CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Based on the experimental results, the following conclusions can be demonstrated as follow:

5.1.1 Chromium removal efficiency of constructed wetland systems

Efficiency of chromium removal was shown in the percentage of total chromium in unit per chromium concentration in the influent. The unit type has no significantly effect on the chromium removal efficiency at 95% confidence. This is possibly resulted from salt stress effect; the efficiency was declined after plant dead occurred. So the optimal plant types could not be determined. However, the chromium removal efficiency of both experimental unit types before plant dead was clearly different from control unit at all wastewater level.

1) Chromium removal efficiency at 0.15 m wastewater level

For experimental green *C. esculenta* unit, the efficiency closed to 80% before plant dead occurred. The average of chromium removal efficiency was 64.15% and maximized at 79.17% (within 60 days).

For experimental violet *C. esculenta* unit, the efficiency closed to 80% before plant dead occurred. The average of chromium removal efficiency was 62.21% and maximized at 77.78% (within 50 days).

For control unit, the efficiency closed to 60%. The average of chromium removal efficiency was 55.24% and maximized at 63.16% (within 80 days).

2) Chromium removal efficiency at 0.25 m wastewater level

For experimental green *C. esculenta* unit, the efficiency closed to 90% before plant dead occurred. The average of chromium removal efficiency was 69.67% and maximized at 86.36% (within 70 days).

For experimental violet *C. esculenta* unit, the efficiency closed to 80% before plant dead occurred. The average of chromium removal efficiency was 61.91% and maximized at 83.82% (within 40 days).

For control unit, the efficiency closed to 65%. The average of chromium removal efficiency was 57.45% and maximized at 66.67% (within 90 days).

3) Chromium removal efficiency at 0.35 m wastewater level

For experimental green *C. esculenta* unit, the efficiency closed to 85% before plant dead occurred. The average of chromium removal efficiency was 67.18% and maximized at 84.85% (within 60 days).

For experimental violet *C. esculenta* unit, the efficiency closed to 75% before plant dead occurred. The average of chromium removal efficiency was 55.72% and maximized at 76.47% (within 20 days).

For control unit, the efficiency closed to 55%. The average of chromium removal efficiency was 50.45% and maximized at 54.55% (within 40 days).

However, the system efficiencies of all experimental units within 40 days period time were interested because of plants still grew up ordinary. The average of chromium removal efficiencies within 40 days period time at 0.15 m wastewater level were 73.59% and 67.33% for green and violet C. *esculenta*, respectively. At 0.25 m wastewater level were 76.16% and 72.75% for green and violet C. *esculenta*, respectively. At 0.35 m wastewater level were 78.40% and 73.03% for green and violet C. *esculenta*, respectively.

5.1.2 Optimum wastewater level

Wastewater level has no significantly effect on the chromium removal efficiency at 95% confidence. As a result, the optimum wastewater level for chromium removal of both plant types can not be determined.

5.1.3 Chromium accumulation in constructed wetland systems

From mass balance data, chromium accumulation in wetland soil beds was very clearly higher than in wetland plants (about 97% of all). For chromium accumulation in plant, both of them could accumulate chromium about 0.5036 mg/g (dry weight).

5.1.4 Chromium accumulation in various parts of plant

Chromium accumulation was determined into amount of chromium per dry weight. It indicated that the level of chromium accumulation was in root > corm > lamina > petiole, respectively (0.2533 > 0.1165 > 0.0810 > 0.0612 for green *C. esculenta* and 0.2478 > 0.1131 > 0.0804 > 0.0607 for violet *C. esculenta*) and there were no significantly difference of chromium accumulation in all wastewater levels in each part of plant.

5.1.5 The plant growth rate on wetland condition

After start-up constructed wetland system with feeding tannery post-treatment wastewater in all experimental units and clean water in all plant-observed units, plant growth rates were recorded into fresh weight, dry weight, and length of petioles every 10 days through 100-day experimental period.

From all plant growth rate data, it indicated that experimental green *C. esculenta* at 0.25 m and 0.35 m wastewater level could be grown the best when comparing within experimental types. However, it was found that there were differences significantly in the average of all growth rate parameters comparing between experimental and plant-observed type. That was plant-observed type could grow better than experimental type in all water level due to plant dead occurrence in all experimental units resulted from salt stress effect. The best growing type of plant-observed was green *C. esculenta* at 0.35 m water level.

5.2 Recommendations

From this study, several recommendation for further study are provided as follows

5.2.1 *Colocasia esculenta* (L.) Schott is not suitable for the tannery wastewater because it can not survive in salt stress condition.

5.2.2 From the data about chromium accumulation in wetland plant, it showed that this species has high performance to assimilate heavy metal. So, it is possible to utilize for treating toxic substance in other condition without salt stress effect.

5.2.3 Due to the diversity of this species, the discovery of botanical variety types which can tolerance to salt stress is challenged.

5.2.4 For removing chromium from tannery post-treatment wastewater by using FWS constructed wetland type, other wetland plant types such as *Typha*, *Phragmite*, and *Canna* should be utilized.

5.2.5 Subsurface flow constructed wetland type is an interested method for using to remove chromium from tannery post-treatment wastewater.