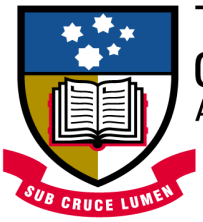

THE UNIVERSITY
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Adelaide University

School of Chemical Engineering

Microbial Flocculation for Large Scale Harvesting of Marine Microalgae for The Production of Biodiesel

A thesis in fulfilment of the requirements for
the degree of Master of Engineering Science

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Declaration

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

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Summary

This research project aims to develop a large scale harvesting process suitable for the production of biodiesel from the marine microalga *Pleurochrysis carterae*. The ideal process required the consideration of factors such as cost, reliability and low levels of contamination in the final product. However, a review of harvesting literatures revealed that there to be no suitable commercial technique available for the production of biodiesel and laboratory experiment showed bioflocculation by pH stress is ineffective.

Microbial flocculation is based on the principle that by stressing certain bacteria, extracellular polymeric substances (EPS) may be produced to co-flocculated the microalgae. With a dosage of 0.1 g L^{-1} of organic carbon (acetic acid, glucose or glycerine) and a 24 h mixing time, a recovery efficiency (RE) of over 90% and a concentration factor (CF) of 226 was achieved. Statistical analysis showed that both RE and CF were independent of the substrates used and that RE was positively correlated with mixing time, while CF was correlated positively to the mixing time but negatively to the interaction of substrate concentration and mixing time.

The harvested microalgae were not under stress and remained viable, with laboratory result showing that the media could be reused without further treatment. The process was observed to be reliable.

Modelling from an existing wastewater treatment plant in Bolivar showed that by incorporating 2 clarifiers and 1 baffled hydraulic flocculator in the plant design, industrial scale harvesting was feasible with a theoretical energy consumption of 2.6 kWh per 10^4 m^3 of culture media. Raw materials were the major cost, however, they could be potentially low-cost as glycerine is a by-product of biodiesel production and acetic acid is one of the major products of anaerobic digestion of the biomass residue after lipid extraction.

Further experiments are required to optimise the mixing time and the scale up.

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