

Study on nano-chitosan grafting quaternary ammonium salt modified polyacrylamide for flocculation and sterilization

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ABSTRACT

A dual-function chitosan-based flocculant named nano-chitosan-graft-poly(acrylamide and acryloyloxyethyltrimethyl ammonium chloride (NCS-g-P(AM-DAC)) with flocculation and sterilization properties was successfully synthesized by using nano-chitosan (NCS), acrylamide, and acryloyloxyethyltrimethyl ammonium chloride (DAC) under ultraviolet irradiation with 2,2'-Azobis(2-methylpropionamide) dihydrochloride as the photo-initiator. NCS was obtained via ion cross-linking between chitosan and sodium tripolyphosphate. The structure and physicochemical properties of the product were characterized by various methods. The influence of different factors on the intrinsic viscosity of synthetic copolymer was investigated to optimize the synthetic condition. The flocculation performance of NCS-g-P(AM-DAC) was evaluated. Results showed that the superior flocculation efficiency was acquired under pH = 6 and flocculant dosage of 5 mg L⁻¹, in which turbidity removal efficiency was above 85%. Considering that the quaternary ammonium salt was grafted and the nanoparticle generated, NCS-g-P(AM-DAC) was also applied to flocculate *Escherichia coli* (*E. coli*) suspension to evaluate the sterilization performance. At suitable dosage and pH conditions, the flocculant effectively removed turbidity and bacterial cells. 3D fluorescence spectroscopy analysis of *E. coli* suspension after the flocculation was conducted to investigate the sterilization mechanism. The results showed that NCS-g-P(AM-DAC) could destroy cell membranes, indicating its bactericidal, not simply antibacterial, effect during flocculation.

Keywords: Nano-chitosan; Turbidity removal; Grafting; Dual-function; Flocculation; Sterilization

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