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Supporting Information

Physicochemical properties of functionalized A200 and SBA-15 nanoparticles with enhanced amphiphilicity for Pickering emulsions

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1. NMR characterization of the synthesized poly(ethylene glycol)-poly(dopamine methacrylamide) copolymer

To confirm the successful preparation of the block copolymer poly(ethylene glycol)-poly(dopamine methacrylamide) (mPEG-PDMA, abbreviated as mp), a certain amount of mp was weighed and dissolved in 0.5 mL of deuterated dimethylsulfoxide (DMSO), and tetramethylsilane (TMS) was used as a deuterated solvent internal standard, and the spectral test was performed by a Bruker AVANCE III 400 MHz proton nuclear magnetic resonance (NMR) spectrometer at room temperature, and the results are shown in Fig. S1.

As seen in Fig. S1, in addition to the characteristic peaks of polyethylene glycol itself, the characteristic chemical shift peaks of Ar-H at δ = 6.6-6.45 ppm, -NH- at δ = 8.15 ppm, and Ar-OH at δ = 8.78-8.62 ppm were observed. This indicates that the dopamine methacrylamide block was introduced into the poly(ethylene glycol) and the block copolymer was successfully synthesized.

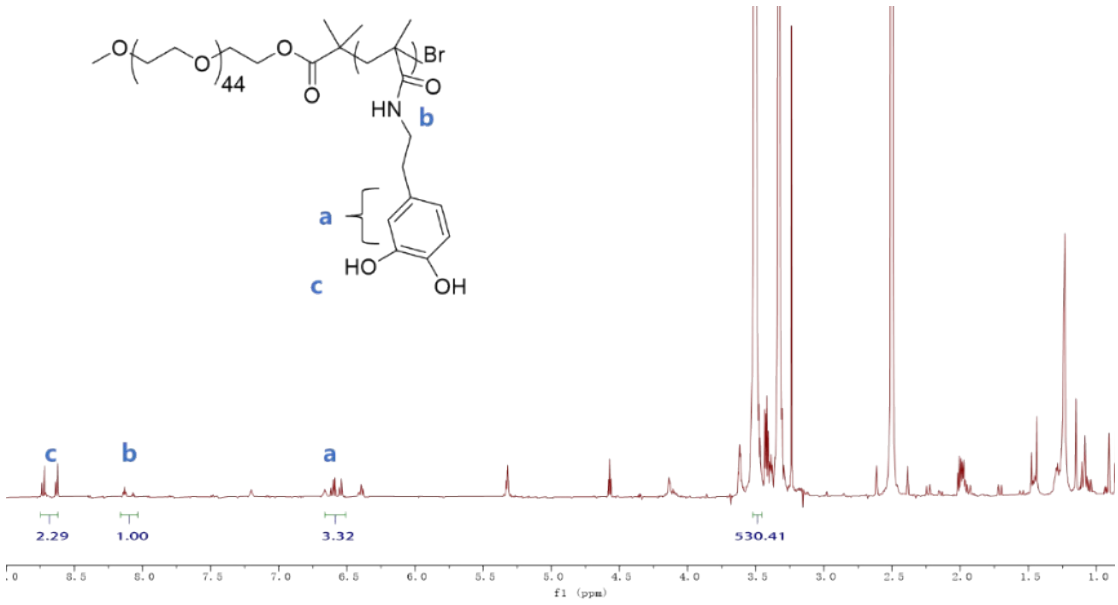

Fig. S1 ^{1}H NMR spectrum of mPEG-PDMA copolymer

2. Optimization of the modification conditions of A200-mp particles

In order to study the effect of the feeding ratio of copolymer to particle on its emulsifying property and to confirm the optimum ratio of copolymer to particle, five feeding ratios of mp copolymer to A200 particles in a wide value range from 1:1 to 1:30 were used to synthesize A200-mp and the A200-mp products were subjected to emulsify toluene-water mixture. The copolymer grating density and the water contact angles of the modified particles were detected by thermo gravimetric analysis (TGA) and sessile drop method. As shown in Fig. S2, the grafting density of mp on the surface of the particles were similar in the ratio range of 1:10-1:30, and increased with the ratio from 1:10, to 1:5 and 1:1. The contact angles of A200-mp particles were stable at about 50° in the feeding

ratio range of 1:10-1:30. The A200-mp stabilized emulsions were formed without obvious difference in the volume fractions. However, the increase in mp grafting content caused the color change of the emulsion from white to light yellow by changing the mass ratio from 1:30 to 1:1. At the feeding ratio of 1:10-1:30, the droplet size of the prepared A200-mp emulsions was stabilized at about 16 μm. When the mass ratio was 1:10-1:1, the droplet size of the emulsion became larger. In summary, the suitable feeding ratio of mp copolymer to A200 particles was 1:10.

