

Supporting Information

Synthesis of a Cationic Polyacrylamide by Photocatalytic Surface-Initiated Method and Evaluation of Its Flocculation and Dewatering Performance: Nano-TiO₂ as Photo Initiator

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This file contains three Texts, two Table and two Figures.

Text S1. Measurement of Intrinsic Viscosity

The intrinsic viscosity of TPADs was measured by the One Point Method [28,29]. The intrinsic viscosity of TPADs was determined using Ubbelohde capillary viscometer (Shanghai Shenyi Glass Instrument Co., Ltd., China) at 30±0.05 °C. The viscosity average molecular weight of the polymers was calculated according to their intrinsic viscosities. The calculation equation according to Formula (1) (GB/T 12005.10-1992), as follows:

$$M_r = 802[\eta]^{1.25} \quad \text{Formula (1)}$$

In this formula, M_r is the viscosity average molecular weight, $[\eta]$ is the intrinsic viscosity (mL/g).

Text S2. Calculation method of supernatant turbidity (ST) and filter cake moisture content (FCMC)

Supernatant turbidity (ST) was measured with a HACH (HACH 2100Q, American Hach Company) turbidity meter at the depth 2 cm below the liquid surface. FCMC was calculated by the Formula (3).

$$\text{FCMC}\% = \frac{M_1 - M_2}{M_1 - M_0} \times 100\% \quad \text{Formula (3)}$$

Where M_1 is the total weight of the filter cake and crucible before drying, M_2 is the total weight of the filter cake and crucible after drying, and M_0 is the weight of the crucible.

Text S3. Calculation method of specific resistance to filtration (SRF) and sludge flocs size

The quantitative paper with a 30-50 μm pore size was cut to 7 cm in diameter and then was putted in Buchner funnel. The raw and conditioned sludge was poured into the Buchner funnel to filter under a pressure of 0.5-0.6 MPa of vacuum filtration. The volume change of filtrate was recorded every 10 s until vacuum breaking. The SRF of sludge was calculated by the Formula (4).

$$\text{SRF} = \frac{2bPA^2}{\mu W} \quad \text{Formula (4)}$$

Where SRF is the specific resistance to filtration of sludge (cm/g), P is the filtering pressure (Pa), A is the filtering area (cm²), μ is the kinetic viscosity (Pa·s), b is the slope of the filtration equation curve in the Formula (5), and W is the filter cake weight per unit volume filter (g/mL), which can be calculated by the Formula (6).

$$\frac{t}{v} = bv + a \quad \text{Formula (5)}$$

Where t is the filtering time (s), and v is the filtrate volume (mL).

$$W = \frac{C_0 \cdot C_b}{C_0 - C_b} \quad \text{Formula (6)}$$

Where C_0 is the moisture content of the initial sludge (g/mL) and C_b is the moisture content of the filter cake (g/mL).

Sludge flocs size were measured using a laser diffraction instrument (Mastersizer, 2000; Malvern, UK).

Table S1. Physical properties of the copolymers.

Sample	Parameter
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	BET ^a specific surface area (m ² /g)	Langmuir surface area (m ² /g)	Adsorption average pore width (4V/A by BET) (nm)
PAD1	0.0289	0.0327	-
TPAD2	0.3394	0.4743	14.14688
TPAD4	0.4513	0.6231	16.31059

a BET: Brunauer Emmett Teller.

Table S2. Details of used flocculant in flocculation and dewatering test.

Flocculant ^a	TiO ₂ (wt %)	Cationic degree (%)	[η] (mL/g)	M _r × 10 ⁴
TPAD1	0.125	30	1487	740
TPAD2	0.250	30	1724	890
TPAD3	0.375	30	1690	869
TPAD4	0.500	30	1553	781
PAD1	0	30	1430	705
CPAM	0	30	1450	717

^a TPAD (1-4): poly(AM-DAC) by photocatalytic surface-initiated polymerization using nano-TiO₂ as initiator; PAD1: poly(AM-DAC) by UV-initiation using VA-044 as initiator; CPAM: commercial poly(AM-DAC).

