

OC3) Freshwater Microalgae Removal via Coagulation –enhanced Electro–flotation

Arpon Lucero Jr · Young–Seek Park¹⁾ · Dong–Seog Kim

Department of Environmental Science, Catholic University of Daegu

¹⁾DU University College, Daegu University

1. Introduction

Electro-flotation is the most sustainable and cost-effective technique in removing microalgae however, previous studies showed its relatively low efficiency. This study was conducted to explore the possibility of increasing the efficiency in two ways: (1) by using the appropriate electrode and (2) by introducing flocculation.

2. Materials and Methods

Microcystis Aeruginosa from KMMCC (Korean Marine Microalgae Culture Center, AG10159) was mass cultivated in a 120 L photo-bioreactor using JM (Jaworski's medium) as growth media. The reactor used in the experiment was made of plexiglas (thickness = 0.5 cm) with dimensions of 5.5 cm × 6.0 cm × 60 cm (1980 cm³). Stock solutions of 1000 mg/L of four different types of coagulants namely aluminum sulfate (Al₂(SO₄)₃), iron sulfate (FeSO₄), polyaluminumchloride (PAC) and polymer anion (PA) were prepared and used as flocculant for flucculation experiment and as enhancement to electro-flotation. The jar test was done by subsequently subjecting a 1 L microalgal suspension dosed with predetermined amount of flocculant into 350 rpm of rapid mixing for 3 min, 100 rpm of slow mixing for 30 min, and 30 min of sedimentation. Six different mesh type based on mesh opening and a plate type electrodes were tested for their microbubble generation. The type of electrode that has the highest microbubble generation rate was the one used in this experiment. In an effort to employ the current method being tested to real situation, freshwater microalgae at Nakdong river located in Daegu, South Korea were collected and went through similar methods of jar testing and electro-flotation experiments discussed above.

3. Results and Discussion

The results showed that 3 out of four flocculants have the capacity to separate 1 g of microalgae from the suspension with efficiency of more than 95% by using 301.40 mg, 452.10 mg, and 37.67 mg of Al₂(SO₄)₃, FeSO₄ and PAC, respectively via flocculation alone.

By retrofitting electro-flotation into the process, the amount was decreased to 74.17 mg, 222.51 mg, and 22.25 mg of Al₂(SO₄)₃, FeSO₄ and PAC, respectively. Polymer anion on the other hand showed ineffective on microalgae removal by flocculation and a negative effect via enhanced electro-flotation.

Moreover, 95% removal of unidentified microalgae from local eutrophic reservoir only required 51.92 mg of PAC for every 1 g of microalgae. The results in this study showed the current method tremendously decreased the flocculant consumption as compared to other removal methods such as flocculation and flotation by DAF.