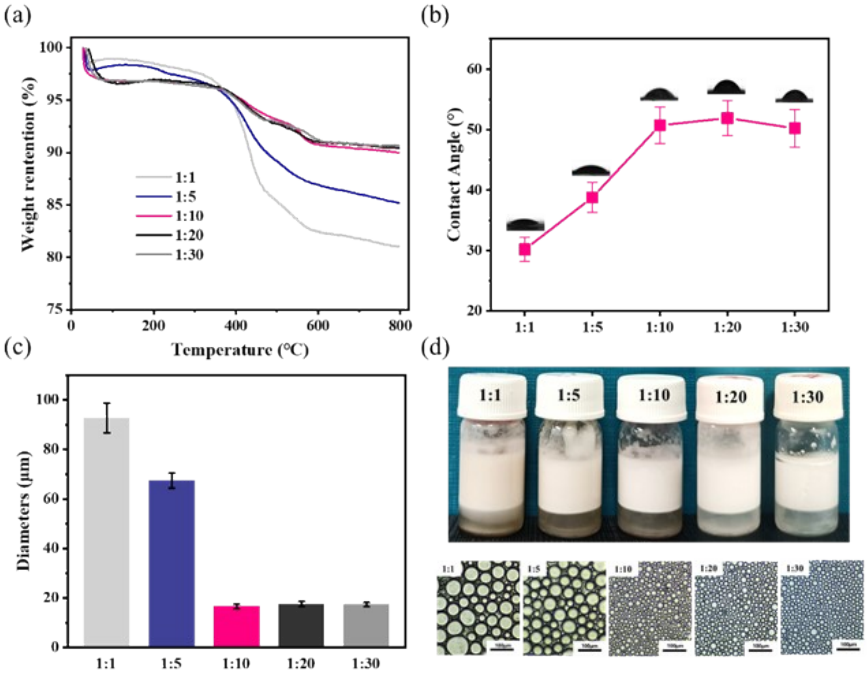

Fig. S2 (a) Thermo gravimetric analysis (TGA) curves and (b) water contact angles of A200-mp particles prepared with different feeding mass ratios. (c) Droplet sizes and (d) microscope photographs of emulsions prepared with A200-mp particles with different feeding mass ratios.

Table S1 XPS data for A200, SBA-15, A200-mp and SBA-15-mp particles

Modified particles	O (at%)	Si (at%)	C (at%)	N (at%)
A200	65.47	32.52	2.01	—
SBA-15	64.40	31.99	2.13	—
A200-mp	62.53	29.33	7.82	0.32
SBA-15-mp	60.39	27.65	9.27	0.79

