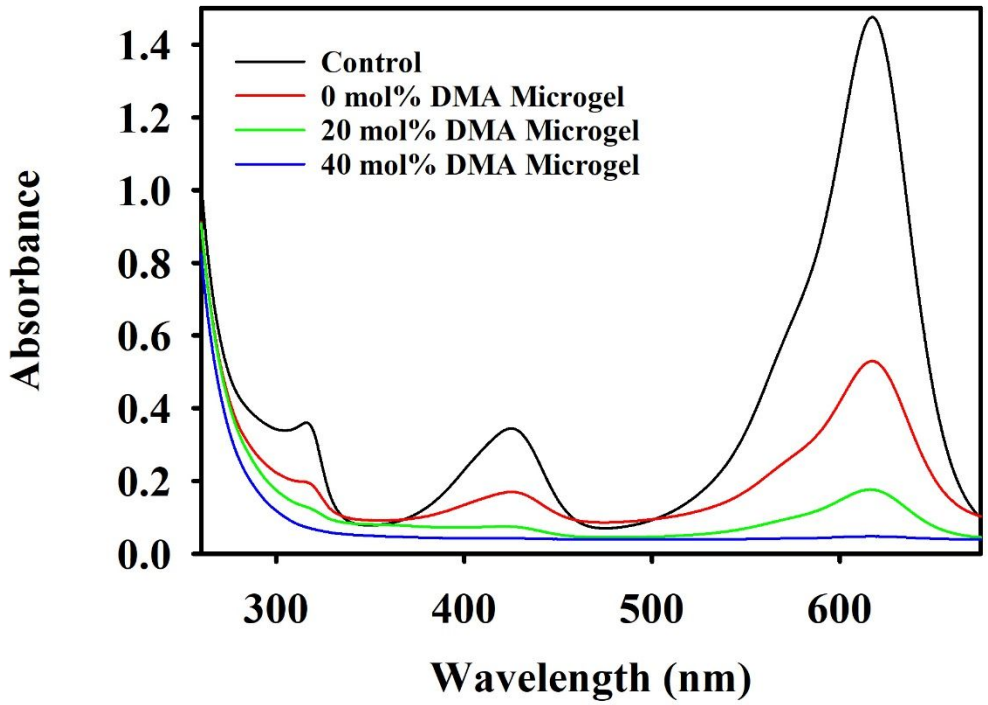


**Figure S7.** UV-vis spectra of Malachite Green (150 mg/mL) incubated with FeMNP (5 mg/mL) and microgel containing 0, 20, and 40 mol% of DMA (25 mg/mL) for 24 hours at 37 ˚C. Control is a mixture of Malachite Green and FeMNP incubated at the same concentration for 24 hours at 37 ˚C.

