Desalination and Water Treatment
www.deswater.com

doi: 10.5004/dwt.2019.23309

139 (2019) 297–304
January

Optimizing the removal of humic acid with polyaluminum chloride and polyaluminum ferric chloride as green coagulants using response surface methodology

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Received 26 May 208; Accepted 16 October 2018

ABSTRACT

Humic acid is a major precursor of chlorinated byproducts that need to be removed from water, via treatment, given their adverse effects on human health. The current study aimed at identifying the optimal conditions to remove humic acid from surface water, using coagulants such as polyaluminum chloride (PACl) and polyaluminum ferric chloride (PAFCl). The effects of independent variables such as total organic carbon (TOC) concentration (1.6–7 mg/L), pH level (5–9), and coagulant dosage (10–50 mg/L) on humic acid removal were studied using response surface methodology and central composite design. A coagulant dose of 15.72 mg/L (for PACl and PAFCl), TOC concentration of 2.66 mg/L, and pH of 7.84 comprised the optimal conditions, and the removal efficiencies of 97.55% and 98.18% were obtained with PACl and PAFCl, respectively. Zeta potential analysis showed that the leading mechanism for coagulation, with both coagulants, was charge neutralization. PACl and PAFCl had adequate potential to remove humic acid from surface water, but PAFCl had a better performance regarding the treatment of aluminum residuals.

Keywords: Coagulation; Humic acid; Polyaluminum chloride; Polyaluminum ferric chloride

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