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USING OF *ABELMOSCHUS ESCULENTUS* RESIDUES TO REMOVE SOME HEAVY METALS OF CONTAMINATED WATER

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Abstract

The present experiment was carried out to remove some trace elements such as lead, cadmium, zinc and nickel of the contaminate water using the ground stem, leaves and roots of the Okra plant (*Abelmoschus esculentus*) as adsorbent. The contaminated water samples were collected from AL-Yohedia Stream drainage in Hilla city, Iraq using polyethelen container.

Five separation columns (250 ml) and (5 cm diameter) used to achieve the experiment which include two stages. The first stage include fill the first column in stems, second fill in leaves, third fill in roots , fourth fill in mix of stems and leafs and roots and the fifth fill in chelix-100 as a control with high 6 cm for all columns. The second stage was similar to the first stage, but in different high that was 12 cm.

The current results showed the fourth column was higher efficiency to removing the studied heavy metals in both stages. As well as the efficiency of the fourth column with high 12 cm was higher compare with high 6 cm.

Key words : Heavy metals, adsorbent, Okra, separation column.

Introduction

Contamination of the environment by heavy metals with their potential effects on human health, agriculture and natural ecosystems have become a subject of worldwide concern. Hazards of heavy metal contamination have been reported (Takeuchi, 1972; Friberg, 1974; Chaisemartin, 1983; Chan *et al*., 1999 and Heing & Tate, 1997). Toxic elements are regarded as non-biodegradable materials, having prolonged half-life. They cause serious health concerns due to their ability to get store in various body parts. This issue is becoming worse day by day with special reference to third world countries (Singh *et al*., 2010). There are many methods for remediation, but they are expensive or ineffective. However, Manyresearchers has found that a wide variety of commonly discarded waste can efficiently to remove the toxic heavy metal from contaminated water. Biosorption is a physiochemical process that occurs naturally in certain biomass which allows it to concentrate and bind contaminants onto its cellular structure. Though, using biomass in environmental cleanup has been in practice for a while, scientists and are hoping this phenomenon will provide an economical alternative for removing the toxic heavy metals from industrial wastewater and aid in environmental remediation (Ahalya *et al*., 2003). The use okra residuse which is composed of α-cellulose, protein, lignin and some of mineral elements in small concentrations had been carried out by researchers to diminishing the metal concentrations from both synthetic and industrial waste water (Hashem, 2007; Barak & El-Said, 2010; Al-Samawi & Hama, 2012). These researchers had established the potential use of okra residuse to remove Pb, Cd, Fe and other metals. Lignocellulosic wastes such as sugar waste having 40%wt of cellulose, 27% wt of hemicellulose and 10%wt of lignin (Nigam *et al*., 2009) could also serve the same goal because of the presence of the -OH bond of the cellulose.

Materials and Methods

The contaminated water samples were collected from AL-Yohedia Stream drainage in Hilla city, Iraq using 5

Litters polyethelen container which are well washed with acid and deionized water. The plant samples were collected from different agricultural lands, which are washed with tap water and Deionized water then with nitric acid (0.5 N) to get rid of all soil particles and suspended impurities. Stems, leaves and roots were separated and cut intosmall parts and dried in oven at 70^0C for 72 hours to remove moisture. Then grinded by mortar to powdered. Whereas the contaminated water samples filtered using 0.45 mm filter paper to get the dissolved metals.

Five separation columns (250 ml) and (5 cm diameter) used to achieve the experiment, which include two stages. The first stage include fill the first column in stems, second fill in leaves, third fill in roots, fourth fill in mix of stems and leafs and roots and the fifth fill in chelix-100 (Sodium form) with mish size (50-100) as a control with high 6 cm for all columns. The second stage was similar to the first stage but in different high that was 12 cm. The contaminated water samples were pass throw the columns in flow rate 5 ml/minute to ensure well adsorption then measurement the heavy metals concentration by Flame Atomic Absorption Spectrophotometer (APHA, 2005).