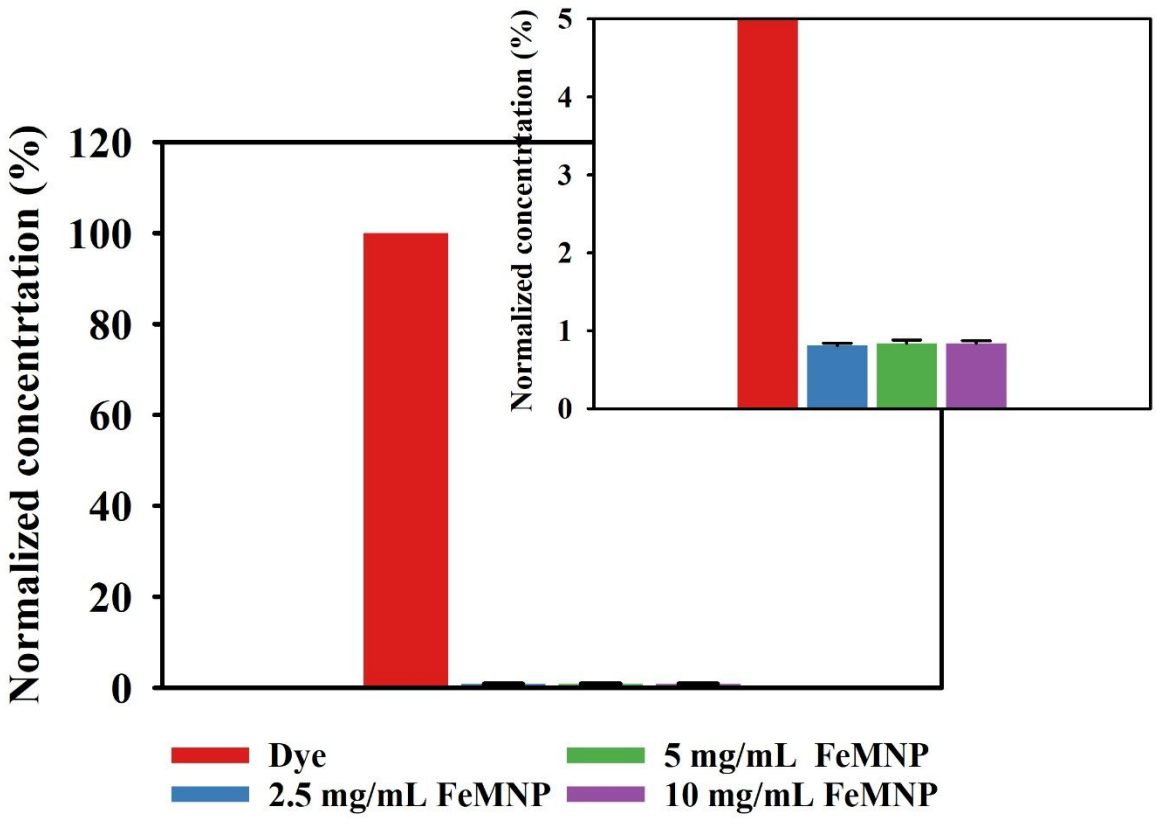


**Figure S8.** Normalized concentration of Rhodamine B after incubating with 40 mol% DMA microgels (25 mg/mL) and FeMNP (2.5-10 mg/mL) at pH 3 for 24 hours. The concentration was normalized to the starting dye concentration of 150 mg/mL. The inset shows the zoomed-in figure of normalized Rhodamine B dye concentration in the normalized concentration between 0-5 %. The dye has greater than 5%. The other groups show normalized concentration around 1 %.

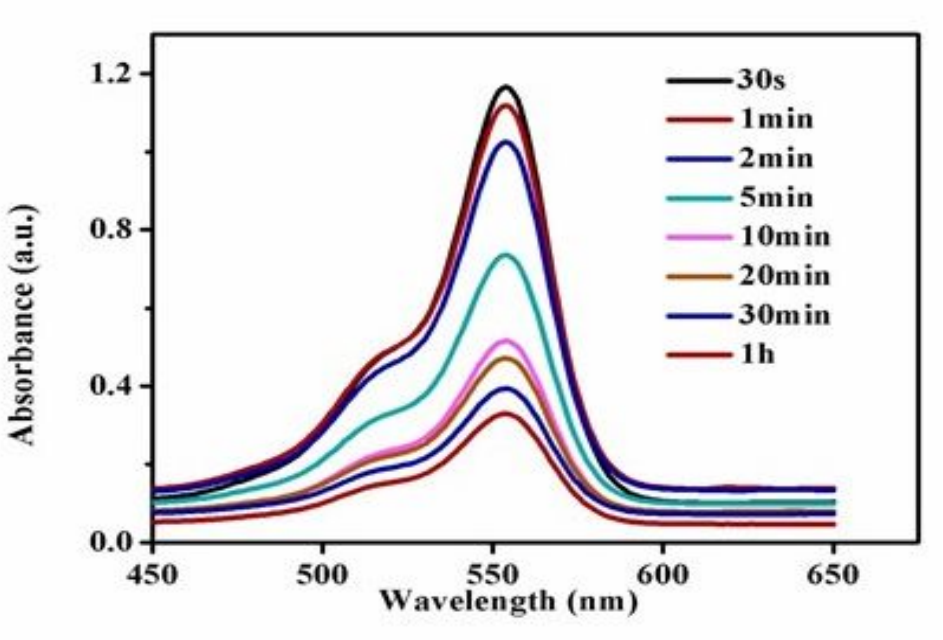


**Figure S9.** Changes in the UV-vis spectra of Rhodamine B (150 mg/mL) within 1 hour of mixing with FeMNP (5 mg/mL) and microgel containing 40 mol% DMA (25 mg/mL) at pH 3 and 37 ˚C.

