

The algae pretreatment of the water treatment plant influent by using the high-speed electrical flotation system

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Abstract. The high-speed algae pretreatment system consisted of coagulation and electro coagulation process was tested. This study examined algae removal efficiency by the comparison of chlorophyll-a concentration before and after treatment. As a result, the system showed about 45% of removal efficiency by the only flotation separation without coagulation. As increase of electric power and coagulant dosage, the removal efficiency was improved to about 80%. The system could treat algae containing solution with a few minutes on the basis of residence time of flotation tank. Consequently, this study suggests that the system could be used as a pretreatment step in water treatment process.

Keywords: electro flotation, coagulation, algae pretreatment

1 Introduction

The algae bloom is a massive increase of harmful algae caused by eutrophication of the stagnated water body such as lake and reservoir. Algae not only cause taste and odor in drinking water, but threaten the public health by discharging harmful toxins such as Microcystin-LR [1].

On the other hand, algae bloom in river recently has been issued in Korea. This comes from the increase of residence time due to the construction of dams inside river, and from the high rate of dependence of water intake on river water. To reduce treatment load to water treatment plant (WTP) due to river algae bloom, it is necessary to develop a control method connected with water intake pipe. Because the pipe has a very fast water velocity to meet a treatment capacity of WTP, a more rapid pretreatment method than conventional coagulation and pre-oxidation systems.

The electro-coagulation and flotation (ECF) process has been investigated for algae control [2]. This process has advantages of less chemical dosage and no pH adjustment however, it needs relatively long electrolysis time over 30 minutes [2]. This is because aluminum ions need time to flow out from the sacrificial electrode.

This study focused on the fast algae pretreatment method. To reduce the electrolysis time, a coagulation combined with electro-flotation (EF) process was studied. A pilot scale of pretreatment system was tested to control the harmful algae

2 Materials and methods

2.1 The high-speed algae pretreatment system

Fig. 1 shows the pilot scale of algae pretreatment system, which was composed with coagulant with electro flotation (EF) process. The system designed to treat 100 m³/day of raw water, that was installed in a WTP located around Nak-Dong river basin in Korea. The influent was dosed with a coagulant, and was contacted with micro bubbles created from the EF system. The EF system was composed with two separated reaction modules. The supernatant algae scum was overflowed to the upper drain. In this study, the influent was tested a capacity of 17.5 m³/day.

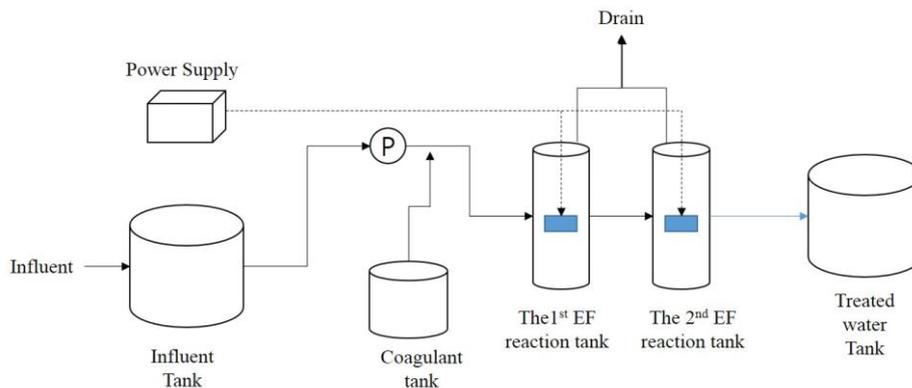


Fig. 1. The high-speed algae pretreatment system for WTP influent

2.2 Coagulation

As a coagulant to accelerate coagulation between algae molecules, 17% of the powdered potassium aluminum sulfate (alum) was used. The solution of the alum in water was supplied to pipe before EF reaction modules.

2.3 The algae pretreatment efficiency

The algae pretreatment efficiency of the high-speed electro flotation system was analyzed by comparing chlorophyll-a concentration of the raw water and the treated water. Furthermore, the effect of electric power and coagulant dosage was evaluated by changing the operating conditions. The electric power was 20-280W, and the coagulant dosage was 0-25ml.

3 Results and discussions

Fig. 2 shows chlorophyll-a concentration of the raw water and the treated water by the change of electric power. The removal efficiency of chlorophyll-a concentration was about 40% in the 20 W electric power conditions. With increase of the electric power to 110W, removal efficiency was changed little. It was observed that the efficiency was increased to about 50% in the 190W electric power condition and about 65% in the 280W electric power condition compared to raw water. The algae removal could be improved by the increase of micro bubble quantity due to the electric power change.

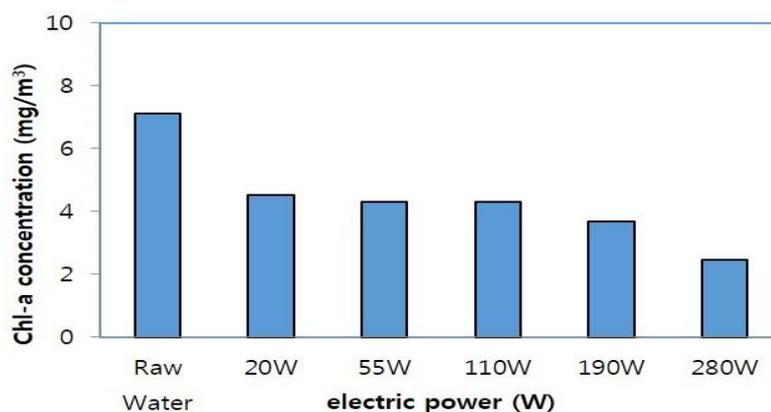


Fig. 2. The treatment efficiency by the change of electric power

Fig. 3 shows experimental results by the change of coagulant dosage. The removal efficiency of chlorophyll-a concentration was about 45% in the 0 ml/min coagulant dosage condition. It means that the removal efficiency was not enough with the only electro flotation system without coagulation. As coagulant dosage increased over 15ml/min condition, removal efficiency was increased to about 60%. In the 25ml/min

of coagulant dosage, the removal efficiency was increased to about 80% compared to raw water. The algae removal could be improved by the increase of coagulation efficiency.

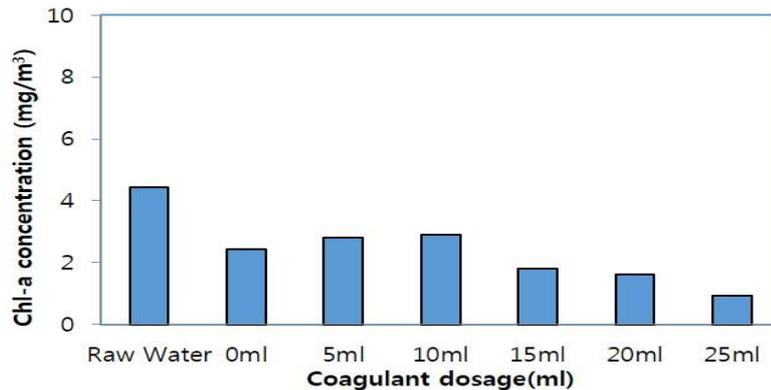


Fig. 3. The treatment efficiency by the change of coagulant dosage

4 Conclusion

This study evaluated algae pretreatment efficiency by the comparisons of chlorophyll-a concentration between the raw water and the treated water. As the increase of electric power and coagulant dosage, the removal efficiency was improved to about 80% within 1 minute on the basis of a residence time of the flotation tanks. This coagulation combined with electro flotation system could be used as a pretreatment process at the previous step of water treatment process of WTP

References

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