Statistical analysis

SPSS 17.0 programs used for least significance differences (LSD $\leq$ 0.05). Analysis of variance test (ANOVA) between the columns.

Results and Discussion

Many variation in the trace elements concentrations has been recorded during this study for both stages as shown in figs. 1, 2, 3 and 4, which describe the concentration of Pb^{+2}, Cd^{+2}, Ni^{+2} and Zn^{+2}, respectively in the first stage compared to the control.

The figs. 5, 6, 7 and 8 describes the concentration of Pb^{+2}, Cd^{+2}, Ni^{+2} and Zn^{+2}, respectively in the second stage compared to the control.

The current results indicated to that the fourth column was higher efficiency to removing the heavy metal ions in both stages. As well as the efficiency of the fourth column with high 12 cm was higher compare with high 6 cm as a result of the increasing of the adsorbent area in addition to the increasing the adsorbing time (Olabanji and Oluyemi, 2015).

The okra plant can be considered as multi-purpose (biological treatment and food) (Oyelade *et al.*, 2003). Okra residues is composed of á- cellulose and protein (Hashem, 2007; Al-Samawi and Hama, 2012). The infra red analysis of the okra waste showed that amino, hydroxyl and carboxyl depicting the functional groups of

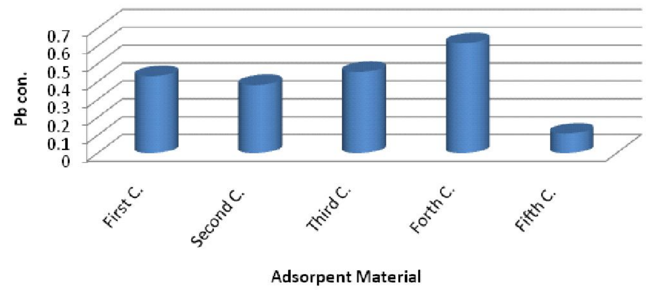

Fig. 1 : Average Pb concentration in separated column (6 cm).

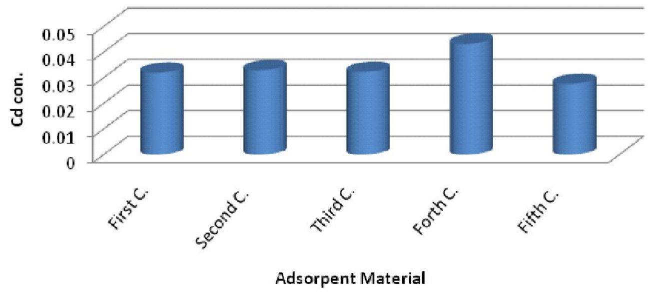

Fig. 2 : Average Cd concentration in separated column (6 cm).

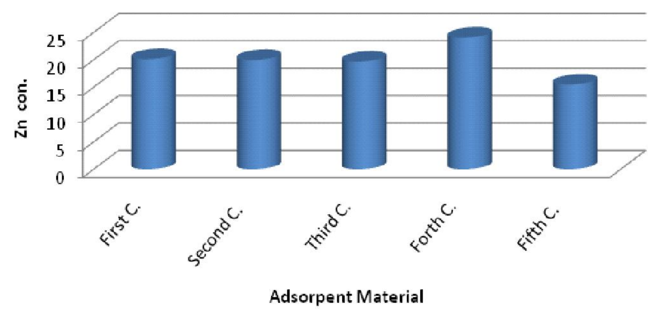

Fig. 3 : Average Zn concentration in separated column (6 cm).

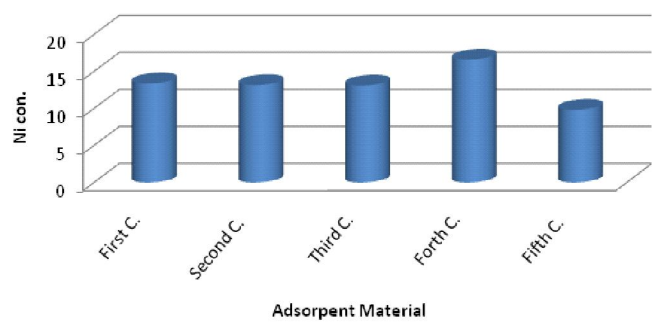

Fig. 4 : Average Ni concentration in separated column (6 cm).