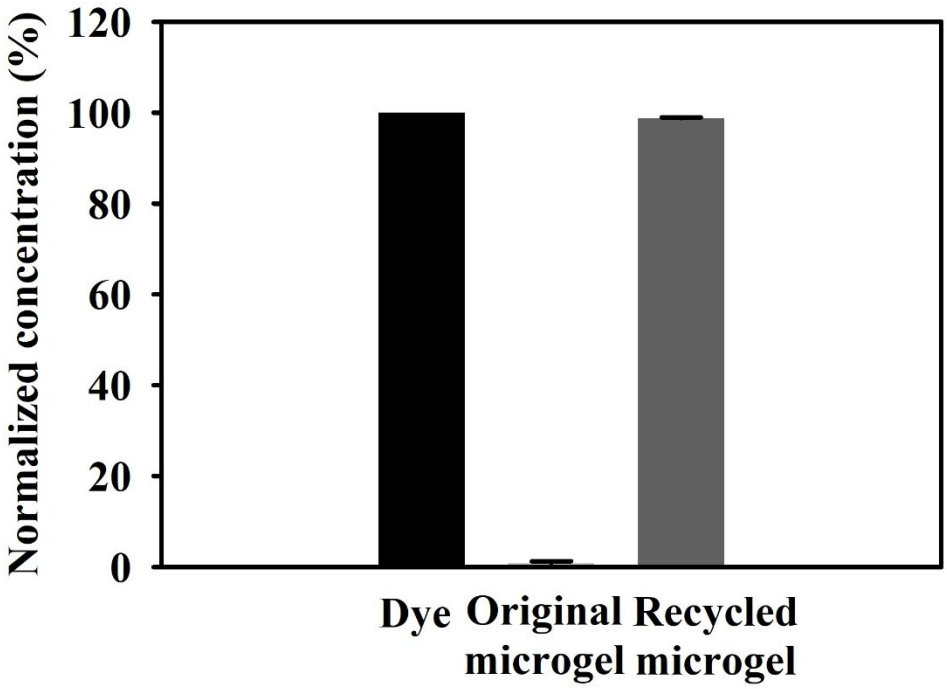


**Figure S10.** Normalized concentration of Rhodamine B after incubating with original and recycled 40 mol% DMA microgels (25 mg/mL) and FeMNP (5 mg/mL) at pH 3 for 24 hours. The original microgel is the as prepared microgel. The recycled microgel is recovered after a round of dye degradation. The microgel was collected by filtration and washed with pH 3 water and acetone.

