Chitosan for direct bioflocculation of wastewater

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ABSTRACT

Coagulation/flocculation is a major phenomenon occurring during industrial and municipal water treatment to remove suspended particles. Common coagulants are metal salts, whereas flocculants are synthetic organic polymers. Those materials are appreciated for their high performance, low cost, ease of use, availability and efficiency. Nonetheless, their use has induced environmental health issues such as water pollution by metals and production of large amounts of sludges. As a consequence, alternative coagulants and flocculants, named biocoagulants and bioflocculants due to their biological origin and biodegradability, have been recently developed for water and wastewater treatment. In particular, chitosan and chitosan-based products have found applications as bioflocculants for the removal of particulate and dissolved pollutants by direct bioflocculation. Direct flocculation is done with water-soluble, ionic organic polymers without classical metalbased coagulants, thus limiting water pollution. Chitosan is a partially deacetylated polysaccharide obtained from chitin, a biopolymer extracted from shellfish sources. This polysaccharide exhibits a variety of physicochemical and functional properties resulting in numerous practical applications. Key findings show that chitosan removed more than 90% of solids and more than 95% of residual oil from palm oil mill effluents. Chitosan reduced efficiently the turbidity of agricultural wastewater and of seawater, below 0.4 NTU for the latter. 99% turbidity removal and 97% phosphate removal were observed over a wide pH range using 3-chloro-2-hydroxypropyl trimethylammonium chloride grafted onto carboxymethyl chitosan. Chitosan also removed 99% *Microcystis aeruginosa* cells and more than 50% of microcystins. Here, we review advantages and drawbacks of chitosan as bioflocculant. Then, we present examples in water and wastewater treatment, sludge dewatering and post-treatment of sanitary landfill leachate.

KEYWORDS

Chitosan; Biofocculant; Direct biofocculation; Wastewater treatment ; Sludge dewatering

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