CHAPTER V

SUMMARY

1. <u>Metal Accumulation by A. halophytica</u>

1.1 <u>Lead Accumulation</u>

The accumulation of lead by *A. halophytica* could be described as a passive adsorption at cell surface. The accumulation occurred rapidly and became saturated at 90 ug/mg dry weight within 1 hour. The rate of lead accumulation was highest at pH 6.5. Zinc could increase the rate of lead accumulation twice but other cations tested did not have any effect. The lead accumulation of *A. halophytica* was not dependent on the age of cells except for the younger cells (below 14 days) which showed a small increase. The rate of lead accumulation depended on metal concentration in solution but saturated when the metal was in excess. The total lead accumulation increased with increasing cell density. However, the rate of lead accumulation per hr per mg dry weight was rather stable.

1.2 <u>Zinc Accumulation</u>

The zinc accumulation was also a passive adsorption at cell surface and exhibited non-saturation pattern. After a rapid rate in the first 10 minutes, the zinc accumulation still increased at a slower rate of 7.8

ug/hr.mg dry weight. Aphanothece halophytica was able to accumulate zinc at 45 ug/mg dry weight within 5 hours. It was more efficient when the pH was above 6.0. The effect of cations on the accumulation of zinc varied. The accumulation of zinc was completely inhibited by lead. Na^+ and K^+ were not inhibitory. The ability of cells to accumulate zinc was independent of the cell age up to 20 days after which the accumulation of zinc slightly decreased. The rate of zinc accumulation depended on metal concentration in solution but was saturated when the metal was in excess. The total zinc accumulation increased with increasing cell density. However, the rate of zinc accumulation per hr per mg dry weight decreased with increasing cell density and became stable after the cell density reached 0.5 mg dry weight/ml.

2. Metal Accumulation by S. platensis

2.1 Lead Accumulation

Spirulina platensis was able to rapidly accumulate lead at cell surface and about 50% was transported into the cell. The lead accumulation was 105 ug/mg dry weight within 5 hours. It was more efficient when the pH was above 6.5. The effect of cations on the accumulation of lead varied. Cobalt and manganese ions were without effect whereas other tested ions elicited inhibitory effect. Mercuric ion was the strongest inhibitor, lowering the normal accumulation rate by one half. The ability of cells at different age to accumulate lead increased up to 8 days and stayed relatively unchanged afterward. The rate of lead accumulation depended on metal concentration in solution but was saturated when the metal was in excess. The total lead accumulation increased with increasing cell density. However, the rate of lead accumulation per hr per mg dry weight decreased with increasing cell density and became stable after the cell density reached 1 mg dry weight/ml.

2.2 Zinc Accumulation

Spirulina platensis was able to accumulate zinc at cell surface at 19 ug/mg dry weight within 5 hours. Parts of zinc accumulation required energy from metabolic process. It was more efficient when the pH was above 6.0. The effect of cations on the accumulation of zinc varied and the inhibition was in the range 50-70 %. The ability of cells to accumulate zinc was independent of the cell age. The rate of zinc accumulation depended on metal concentration in solution but were saturated when the metal was in excess. The total zinc accumulation increased with increasing cell density. However, the rate of zinc accumulation per hr per mg dry weight decreased with increasing cell density and became stable after the cell density reached 0.6 mg dry weight/ml.

3. Removal of Lead and Zinc from Waste Water

The pH conditions of waste water are important factors in the removal of lead and zinc from the waste water using either A. halophytica or S. platensis. In this experiment, it was successful to remove zinc from waste water sample with alkaline pH with the efficiency of 85% for zinc removal. Using suitable density of cells was necessary for economy because using a high density of cells decreased efficiency of metals accumulation. Aphanothece halophytica was not available for repeated use by EDTA washing after the removal of zinc from waste water. After A. halophytica and S. platensis had been in use, they could be removed out of the waste water by sedimentation and flocculation or centrifugation and filtration with 20 micron plankton net respectively.