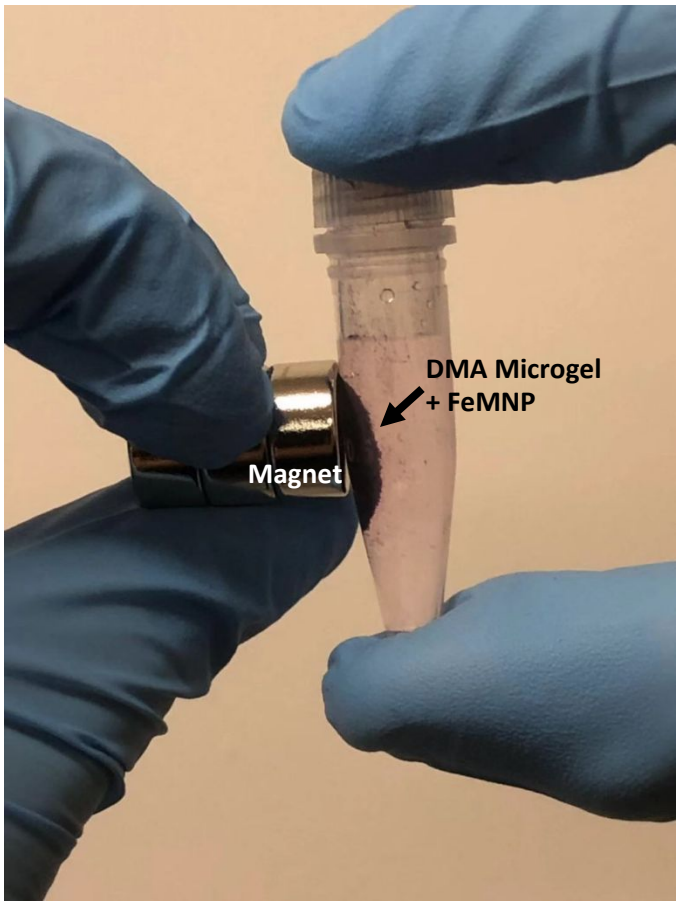


**Figure S11.** 40 mol% DMA microgels become magnetic after incubated with FeMNP (arrow) and accumulated to the magnet held by the hand on the left.

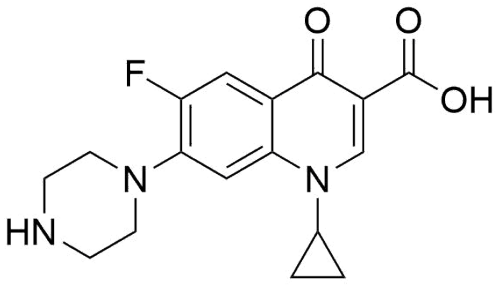


**Figure S12.** Chemical structure of ciprofloxacin.

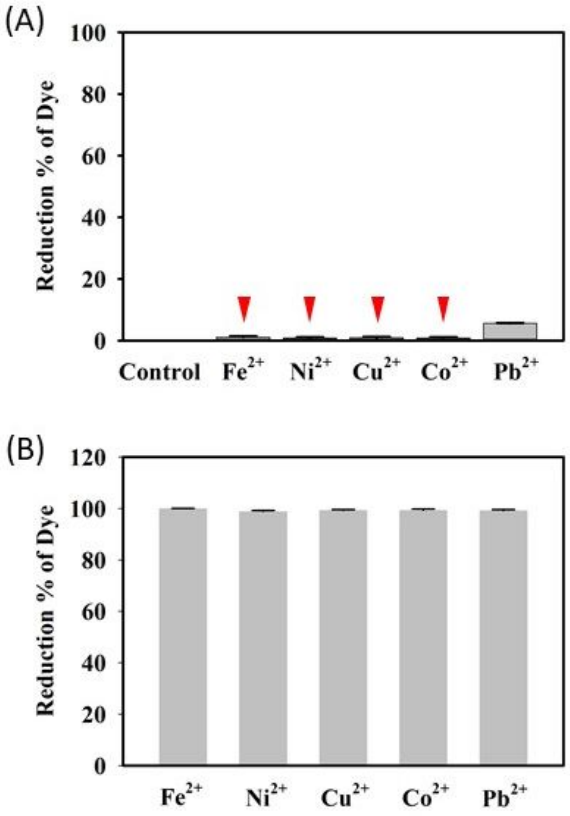


**Figure S13.** Percent reduction of Rhodamine B (150 mg/mL) after 24-hour incubation with (A) 20 mM of different metal ions and (B) a mixture of 40 mol% DMA microgel (25 mg/mL) and 20 mM of the different metal ions. The control in panel (A) is Rhodamine B (150 mg/mL) under the same incubation time and condition without any metal ions. The percent reduction of control is 0 %. Red triangles in panel (A) indicates trials with extremely low values.

