Supplementary Information

Synthesis of Fe_3O_4 nanocomposites for efficient separation of ultra-small oil droplets from hexadecane–water emulsions

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1. Characterization of Fe_3O_4@PDDA

PDDA-modified Fe_3O_4 NPs were prepared using previously reported methods [1]. The XRD diagram for Fe_3O_4@PDDA (Fig. S1) shows that the material has diffractions of (220), (311), (400), (511), (440) and is consistent with the standard card (JCPDS NO. 19-0629), indicating the cubic spinel structure of Fe_3O_4.

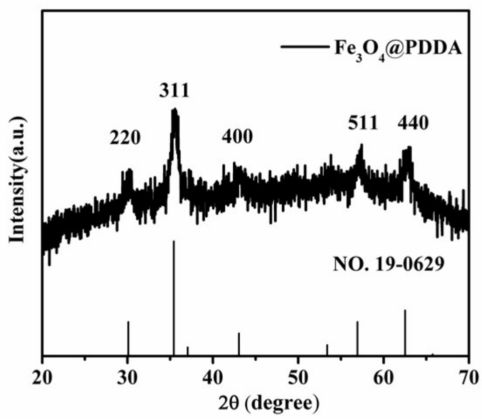

Fig. S1 XRD patterns of Fe_3O_4@PDDA samples.

The TEM image (Fig. S2A) shows that the Fe_3O_4@PDDA NPs are agglomerate and non-spherical. The SEM image (Fig. S2B) confirmed that the samples had particle sized about 20–40 nm. The results of DLS (Fig. S3) showed that the average particle size of Fe_3O_4@PDDA NPs was 138.4 (±11.5) nm.

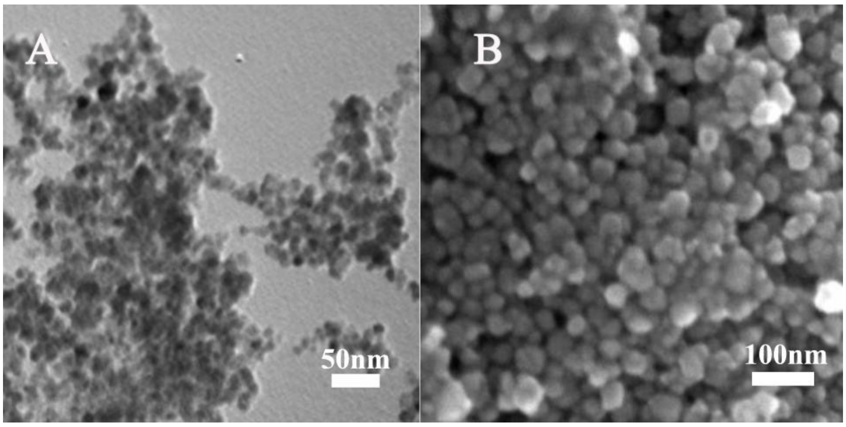

Fig. S2 TEM image and SEM image of Fe_3O_4@PDDA samples

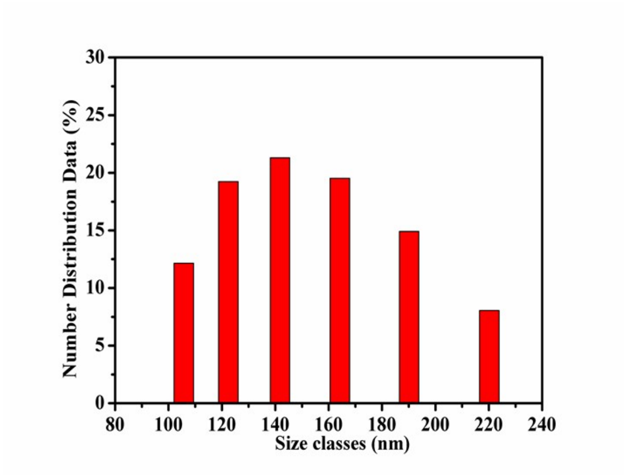

Fig. S3 Particle size distribution of Fe_3O_4@PDDA NPs

2. Particle size distribution of emulsion

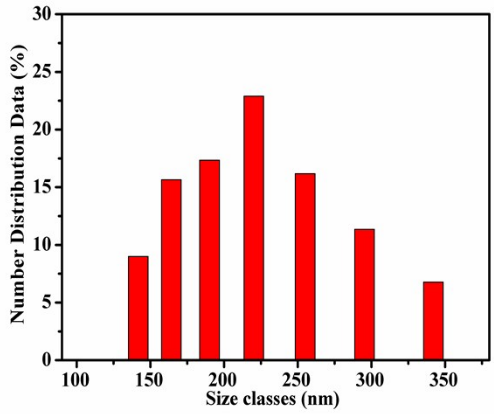

Fig. S4 Particle size distribution of hexadecane-water emulsion

3. Oil-water separation performance of magnetic nanoparticles (MNPs)

Fig. S5 shows that E_S reaches equilibrium when the shaking time was 150 min. For the hexadecane-water emulsion without MNPs, the change of E_S is almost zero with the change of shaking time, which also shows that the emulsion is stable in the range of shaking time.

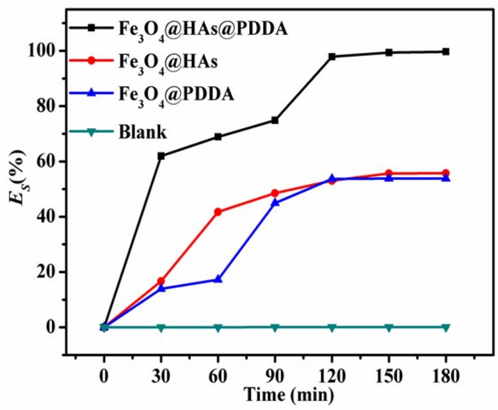

Fig. S5 The effect of magnetic nanoparticle shaking time on E_S in O/W emulsion

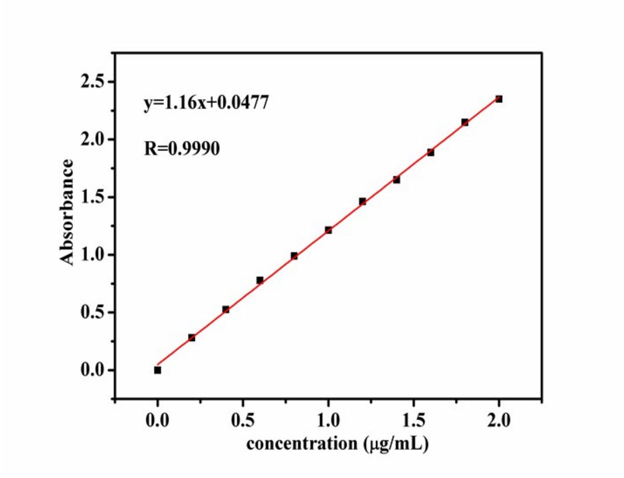

Fig. S6 Standard curve of hexadecane emulsion

References:

1 J. Chen, Y. Ju and H. Chen, *NANO*, 2019, **14**, 1950019-1950033.