Synthesis and characterization of a novel cationic modified γ-polyglutamic acid with improved its flocculation performance in seawater

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Abstract

Water is the source of life, it is indispensable to human life and production resources. As the world's population growth and the rapid development of modern industry, the human demand for water continues to grow. The water crisis is rising, due to the destruction of the ecological environment, unreasonable exploitation of water resources and water pollution problems. In order to solve the problem of increasing freshwater resources in the land, each country develop seawater desalination and direct utilization of seawater. However, the seawater contains a large number of suspended particles, bacteria, large particles of organic matter and other pollutants. Flocculation sedimentation method is a widely used water purification treatment method, and the high efficient and nontoxic flocculant is the core problem in the flocculation process.

An environmentally friendly flocculant was firstly synthesized by Cationic modified γ-polyglutamic acid (γ-PGA). The flocculant was prepared via chemical reaction between γ-PGA and 3-chloro-2-hydroxypropyl trimethyl ammonium chloride. γ-PGA, as a new type of microbial flocculant with water-soluble, biodegradable, non-toxic and edible characteristics in water treatment has broad application prospects. Cationic modification γ-PGA has an obvious effect of flocculating sedimentation, attributing to the negative charges of the suspended solids in the seawater. Moreover, studies have showed that the presence of Ca^{2+} can enhance the flocculation effect of γ-PGA, thus, the modified γ-PGA is very suitable for flocculation and sedimentation of seawater, owing to the abound Ca^{2+} in seawater, so the modified γ-PGA is very suitable for flocculation and sedimentation of seawater.

The cationic degree of cationic modified γ-PGA was characterized using conductivity meter. Infrared spectrometry (FTIR) and 1H NMR were explored to analyze chemical structure of the composite flocculant. The influence of etherification agent, reaction temperature, reaction time, as well as the molar ratio of etherifying agent and NaOH on flocculation...
performance were investigated. The results showed that the turbidity of the seawater distinctly decreased from 95NTU to 10NTU with 2mg/L modified γ- PGA.