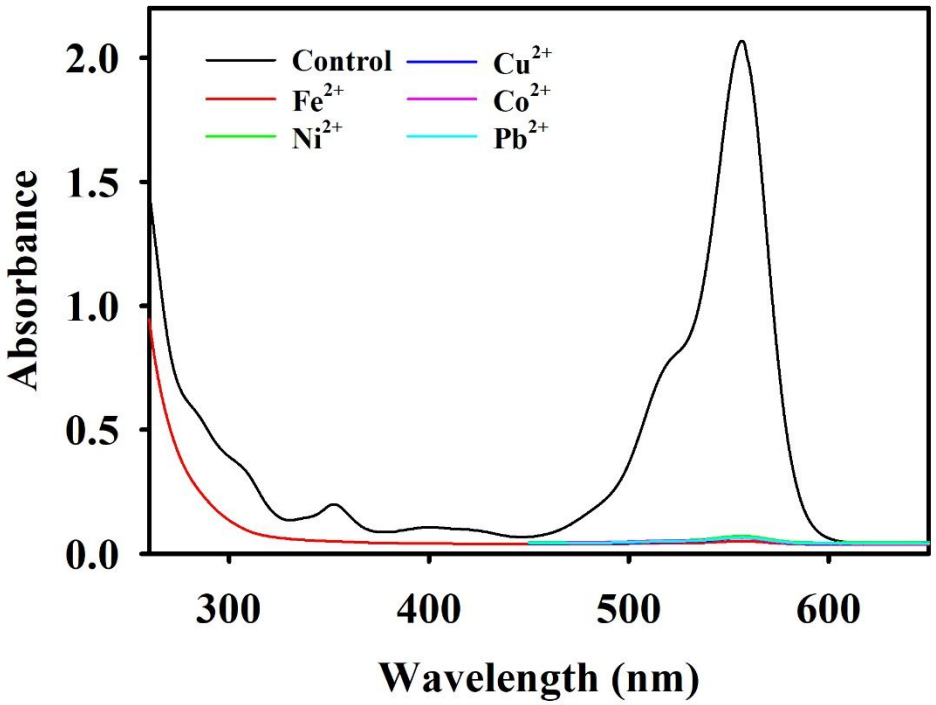


**Figure S14.** UV-vis spectra of Rhodamine B (150 mg/mL) after incubating with 40 mol% DMA microgel (25 mg/mL) and different metal ions ($Fe^{2+}$, $Ni^{2+}$, $Cu^{2+}$, $Co^{2+}$, $Pb^{2+}$, 20 mM) for 24 hours at pH 3 and 37 ˚C.

