Summary and Conclusions

4.1 Summary

Efforts have been done to minimize production of hazardous waste; accumulated waste has become one of the most important environmental challenges that the world faces today. According to recent surveys, the most common contaminants reported in wastewater are heavy metals. Therefore, inexpensive materials for removing and entrapping heavy metal wastes from contaminated water are requires concentration of the metals a smaller volume followed by recovery. Different treatment techniques have been developed a new adsorbents from plentiful sources of natural wastes (or byproducts).

New current methods of removal of heavy metals by rich straw, guava seed, willow bark, root and shoot section of Eichhornia crassipes and leaves, stem of Phragmites australis.

Natural materials, such as clay minerals (hebba), can also be utilized for the removal of heavy metal ions from polluted aqueous system.

The main objective of this study to evaluate the effecting of byproduct on treatment heavy metals, so the effecting of clay minerals to examine the effectiveness of time, examine the effectiveness of pH and examine the effectiveness of initial concentration of wastewater (synthetic waste) in the treatment of heavy metals. This steps will be taken place for (Fe^{3+}, Zn^{2+}, Cu^{2+}) and final check with the wastewater of CLEQM before enter to filter which remove heavy metals. The results would be useful when evaluating the heavy metal removal form wastewater.

4.2 Conclusions

The study covered the screening of various types of heavy metals removal from wastewater by different sorbent types including agriculture by-product such as rice straw, guava seeds, willow bark, Eichhornia crassipes (shoot, root) and Phragmites australies (stem, leaves). And clay such as hebba.

There are many considerations that should be taken in to account during the selection of these materials such as low cost of material, availability of getting these materials and the reused to clean the environmental from it, and materials waste ability to be treated after treatment.

The conclusions drawn from the study are presented as:

1. Treatment by rice straw showed a small increase in the pH values by increasing the weights of sorbent; decreased in the values of EC after treatment was observed. A large increase in the TOC values. Pb^{2+} has maximum removal in the treatment by this material that equal to 96.8%.

2. Treatment by guava seeds showed a little increase in the pH values by increasing the weights of sorbent; decreased in the values of EC after treatment was observed. An increase of TOC values, which have a great effect on treatment. Generally guava seeds are rich by vitamin C (Ascorbate), which have the ability to absorbed iron, so maximum removal for Fe^{3+} (98.85%) was obtained. This sorbent also showed high removal of Al^{3+}, Pb^{2+} (96.57%, 95.08%) respectively.

3. Treatment by willow bark showed that a slight increase of pH values rose to 3.8 by the increase in weights of sorbent, a decreased in the

EC values and a high increase in TOC values due to its structure. This type of sorbent showed the great effect on the treatment of Pb^{2+} with maximum removal equal to 99.5%. It has also a good indication for the removal of Cr^{3+}, Fe^{3+}, Co^{2+}, Cd^{2+}, Cu^{2+}, Al^{3+}, and Ba^{2+}, with values equal to 85.4%, 84.5%, 75.2%, 72.8%, 71.2%, and 59.7%, respectively

4. Treatment by Eichhornia crasspies (shoot and root) showed a small increase in the pH values to 4.24 in shoot and 5.97 in root, a decreased in the EC values after treated of 0.1gm in shoot only and at 0.1, 0.2 gm in the root. This indicated that the root part has a great effect on the removal rate than in the shoot part. TOC values in the shoot part are of higher values than in the case of root part. Pb^{2+} has maximum removal in the treatment, which equal to 99.4% in the root, 98.55% in the shoot. All results showed that root part has great effect in the treatment than shoot part.

5. Treatment by Phragmites australies (stem and leaves) showed a little increase in the pH values to about 3.86 in each part. A decreased in the values of EC was observed after treatment by 0.1gm in leaves only. TOC values in the leaves part are less than that of the stem part. Pb^{2+} has maximum removal in the treatment that equal to 96.9% in the leaves, 93.47% in the stem; all results showed that leaves part has great efficiency in the treatment than stem part.

6. Treatment by hebba showed a large increase in the pH values reached to 7.8 by increasing weights of sorbent. A decreased in the values of EC in 0.1, 0.2, and 0.3 gm only after treated was found. Cr^{3+}, Cu^{2+}, Pb^{2+}, Al^{3+}, Fe^{3+}, Zn^{2+}, Cd^{2+} have maximum removal in the

treatment that equal to 99.8%, 99.7%, 99.5%, 99.0%, 98.88%, 93.6%, and 70.09%, respectively.

7. It was found that hebba has a great effect in the treatment being of best results, low contamination, easy to obtain and have low cost. So that the optimum conditions for treatment (pH, time, initial concentration) were studied for iron, copper and zinc. The study showed that the optimum pH is at 3.1 for iron, which has great removal (98.8%). With the optimum time of 12 hours, hebba has the ability of removal concentration of iron from (10-180) mg/L, for copper ion the optimum pH is at 3.1, which has great removal equal to 99.7% without addition any buffer. And the optimum time is 12 hours, which have maximum removal. hebba has the ability of removal concentration of copper from (10-50) mg/L, for zinc ion the optimum pH is at 3.1, with corresponding removal (99.4%) without addition of any buffer. with optimum time of 12 hours. hebba has the ability of removal concentration of zinc ion from (10-40) mg/L.

As an application on the previous studies, the drain of the treatment of the station of CLEQM by the eight materials gives the following results:

- In the treatment by rice straw the best removal was found in the order $Pb^{2+} > Cd^{2+} > Al^{3+}$ which equal to 89.3 % > 83.3% > 2.86%.
- In the treatment by guava seeds the best removal was in the order $Pb^{2+} > Cd^{2+}$ which equal to 89.3% > 83.3%.
- In the treatment by willow bark the best removal was found in the order $Cd^{2+} > Cu^{2+}$ which equal to 83.3% > 64.2% > 48.9% > 22.9%.
- In the treatment by Eichhornia crassipes shoot the removal was found in the order $Pb^{2+} > Cd^{2+}$ which equal to 85.1% > 83.3%.
- In the treatment by Eichhornia crassipes root the removal was found in the order $Pb^{2+} > Cd^{2+} > Al^{3+}$ which equal to 87.2% > 83.3% > 47.39%.
- In the treatment by Phragmites australis leaves the removal was found in the order $Pb^{2+} > Cd^{2+}$ which equal to 89.3% > 83.3%.
- In the treatment by Phragmites australis stem the removal was found in the order $Pb^{2+} > Cd^{2+}$ which equal to 87.2% > 83.3%.
- In the treatment by hebba the best removal were appear in Cd^{2+}, which equal to 83.3%. From the treatment of synthetic wastewater and CLEQM station it can conclude that hebba make the best treatment in acidic solution.