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Influence of using Enteromorpha extract as a coagulant aid on coagulation behavior and floc characteristics of traditional coagulant in Yellow River water treatment

Shuang Zhao, Baoyu Gao *, Xiangzuo Li, Min Dong

Shandong Key Laboratory of Water Pollution Control and Resource Reuse, School of Environmental Science and Engineering, Shandong University, Ji'nan 250100, Shandong, People's Republic of China

HIGHLIGHTS

- An effective way of the recycle of hazard wastes-Enteromorpha was found.
- A new kind of coagulant aid-Ee was found and applied in the water treatment process.
- Coagulation performance could be obviously enhanced when appropriate Ee was dosed.
- Floc characteristics were significantly improved due to Ee addition.

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ABSTRACT

A new coagulant aid, Enteromorpha extract (Ee), was used together with traditional coagulants in water treatment process to assess its effect on coagulation behavior and floc characteristics. Four kinds of aluminum and ferric coagulants were studied in this article, with the results indicating that aluminum sulfate (AS) was the optimal coagulant due to its high efficiency and perfect cooperation with Ee for given test water. Then coagulation behavior and floc characteristics of AS coagulation system were studied. Turbidity, UV_{254} (ultraviolet absorbance at 254 nm wavelength) and DOC (dissolved organic carbon) removal efficiencies were used to evaluate coagulation effects; and floc characteristics were investigated in terms of floc size, strength and recovery ability. The results obtained in this study indicated that the coagulation effect of AS could be significantly improved by around 30% when appropriate proportion of Ee was dosed. When AS was used in conjunction with Ee, the generated flocs had bigger sizes and faster growth rate than those generated by AS alone. Meanwhile, the former were also stronger and had better recovery abilities than the latter. The charge neutralization was the dominant mechanism in AS coagulation, and Ee displayed good adsorption bridging effect. Consequently, coagulation efficiency could be enhanced significantly due to the combination of two advantages.

1. Introduction

It is well known that coagulation is the most common process used for particles and organic matter removal in drinking water treatment [1]. In this process, coagulants are added to aggregate destabilized dissolved organic matter (DOM) and colloidal particles into larger-sized flocs, and then the flocs can be effectively removed in sedimentation processes [2]. Due to the effectiveness in treating a wide range of waters at relatively low lost, traditional coagulants (aluminum and ferric salts) become the most commonly used coagulant in water treatment [3–5]. However, recent studies have discovered a number of drawbacks of using traditional coagulants. Alum salts may cause human body disease and ferric salts may cause the unsightly brown staining of equipments [6–8]. Therefore, it is necessary to decrease the dosage of traditional coagulants to reduce negative effects. Applying coagulant aids is the most common method to solve above problems, and meanwhile, the water treatment cost can also be cut down by dosing appropriate coagulant aids. Coagulant aids can accelerate the flocculation process or strengthen the floc to make it easier to filter. They can be roughly divided into two categories based on their mechanism of action. Synthetic polymers are the most common coagulant aids, which bind to particles much like coagulants. Others, generally the inorganic and natural polymers, act as sites of nucleation to speed the formation of floc. However, it has been

* Corresponding author. Tel.: +86 531 88364832; fax: +86 531 88364513.
E-mail address: baoyugao_sdu@yahoo.com.cn (B. Gao).

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