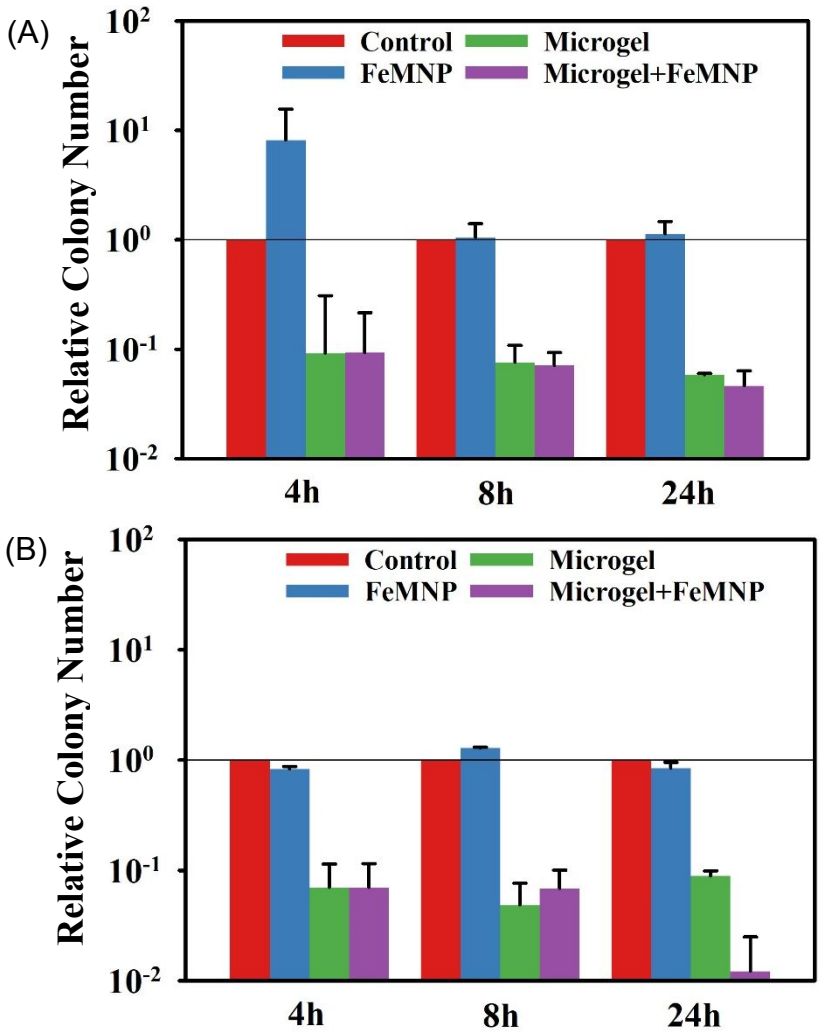


**Figure S15.** Relative colony number of (A) *S. aureus* and (B) *E. coli* after incubating with FeMNP (2 mg/mL), 40 mol% DMA microgel (10 mg/ mL), or the combination of the two for 4, 8, and 24 hours. The untreated control was the bacteria incubated in broth over the same periods.

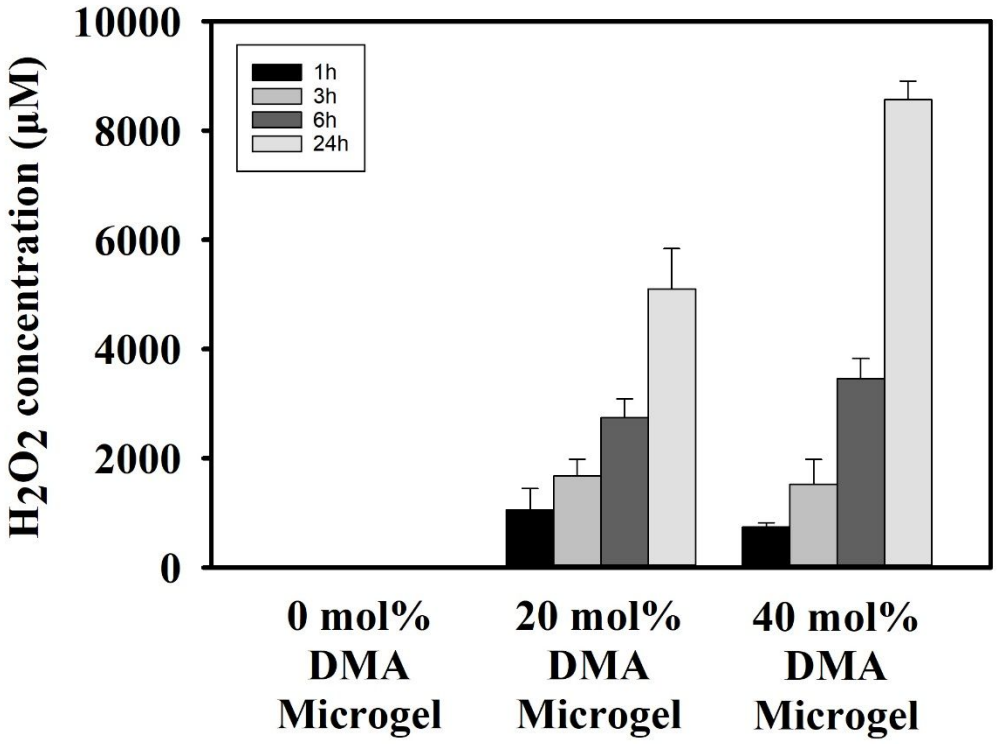


**Figure S16.** $H_2O_2$ generated from the autoxidation of 0-40 mol% DMA microgels during 24-hour incubation at pH 7.4 and 37 ˚C.

