Supporting information

Effect of PACl/Fe-based Coagulant Dosing Sequence on Algae-Laden Water Coagulation: Investigation of floc formation and settling behavior

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Table S1 Fraction of Al/Fe species of coagulants

	Al_a/Fe_a	Al_b/Fe_b	Al_c/Fe_c
PACl	5	70	25
$FeCl_3$	95	1	4
PSI	13	83	4

Floc properties calculation by FlocCAM software

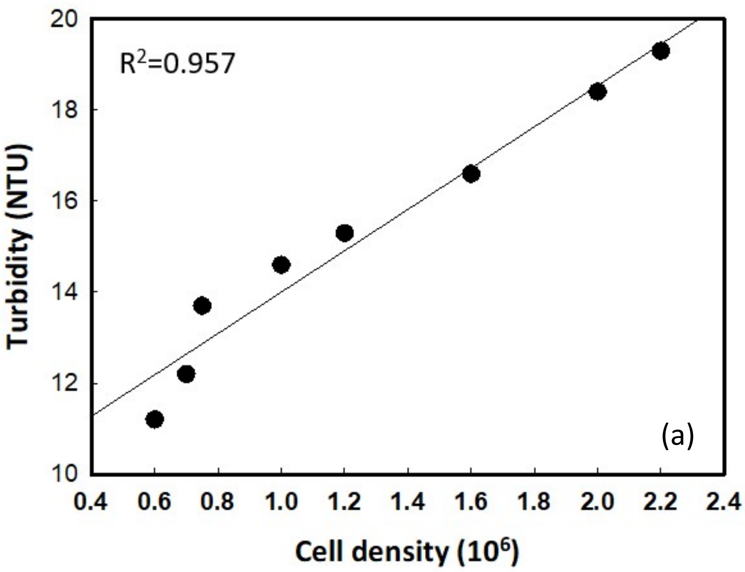
For floc properties calculation, the built-in FlocCAM software sequenced the flocs into pixels first. The size (average floc diameter) of the floc was then calculated by converting areas from square pixels into square millimeters based on FlocCAM calibration factor as shown in the following formula:

$$Avgerage\ Floc\ Diameter = \frac{1}{N}\sum_{i=1}^{N} d(i)$$

Where N represents the total particle count

Spherical flocs areas were calculated by the effective diameter d(i) with the following formula: $d(i) = 2\sqrt{\frac{A(i)}{\pi}}$

The fractal structure of the floc was obtained based on the circumferences and the flocs area. The circumferences were calculated by counting the edge pixels of each floc in units of pixels, the data was then transformed into millimeters using FlocCAM calibration factor. After that, this parameter (fractal dimension) was calculated by plotting a graph of the logarithm of the flocs area and the logarithm of their circumferences where the slope of the linear-fit line is equal to fractal dimension.



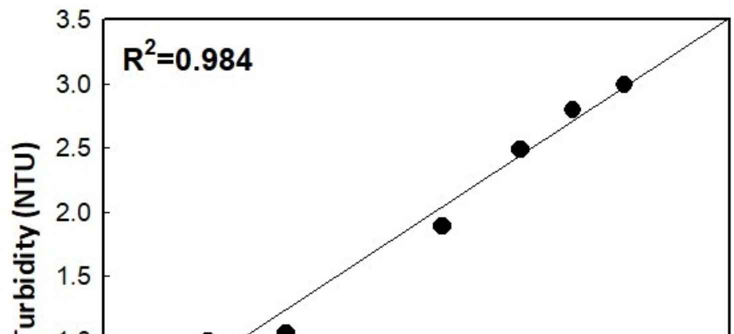


Fig. S1 Regression analysis between turbidity and algal cell density at (a) high cell density representing raw algae containing water and (b) low cell density representing the treated water after sedimentation

