CHAPTER 6

CONCLUSION

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Characterization of RE showed that the quality of the effluent varies with the source. Effluent obtained from Lee Latex had different physical and chemical characteristics although the basic chemical contituents remained the same. The C:N:P ratio of RE from Lee Latex was 42:10:1 while that from Atherton Estate was 37:9:1 . Both sources were carbon limiting.

Flask cultures using organic and inorganic carbon supplementation showed that CO_2 improved *Chlorella* growth, giving a growth rate, μ_{RE+CO2}= 0.64day^{-1} while that of the control (RE alone) was only 0.57day^{-1}. Supplementation of RE with both CO_2 and molasses produced the highest growth rate, μ = 0.81day^{-1}, indicating that the algae *Chlorella vulgaris* utilizes both organic and inorganic carbon substrates.

In the outdoor high rate algal ponds *Chlorella* also had a better growth rate with the CO_2 supplemented ponds than the control. In Batches I, II and III the ponds supplemented with CO_2 had improved growth rate (μ = 1.31 to 3.58day^{-1}) compared to the control (μ = 1.23 to 3.51day^{-1}). CO_2 supplementation gave higher growth rate (μ = 1.31day^{-1}) compared to molasses (μ = 1.23day^{-1}). However in terms of biomass yield, supplementation with

molasses gave higher yields than CO_2. In Batch V the pond supplemented with both CO_2 and molasses had 2.43% higher biomass yield then the control (RE alone).

Autotrophic growth rate was higher in CO_2 supplemented ponds, during daylight hours,compared to the control. In the night, ponds supplemented with molasses had higher heterotrophic growth rates.

Biochemical analysis of the *Chlorella* biomass contained between 43.6 to 68.3% of protein, 8.4 to 22.7% of carbohydrates, 9.6 to 13% of lipids and 0.5 to 0.6mg g^{-1} dry weight of carotenoids. This makes *Chlorella* biomass suitable for animal or aquaculture feed.

The HRAP system showed good COD removal (55.8% to 99.7%). The final effluent quality was 5 to 106mgL^{-1} for COD 18 to 174mgL^{-1} for NH_3-N and 6.51 to 29mgL^{-1} for PO_4-P. These values conformed to the recomended DOE standards for waste water discharge of rubber effluent.

In the HRAP system supplemented with CO_2 it may not be economically viable to use CO_2 if it has to be purchased. An alternative source could be the biogas generated during anaerobic fermentation of wastes like rubber effluent and palm oil mill effluent in the tank digesters or other industries which generate CO_2 as a byproduct.