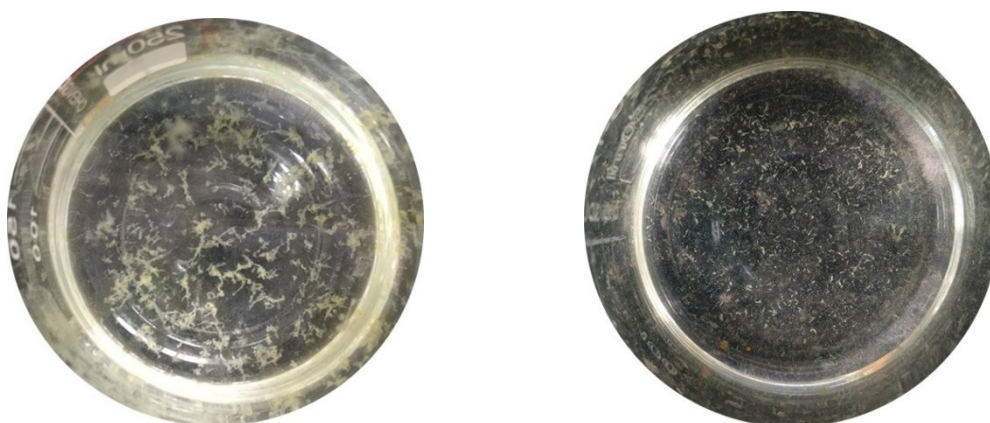
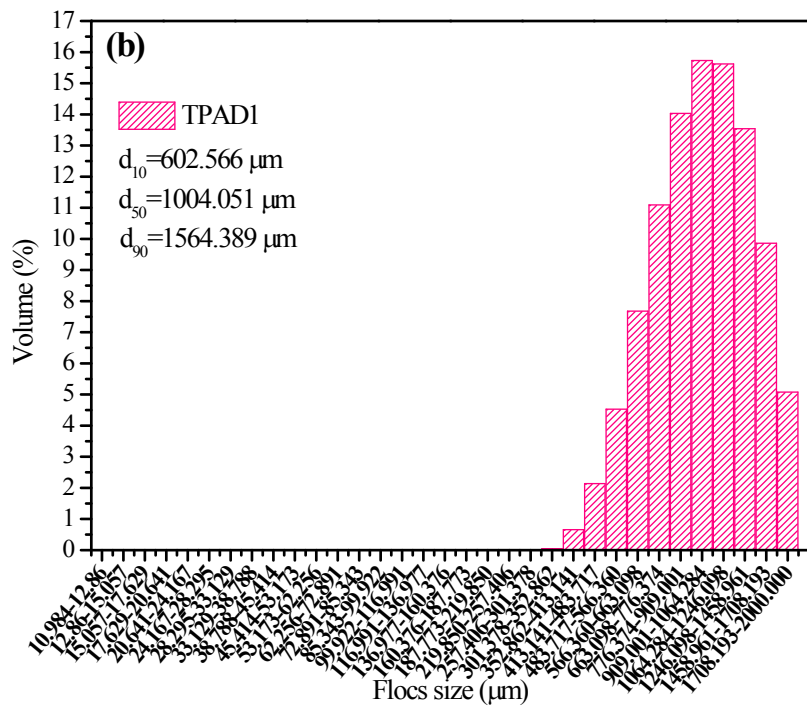
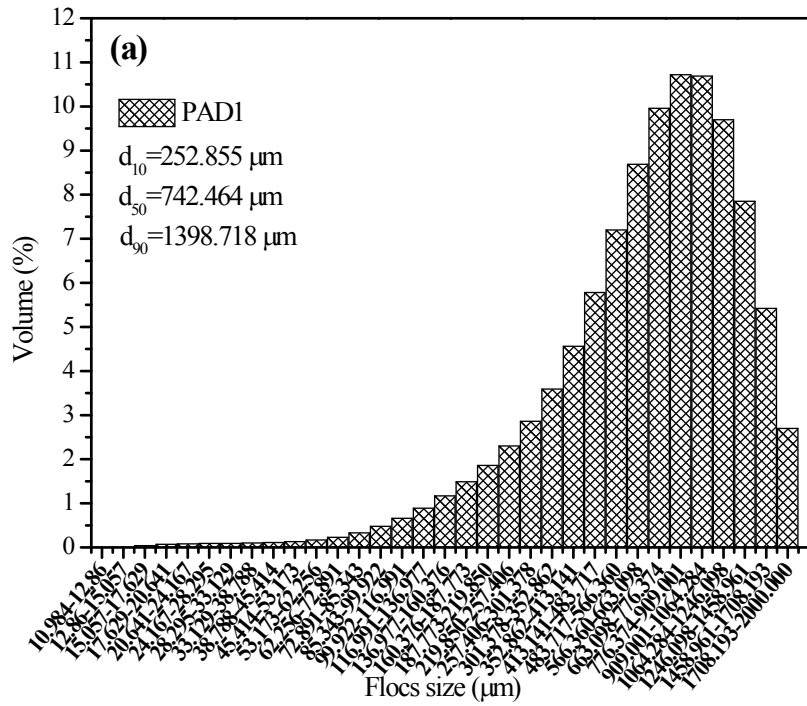


Figure S1. Floc photographs for (a) TPAD2 and (b) CPAM (Experimental conditions: 8 mg/L of dosage, pH=7.5).





(a)



(b)

Figure S2. Sludge floc size distribution and Photographs for (a) TPAD1 and (b) PAD1 (Experimental conditions: 20 mg/L of dosage, pH=6.5).