Removal of Algal Material Using Coagulation-Flocculation-Decantation

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As the problem of water scarcity is increasing by the year, the need for seawater desalination significantly rises. Almost one fifth of the world's population lives in areas where the water is physically scarce. One of the most commonly used methods for seawater desalination is Reverse Osmosis. However, in all seas across the world we can observe an increase in algal bloom events, which can induce strong membrane fouling. In this project, a study of the removal of algal cells and associated exopolymeric substances (i.e., dissolved organic carbon (DOC)) using Coagulation-Flocculation-Decantation (CFD) as water desalination pretreatment was conducted. The CFD experiments were performed using synthetic algal blooms diluted in Red Sea water at a stationary phase obtained from Hymenomonas Species algal culture. Different coagulants were used, such as Clay Minerals (Bentonite, Kaolinite and Montmorillonite) and Ferric Chloride ($FeCl_3$). Results showed that Bentonite provided the highest efficiency out of the three Clay Minerals in removing algal cells (up to 97%) but provided a minor removal of DOC (20.8%). As for the $FeCl_3$, the results have shown the highest efficiency at removing algal cells and DOC (93 %) at a pH of 6.5. Furthermore, the addition of Bentonite followed by the addition of $FeCl_3$, as a combined coagulant, during the CFD experiment increased the algal cells and organic matter removal rate up to 99.8%. In conclusion, the combination of Bentonite and $FeCl_3$ improved the efficacy of the CFD seawater pre-treatment by preventing membrane fouling and increasing water flux rate

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