Cover Page for Supporting Information

Manuscript title: Ultrasonic-Template Technology Inducing and Regulating the Cationic Microblocks in CPAM: Characterization, Mechanism and Sludge Flocculation Performance.

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Fig. S1. The proposed reaction route for TPAD and TPAD-U.

Text S1. Analytical methods for the association constant (K_M) and the polymerization rate (R_p).

The association constant (K_M) and reaction kinetics were investigated as follows. The K_M (between DMC and PMAA) was measured by bag filter method. A predetermined dose of template PMAA with a molecular weight (M_W) of 5100 was added into a dialysis bag (Intercepted, M_WCO 3500, MD 25-3.5, USA), and then the dialysis bag was submerged in deionized water for dialysis. During the process of dialysis, the low M_W of PMAA was removed and the remaining PMAA became more similar and uniform. After 48 h dialysis, the PMAA in the dialysis bag was precipitated by ethanol and the precipitation and dried in a vacuum oven at 60 ℃ for 24 h. A certain dose of DMC and the precipitation PMAA were dissolved in deionized water in a 250 mL glass beaker, and then the solution pH was adjusted to 3.0 by 0.5 mol L^{-1} HCl and NaOH. Subsequently, the glass beaker was sealed immediately and kept for 24 h at room temperature to arrive a penetration balance. Finally, the K_M was calculated by the following formula:

$$K_M = \frac{[PMAA \text{ **** } DMC]}{[PMAA]_f [DMC]_f} \quad (1)$$

Where *[PMAA****DMC]* was the concentration of the association of PMAA and DMC, $[PMAA]_f$ and $[DMC]_f$ were the free concentration when the dialysis kept balance. Meanwhile, the free concentration of PMAA and DMC was measured by

conductometric titration method. Prior to the determination of polymerization rate (R_p), the monomer conversion rate was controlled to less than 10% by shortening the sonication time at 35 ℃, and the calculation equation of R_p was described as follows:

$$R_p = k \times [M] \quad (2)$$

Where *[M]* was the initial concentration of monomer, and *k* was the slope of the $Y_t = \ln[1/(1-C_t)]$ plot (a fitting straight line), where C_t was the monomer conversion (C) with a given reaction time at 1 min, 3 min, 5 min, 7 min and 9 min, and it was determined by gravimetric method.[1]

Text S2. Analytical methods for FCMC and SRF.

After a 30 min settling period, the conditioned sludge was poured into a Buchner funnel for filtering under a vacuum pressure of 0.09 MPa for 30 min or until the vacuum could not be maintained (in <30 min). FCMC was obtained by the Equation 1:[2]

$$FCMC\% = \frac{M_1 - M_2}{M_1}$$ Equation 1

where FCMC is the filter cake moisture content, M_1 is the weight of the wet filter cake after filtration, and M_2 is the weight of filter cake after drying at 105 ℃ for 4 h. SRF was calculated from the Equation 2:[3]

$$SRF = \frac{2bpA^2}{\mu c}$$ Equation 2

where SRF is the specific resistance to filtration, P is the filtration pressure (N/m^2), A is the filtration area (m^2), μ is the viscosity of filtrate ($N \cdot s/ m^2$), b is the slope obtained from the plot of $t/V_f(y) - V_f(x)$, where V_f is the volume of filtrate (m^3) and t is the filtration time (s), and filtrate volume was recorded at 5 s, 10 s, 20 s, 30 s, 40 s, 50 s, 60 s, 70 s and 80 s during the filtration, and c is the weight of solids per unit filtrate volume (kg/m^3), $c= [(1/C_i)/[(100C_i-C_f)/100C_f]$, where C_i is the initial moisture content (%) and C_f is the final moisture content (%).

Fig. S1

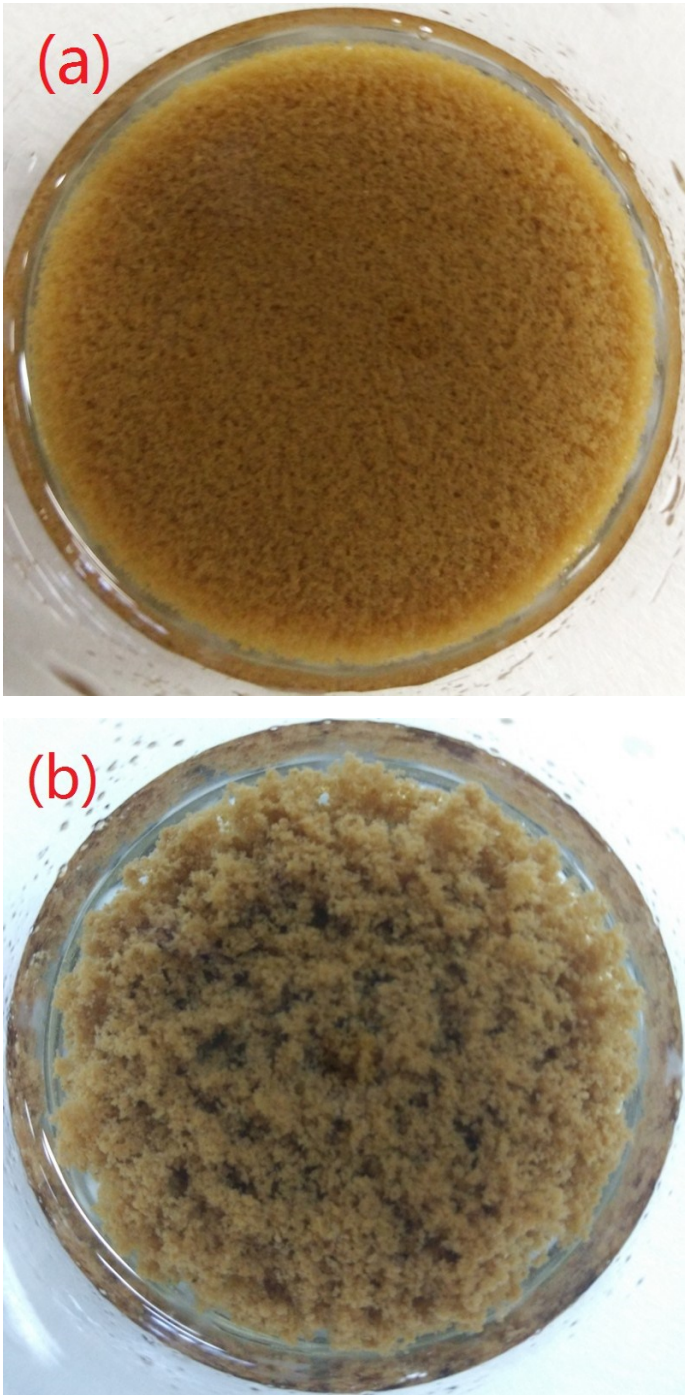

Fig. S 1. The morphology of the sludge conditioned by (a) CPAD and (b) TPAD-U

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