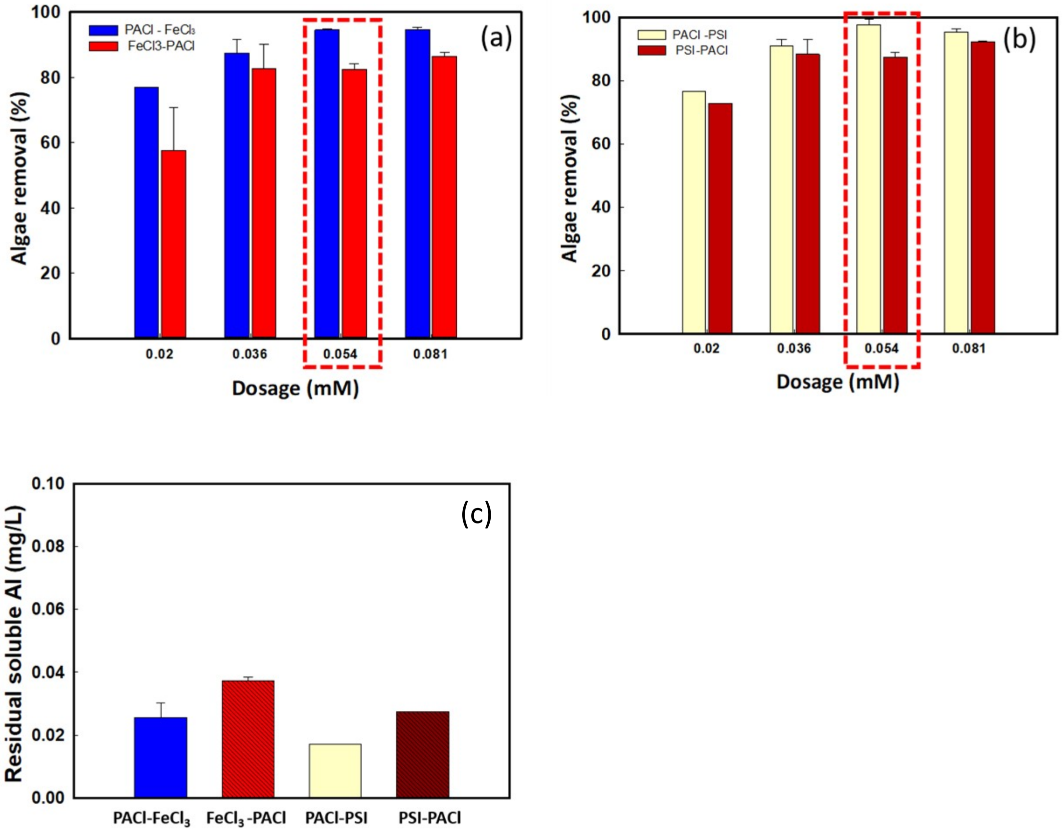
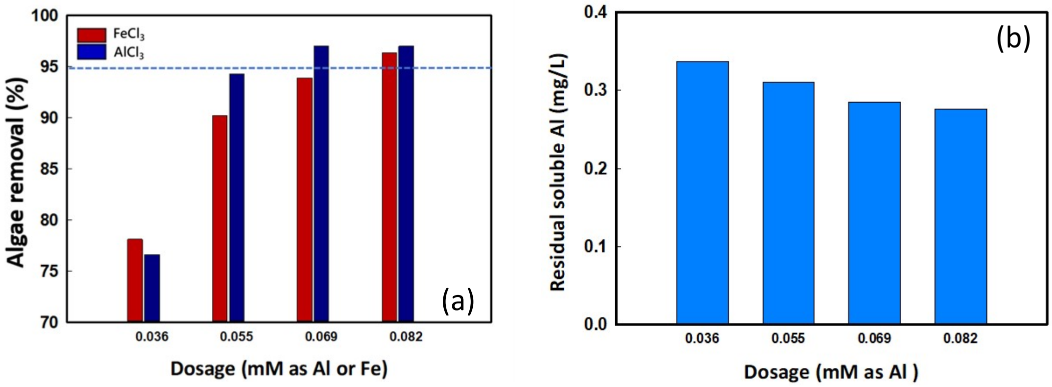


Fig. S2 Effect of dosage on the algae removed by different PACl/IC dosages applied (a) PACl-$FeCl_3$, $FeCl_3$-PACl (b) PACl-PSI, PIS-PACl and (c) residual Al detected in the treated water at optimal dosage of 0.54 mM as Al or Fe (Dosage: 0.054 mM; Turbidity: 17±1.4 NTU; pH: 8.4±0.6; alkalinity: 100 mg/L as $CaCO_3$)



