THE EFFICIENCY OF *MORINGA oleifera* (MALUNGGAY) POWDERED SEEDS AS BIOSORBENT FOR COPPER AND ZINC

A Thesis
Presented to the
Faculty of the Graduate School
ADAMSON UNIVERSITY

In Partial Fulfillment of the
Requirements for the Degree
MASTER OF SCIENCE IN CHEMISTRY

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May 2005

ABSTRACT

Title	:	The Efficiency of *Moringa oleifera* (Malunggay) Powdered Seeds as Biosorbent for Copper and Zinc
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Degree	:	Master of Science in Chemistry
No. of Pages	:	111

This research was conducted primarily to determine the efficiency of *Moringa oleifera* (malunggay) powdered seeds as biosorbent for copper and zinc using both powdered seeds and deoiled powdered seeds. Artificial metal solutions of copper and zinc and wastewater samples were used. Experimental parameters namely: temperature (25°C, 30°C and 35°C); contact time (1, 3 and 6 hours); and pH (3,7 and 10) were varied one at a time to check their effects on the biosorption process. The quantity of adsorbed copper and zinc on the seeds were analyzed using Varian SpectrAA –200 Furnace Atomic Absorption Spectrophotometer.

The following findings were noted from this study:

It was found out that the seeds of *Moringa oleifera* (malunggay), powdered and de-oiled, can be an effective biosorbent for heavy metals like copper and zinc. The quantity of metal ions that was adsorbed from the artificial solutions per gram of powdered seeds ranged from 0.045mg to 0.877mg for copper and 0.102mg to 3.646mg

for zinc. The deoiled powdered seeds adsorbed higher quantity of copper (0.091mg to 2.938mg) and zinc (1.123mg to 3.964mg). There were significant differences in the quantity of copper and zinc adsorbed by powdered seeds when subjected to different degrees of temperature and pH 10. There were significant differences in the quantity of copper and zinc adsorbed by deoiled powdered seeds when subjected to 25°C temperature, to different contact times, and pH 7 and 10. There were significant differences in the quantity of copper and zinc adsorbed by powdered seeds and deoiled powdered seeds when subjected to different contact times and pH 3 (copper) and pH 3 and 7 (zinc). There were significant differences in the quantity of copper adsorbed from the artificial metal solutions and wastewater samples by powdered seeds and deoiled powdered seeds when subjected to 35°C, different contact times, and pH 3 and 10.

The following conclusions were drawn based on the findings in the study:

The seeds of *Moringa oleifera*, be it the powdered or the de-oiled, were proven to be a potential biosorbent for copper and zinc. Both powdered and deoiled powdered seeds adsorbed higher quantity of zinc as compared to copper. There were significant differences in the quantity of copper and zinc adsorbed by deoiled powdered seeds specifically at different temperatures and pH. Biosorption efficiency decreased as the pH increased. Complexation occurs at higher pH thus causing fewer ions to be available for binding to active sites of the seeds. Contact times had no much effect on the sorption process. There were significant differences in the quantity of copper and zinc adsorbed by deoiled powdered seeds specifically at 25°C temperature, different contact times, and pH 7 and 10. There were significant differences in the quantity of copper and zinc adsorbed

by powdered seeds and deoiled powdered seeds when subjected to different contact times and pH, 3 for copper and 3 and 7 for zinc. The deoiled powdered seeds adsorbed greater quantity of copper and zinc as compared to powdered seeds. There were significant differences in the quantity of copper adsorbed from the artificial metal solutions and wastewater samples by powdered seeds and deoiled powdered seeds when subjected to 35°C, different contact times, and pH 3 and 10. There was generally higher quantity of adsorbed copper from the artificial solutions as compared to the wastewater samples. Presence of different competing ions might have caused lower efficiency in the wastewater samples. There was no zinc sorption from the wastewater samples.

Based on the above findings and conclusions, the following recommendations were made to further improve this study:

Use the seeds as biosorbent for other heavy metals especially the more toxic ones, e.g. lead, chromium, mercury, etc. Based on the experimental parameters used, determine the optimum conditions where sorption equilibrium will be achieved using Langmuir and Freundlich Sorption Isotherm Models. Vary the initial concentration of artificial metal solutions to verify efficiency of the seeds when applied to different concentrations. Make use of another dosage of seed in order to determine the optimum dose that will give the best sorption results. Explore on other parts of *Moringa oleifera* such as the bark, roots, leaves and flowers to check if they can also be a potential biosorbent for heavy metals. Explore on the mechanism and kinetics of the biosorption process.

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