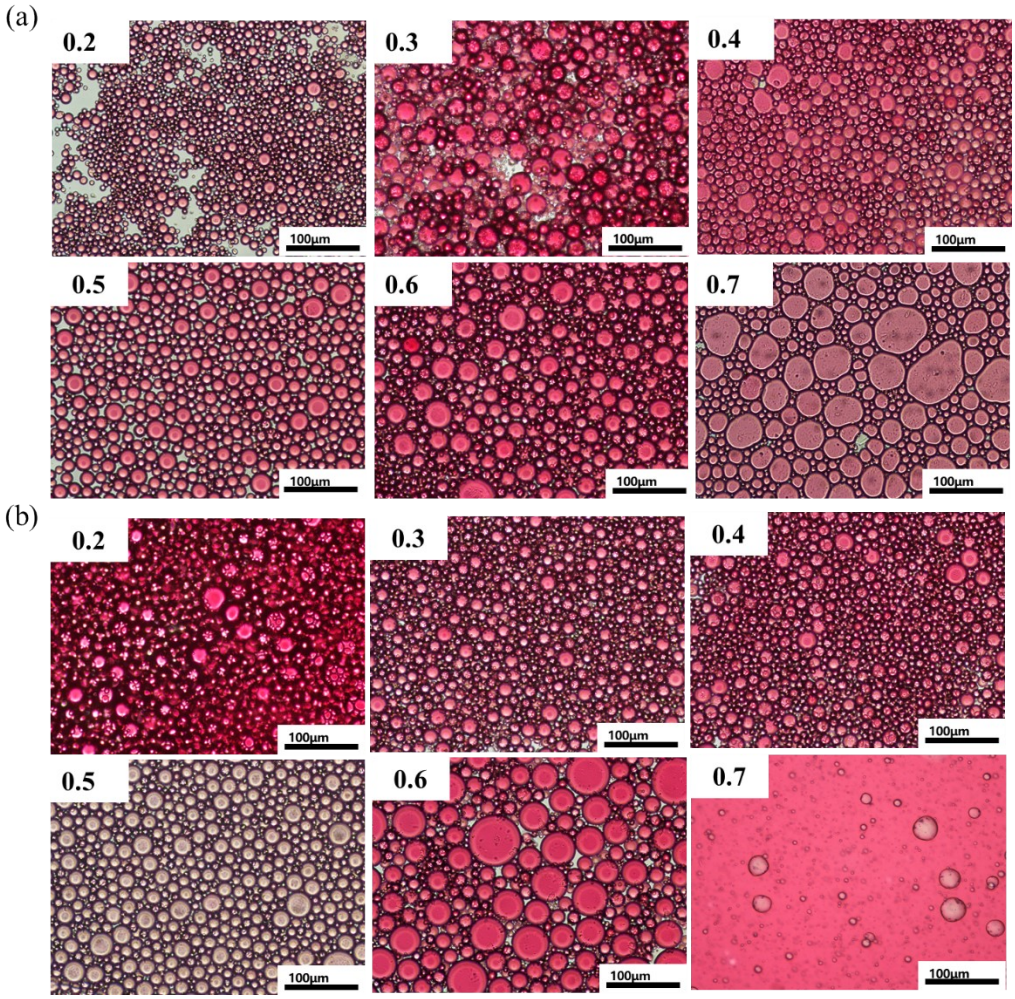

Fig. S3 Microscopic photographs of emulsions prepared from (a) A00-mp and (b) SBA-15-mp particles at different oil phase volume fractions

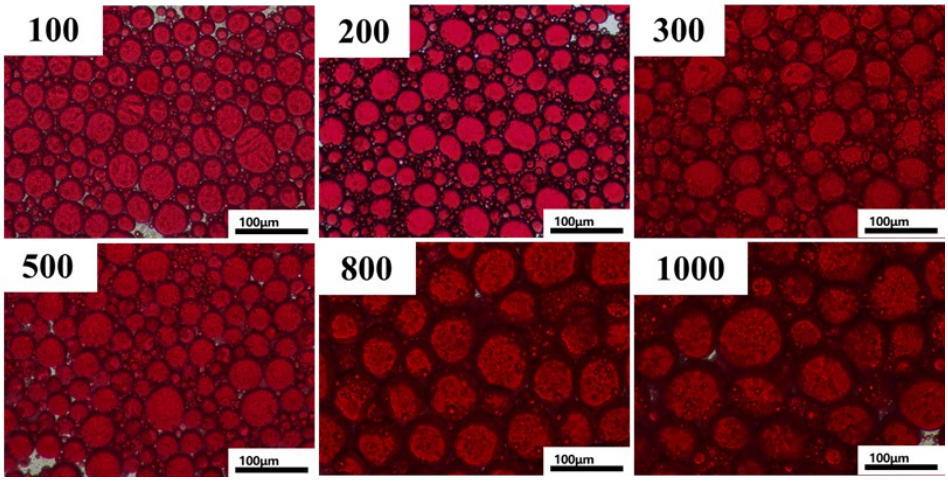

Fig. S4 Microscopic photographs of emulsions prepared from A200-mp particles with different NaCl salt concentrations.