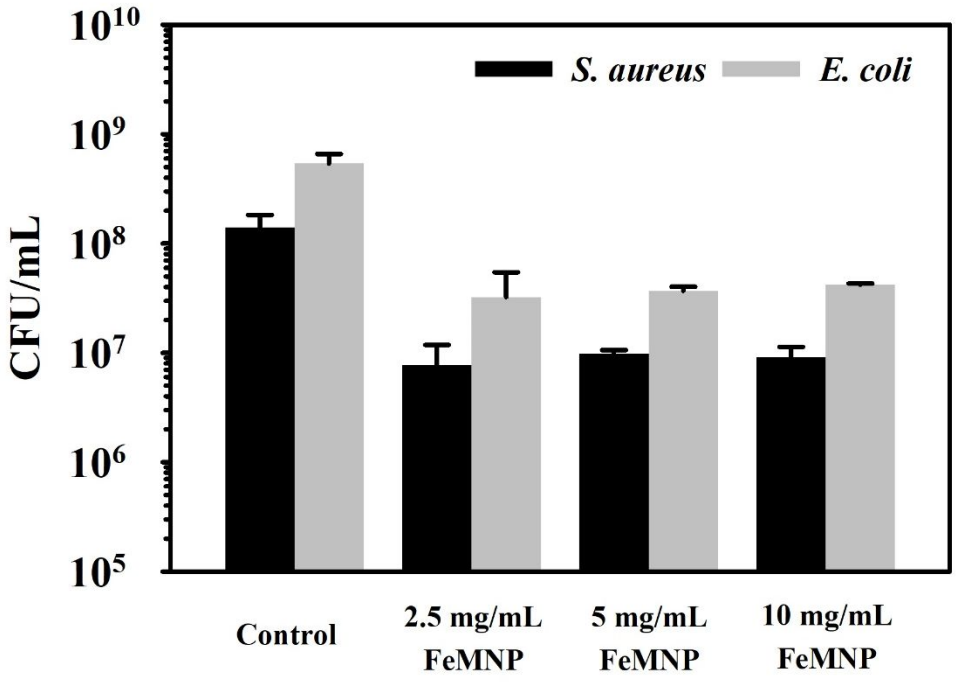


**Figure S17.** Bacteria concentration of *S. aureus* and *E. coli* after incubating with FeMNP (2.5-10 mg/mL) and 40 mol% DMA microgel (10 mg/ mL) for 24 hours. The untreated control was the bacteria incubated in broth over the same periods.

