



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

Andrew Kwong Lee (B.E. Chem)

March 2009

## **Declaration**

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## **Acknowledgement**

I would like to thank my supervisors, Dr Peter Ashman and Dr David Lewis for the encouragement and support throughout the two years of research. The many hours of discussion, guidance and support are invaluable in the completion of this thesis and the publication of my journal paper in December 2008.

I would also like to thank Professor Michael Borowitzka from The Murdoch University, Western Australia, for supplying the starter culture of the marine microalgae *Pleurochrysis cartera*; Dr Lance Mickan and his team from the Infectious Disease Unit, Institute of Medical and Veterinary Science, South Australia, for the confirmation of the bacteria involved in the flocculation; Mr Steven Amos, for the technical assistance with microalgae culturing; Mr Garry Penney, laboratory manager from The School of Molecular and Biomedical Science, for the advice and supply of various biological reagents; Mrs Mary Barrow and Mrs Elaine Minerds from the School of Chemical Engineering office for every thing from stationery to morning tea; and finally my colleagues Chee Kwei, Paul Smith, Ken Ho, and Marjan Rahbari for all the helps and supports.

I am extremely grateful to my dear wife Laifong and my two children, Christopher and Alexander; my wife gave me the necessary support to return to university study after an absence of 30 years and they all have been very patient and provided encouragement throughout this research.

Lastly, I would like to thank Dr James Moore, Head of Colorectal Unit and Dr Dorothy Keefe, Clinical Director of RAH Cancer Centre, both from Royal Adelaide Hospital, for the treatment for my bowel cancer in 2003. Their skill and care in the continuous monitoring of my progress during the next 5 years provided me with the most important ingredient of my research; my health.

## 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  $0.1 \text{ g L}^{-1}$  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  $10^4 \text{ m}^3$  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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