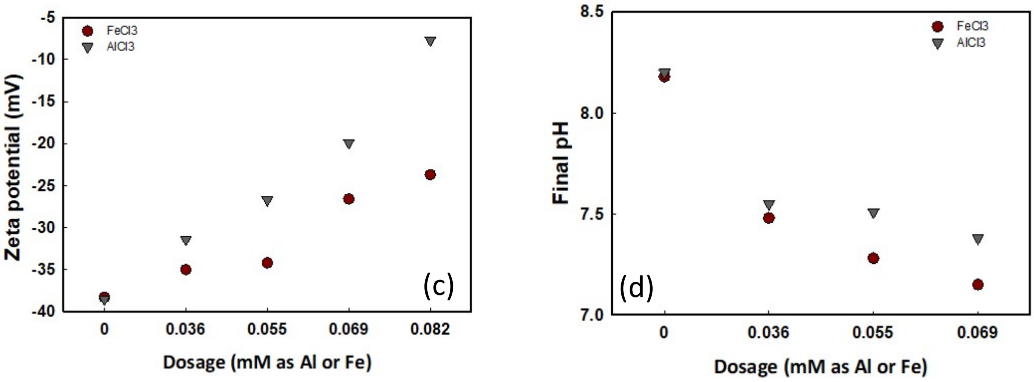
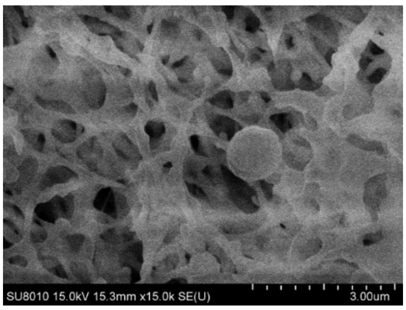


Fig. S3 Effect of dosage on algae removal by traditional monomeric $FeCl_3$ and $AlCl_3$ coagulant (a) Algae removal (b) residual soluble Al in the treated water by $AlCl_3$ dosing (c) zeta potential (d) final pH (Dosage 0.054 mM; Turbidity 17±1.4 NTU; pH 8.4±0.6; alkalinity 100 mg/L as $CaCO_3$)

Fresh algae (not coagulated)

(a)



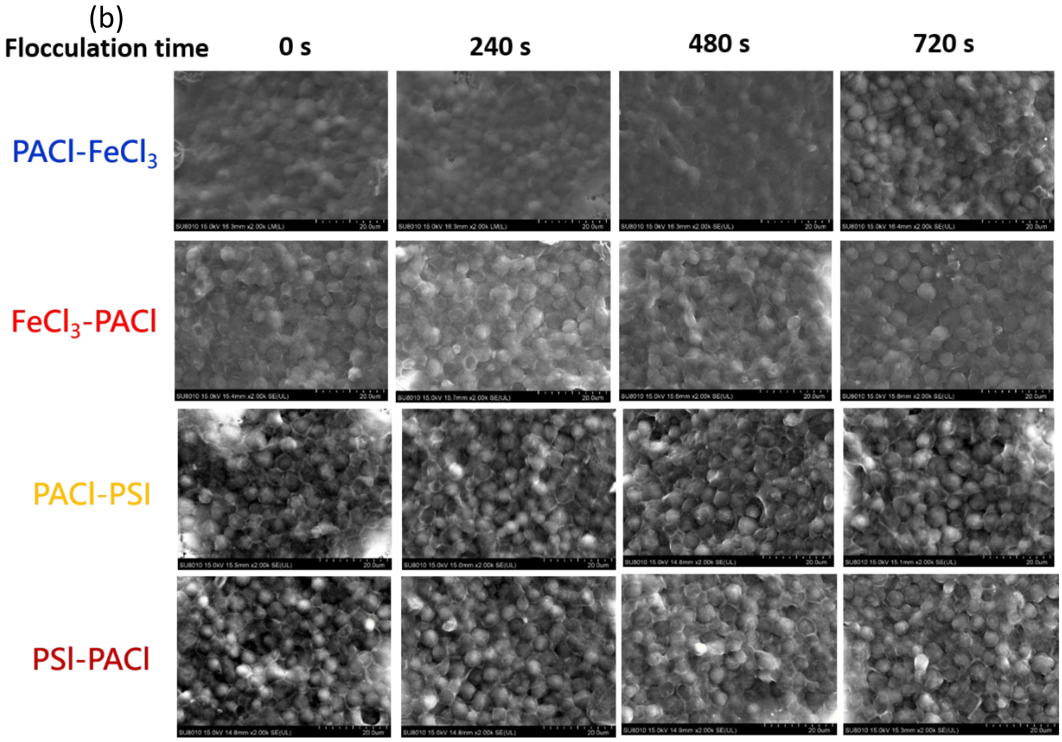


Fig. S4 SEM image of (a) fresh algae and (b) coagulated algae floc by different dosing strategies during flocculation (Dosage: 0.054 mM, Turbidity: 17±1.4 NTU, pH: 8.4±0.6, alkalinity: 100 mg/L as $CaCO_3$)