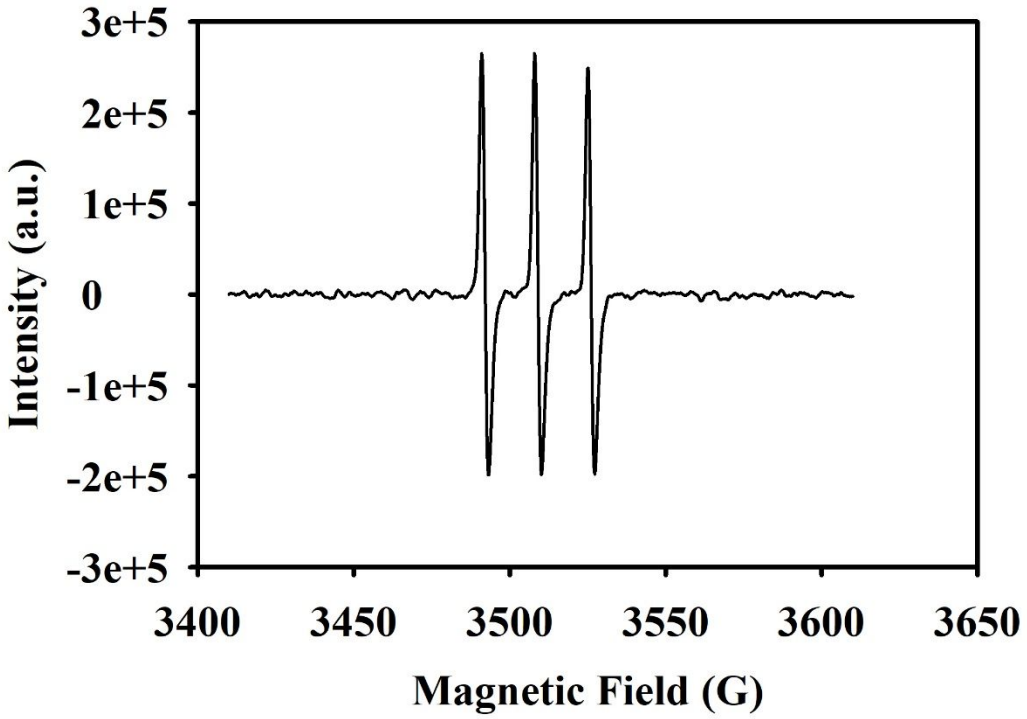


**Figure S18.** EPR spectra of potassium superoxide (0.25 g/mL) and FeMNP (5 mg/mL) for the detection of $^1O_2$ in the presence of TEMP in DMSO anhydrous.

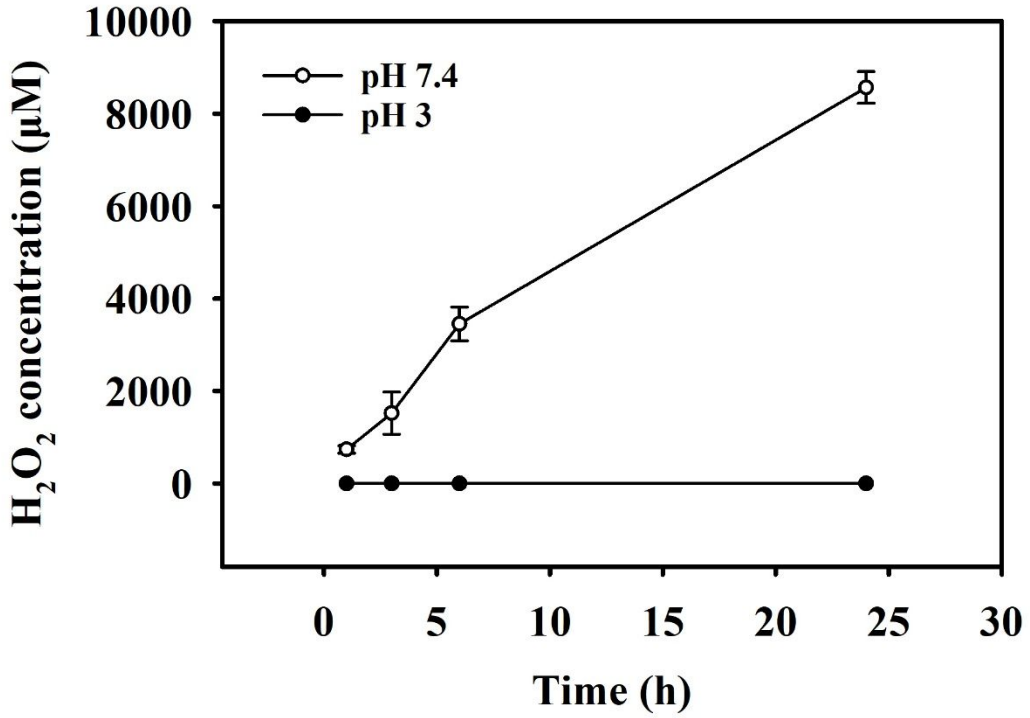


**Figure S19.** Hydrogen peroxide ($H_2O_2$) production of 40 mol% DMA microgel (34.5 mg/mL) after 24-hour incubation in pH = 3 & pH = 7.4 buffer at 37 ˚C.