



Characteristic analysis on morphological evolution of suspended particles in water during dynamic flocculation process

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Received 9 May 2010; Accepted 21 August 2011

ABSTRACT

The evolution of floc morphology during constant-speed and variable-speed flocculation was examined to understand floc growth mechanisms. Flocculation-test results were reported in terms of floc average size and fractal dimension, derived from *in situ* optical sampling and image analysis. The morphological evolution was also described using a fractal growth model, which defined flocculation as the combined processes of aggregation and restructuring. During constant-speed flocculation, aggregation rate increased with increasing shear, but breakage became significant. Also, a decrease was observed after reaching the peak of size, possibly due to floc settling in low shear and the irreversibility of breakage in high shear. The development of floc morphology in variable-speed flocculation indicated that the surface nature of initial flocs was critical to form larger final flocs, because aggregates with irregular shape had more connection spots than those with smooth surface, thus producing a higher aggregation rate for further growth. As expected, longer duration of slow stirring at the first stage produced lower flocculation efficiency because of the change of surface properties by restructuring. Additionally, steady state was attained faster for floc structure than for size at the same shear during whatever flocculation, possibly due to the self-similarity of fractal aggregates.

Keywords: Flocculation; Fractal dimension; Breakage; Image analysis

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