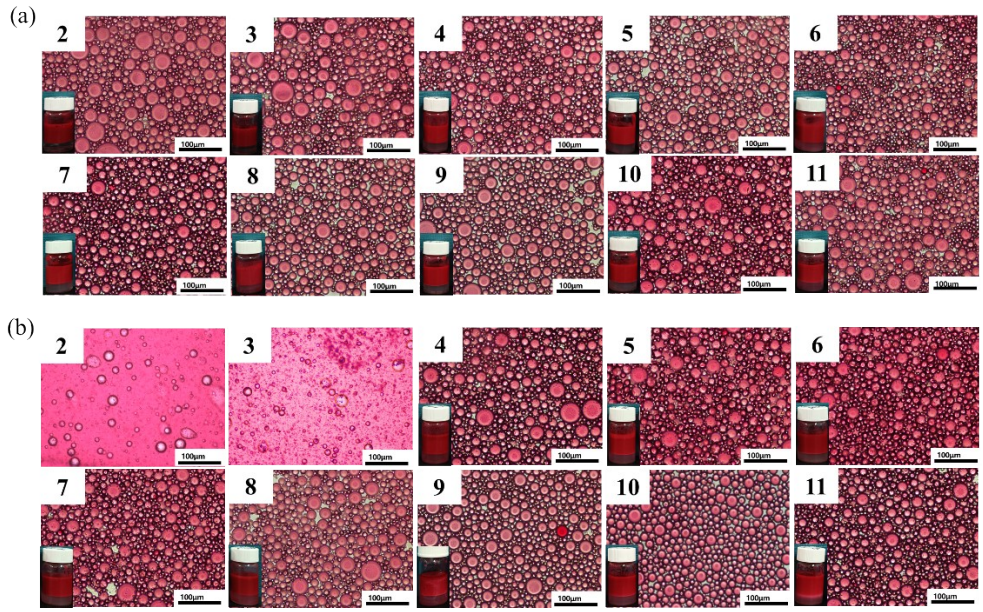

Fig. S5 Photographs and microscope images of (a) A200-mp and (b) SBA-15-mp stabilized emulsions at different aqueous pH values

Table S2 Properties of different oil phases

Oil	Density ($g \cdot mL^{-1}$)	Oil-water interfacial tension ($mN \cdot m^{-1}$)
Cyclohexane	0.779	50.0
Dichloromethane	1.326	28.3
Toluene	0.866	36.1
Paraffin	0.900	28.53
Soybean oil	0.917	26.5
Hexane	0.660	27.65

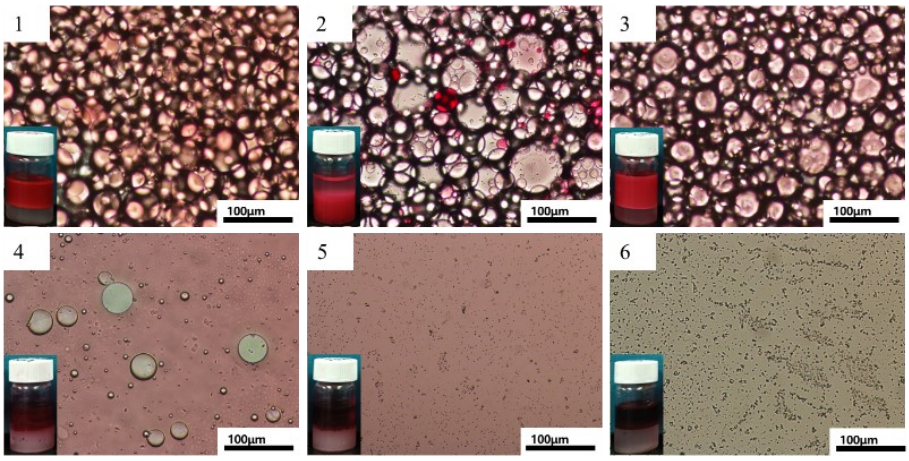

Fig. S6 SBA-15-mp stabilized emulsions with different oil phases. (1) Cyclohexane (2) Dichloromethane (3) Toluene (4) Soybean oil (5) Paraffin (6) Hexane.