Microbial flocculant combined ferric trichloride facilitates floating aggregation of *Microcystis aeruginosa* for efficient removal

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**ABSTRACT**

A combination of microbial flocculant (MBF) and ferric trichloride (FeCl\textsubscript{3}) was applied to aggregate and harvest algae. The orthogonal experiment was designed to optimize conditions of flocculation. Mechanism of flocculation was observed through determining the zeta potential and observing the morphology of algal floc using stereo and scanning electron microscope. The results showed that the optimum combination of flocculants was 0.175 g of FeCl\textsubscript{3} with 10 mL MBF per liter, which exhibited the highest flocculation efficacy (95.12\%) and lowest chemical oxygen demand (10.44 mg/L). The flocculation mechanism was charge neutralization, where the MBF first adhered and coated algae. Due to its high affinity to iron-hydroxy ions and long-chain molecules, the MBF attracted positively charged hydroxyl ions generated by FeCl\textsubscript{3} hydrolysis and interacted with the iron-hydroxy ions to form a larger floc by bridging. The coat made of MBF formed a thin film which protected algae from being destroyed, and trapped the oxygen released from photosynthesis, making the cell more buoyant to float on the surface of water. Findings of this study provided a potentially practical and efficient method for harvesting unicellular algal cells.

**Keywords:** Cyanobacteria; *Microcystis aeruginosa*; Flocculation; Algal harvesting; Microbial flocculant

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