Sedimentation versus flotation based separation of marine microalgae

D. Vandamme[1,2], Y.W. Wong[1], O. Vronska[3], B. Tamburic[3], R.K. Henderson[1]

[1] BioMASS lab, School of Chemical Engineering, The University of New South Wales, Sydney 2052, Australia. d.vandamme@unsw.edu.au
[2] Laboratory for Aquatic Biology, KU Leuven Kulak, E. Sabbelaan 53, BE-8500 Belgium
[3] Plant Functional Biology and Climate Change Cluster, University of Technology Sydney, Sydney, New South Wales, Australia

Abstract

Algal blooms can significantly affect seawater quality and therefore efficient operation of desalination plants. This results in increased membrane fouling rates, and in extreme cases, a temporary shut-down of the plant. Early algal bloom detection and treatment is essential so that production capacity remains unaffected.

In this study, we compared sedimentation versus dissolved air flotation using ferric chloride versus alkaline coagulation for the marine microalgae *Nannochloropsis occulata*. Separation efficiency and the resultant solid:liquid ratio has been determined as a function of the required coagulant dose. Generally, sedimentation resulted in a higher separation efficiency then flotation for both coagulants. For flotation, ferric chloride as coagulant resulted both in a better separation (90±1.5%) and concentration of the biomass as function of coagulant dose compared to alkaline coagulation (70±4.5%). However, ferric chloride will lead to accumulation of iron in the biomass prior to further processing.

Floc size distributions as a function of various stirring speeds were measured for both coagulants to assess floc size and strength. At 3 ppm of ferric chloride, floc growth was slow and increasing the stirring speed resulted in immediate floc fragmentation, while at 10 ppm, flocs growth was faster and slow floc erosion did occur when stirring speed was increased to 200rpm. However, in the case of alkaline coagulation, the stability of the flocs was not influenced by dose nor stirring speed. Alkaline coagulation resulted in smaller but more stable flocs compared to ferric chloride.

Keywords: coagulation, floc growth, floc breakage, DAF, Nannochloropsis