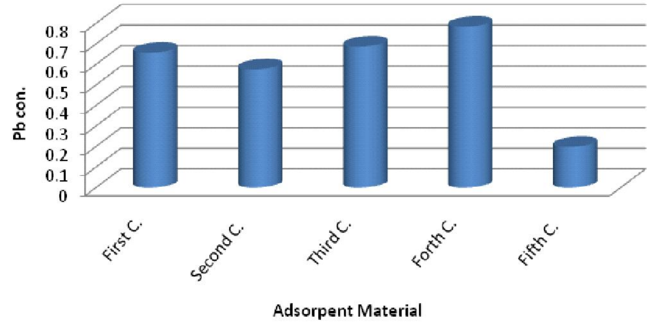

Fig. 5 : Average Pb concentration in separated column (12 cm).

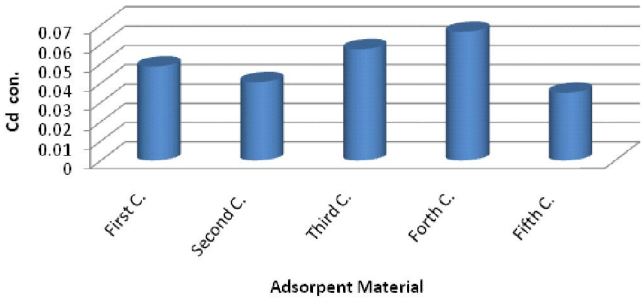

Fig. 6 : Average Cd concentration in separated column (12 cm).

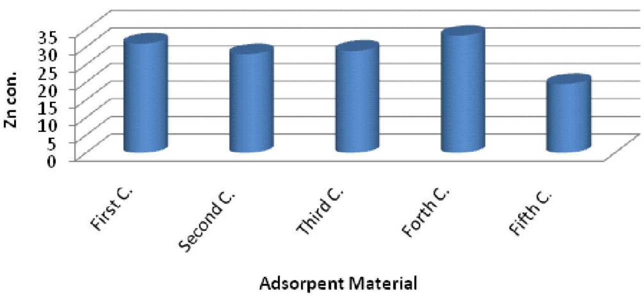

Fig. 7 : Average Zn concentration in separated column (12 cm).

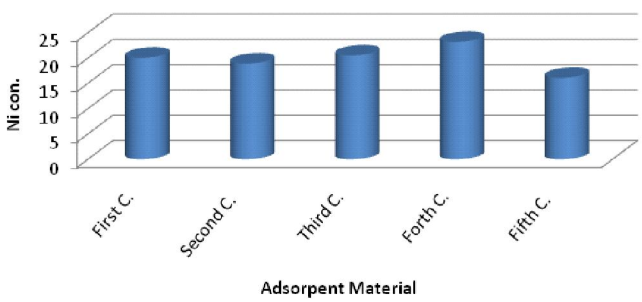

Fig. 8 : Average Ni concentration in separated column (12 cm).

its constituents. The adsorption of metal ions on the wastes may involve interactions or coordination of the metals to the functional groups present in natural proteins, lipids and carbohydrates of the wastes (Kumar, 2006; Drake, *et al*., 1996). Single pair of electrons on oxygen and nitrogen atoms supplies electron to the electron deficient positively charged metals, which made adsorption by okra residues possible, hence positively charged metals could be removed (Nigam *et al*., 2009).

Conclusion

From the analysis, it was found that *Abelmoschus esculentus* residues are very effective and promising in serving as cheap and readily available biosorbents for treatment and reduce the risks of heavy metal contaminations.

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