Fig. S5 shows the settling of floc (floc size > 80μm) by PACl/IC dosing approaches for 10 min settling. Note that, the camera of FlocCAM was situated at the upper region of the jar. Therefore, larger sized flocs might gradually disappeared from the screen due to settling while smaller or lighter flocs tended to be suspended and remained in the monitoring region. At the beginning of the setting period, the largest floc size for all dosing approaches were monitored (**Figs. S5b** and **S5c**). For flocs with their size >200 μm, $FeCl_3$ group (300 s) exhibited longer settling time compared to PSI group (240 s). The size of the suspended floc remained at 100-200 μm for the rest of the time from 300 s to the final 600 s for $FeCl_3$ group. Similar phenomena was observed for PSI group where floc size of 100-200 μm could still be detected when the settling proceeded to 480 s. However, after 480 s, the settling of flocs for >100 μm did not stop, resulting in smaller floc size remained compared to $FeCl_3$ group. The images captured at 600 s in **Fig. S5c** revealed the high clarity supernatant of PSI group, which was attributed to the fast settling of the floc.

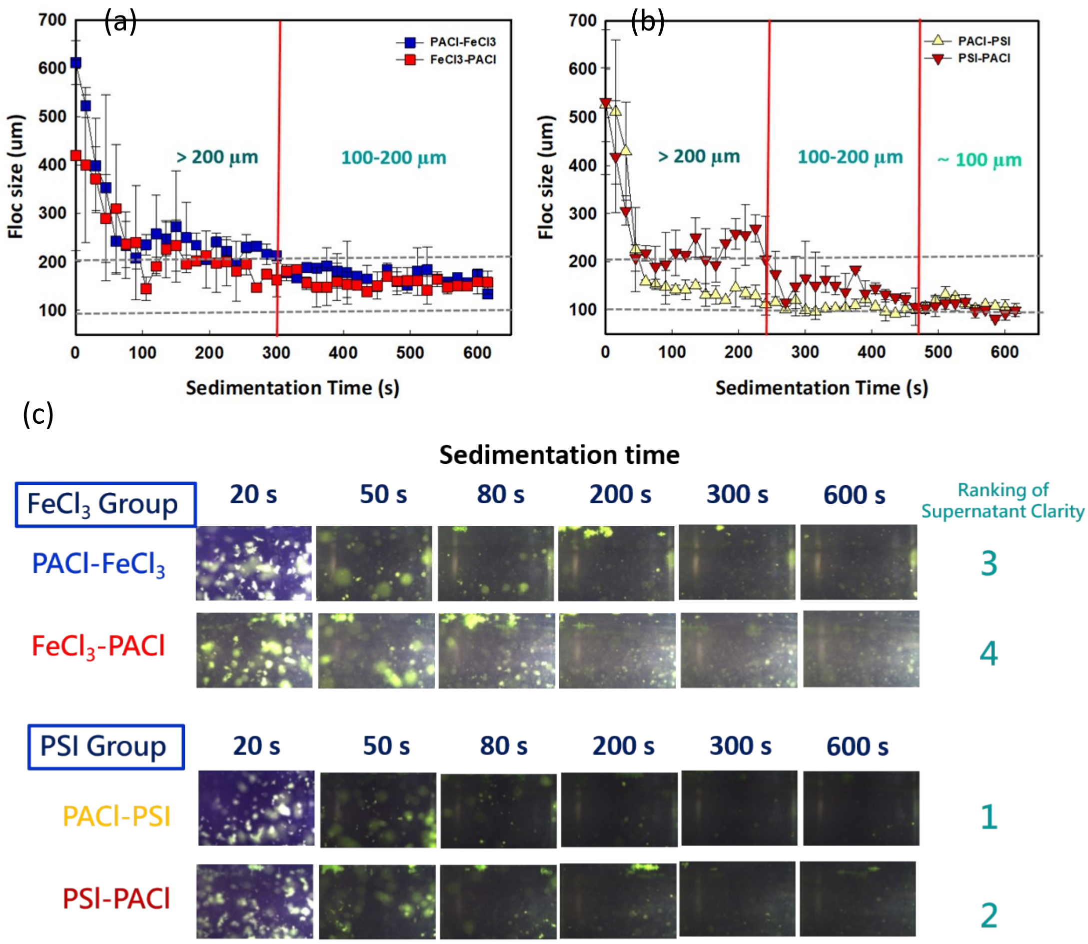


Fig. S5 Real time monitoring of floc settling by FlocCAM for the first 10 min sedimentation (a and b)reduction of floc size and (c)floc image captured in the supernatant along with the settling time (Dosage: 0.054 mM; Turbidity: 17±1.4 NTU; pH: 8.4±0.6; alkalinity: 100 mg/L as $CaCO_3$)