CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

5.1 Performances of ALC with sea water as liquid phase

In summary, sea waters were found to play significant roles in determining the performance of the ALC. Fundamentally, sea water as liquid phase has high surface tension and could produce large bubble formation. However, the hinder coalescence effects from component in sea water only allowed small bubbles in system(with the present sparger employed in the ALC). From this reason, sea water increased gas holdup which led to an increase in the gas-liquid interfacial area. However, although evidence suggested that liquid velocity and gas-liquid mass transfer in the air-sea water system should be larger than those in air-water system, experimental finding revealed that this was not the case. Liquid velocity was not found to be significantly different between the air-sea water and air-water system. Similar finding was observed for K_La.

The comparison between the performances of various kinds of liquid which using in airlift contactors investigates in this work (water, sw15, sw30, sw45) can be summarized as follows:

Comparative performance on different liquid phase in ALC	
Overall gas holdup	w < sw 15 < sw30 < sw45
Riser gas holdup	No trend
Downcomer gas holdup	w < sw 15 < sw30 < sw45
Liquid velocities	w ≈sw 15 ≈sw30 ≈sw45
Mass transfer coefficient	No trend

5.2 Performances of ALC with various A_d/A_r

The Ratio of downcomer to riser cross sectional areas were found to affect the performance of the ALC. A tiny riser or a very large A_d/A_r caused more bubble coalescence and increased the bubble velocity significantly. As a result, a decrease in gas holdups was obtained. In addition, the interfacial gas-liquid mass transfer area decreased and so did the overall volumetric gas-liquid mass transfer coefficient.

The comparison between the performances of ALCs with various ratios of downcomer to riser cross sectional areas investigated in this work can be summarized as follows:

Comparative performance on different Ad/Ar in ALC	
Overall gas holdup	16.55 < 2.61 < 1.79 < 1.21
Riser gas holdup	No trend
Downcomer gas holdup	16.55 < 2.61 < 1.79 < 1.21
Riser liquid velocities	16.55 > 2.61 > 1.79 > 1.21
Downcomer liquid velocities	16.55 < 2.61 < 1.79 < 1.21
Mass transfer coefficient	16.55 < 2.61 < 1.79 < 1.21

5.3 Performances of ALC with various gas velocities

The gas velocities determined gas content in ALC which affected the gas holdup and overall gas-liquid mass transfer coefficient. Moreover, liquid velocities also proportional varied with gas velocities. The comparison in the range of gas velocities which using in this experiment (0 – 28 cm/s) can be summarized as follows:

Comparative performance on the range of gas velocities in ALC	
Overall gas holdup	higher gas velocity > lower gas velocity
Riser gas holdup	higher gas velocity > lower gas velocity
Downcomer gas holdup	higher gas velocity > lower gas velocity
liquid velocities	higher gas velocity > lower gas velocity
Mass transfer coefficient	higher gas velocity > lower gas velocity

5.4 Contributions

This work contributes to the basic knowledge on the behavior of ALC. Thus far, the study on the performance of ALCs in air-sea water system was not available. This work provided new findings regarding the behavior of such system. The results from this investigation was extremely significant for the cultivation of sea-water culture, as the information on both hydrodynamic behavior and mass transfer performance was fundamentally required for the development of effective bioreactors for such applications.

5.5 Recommendations

Although this work had attempted to characterize the behavior of the ALC in air-sea water system, there are still limitations on the evaluation of both hydrodynamic and mass transfer performances of the system. This was partly due to the constraints in experimental device and in time scale for the master degree. Hence, there is still additional work that should be conducted to complete this work and they are summarized as follows:

1) Local gas holdup should be better characterized, e.g. the holdup in downcomer might not be homogeneous and this could lead to misinterpretation of the experimental data.

2) Bubble size distribution should be identified for each operating condition. This will allow a more proper analysis of the gas-liquid mass transfer behavior.

3) Local liquid velocity should be measured or evaluated to allow a characterization of internal liquid circulation in the ALC with air-sea water.

4) Salinity of sea water should be varied to 100 ppt for obvious observation the effect on hydrodynamics and mass transfer.