IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)
e-ISSN: 2319-2402,p- ISSN: 2319-2399.Volume 11, Issue 10 Ver. I (October. 2017), PP 30-31
www.iosrjournals.org

Absorption of heavy metals from leafy vegetables grown using Musi Water

K. Nagajyothi, D.Ugandhar, N. Swathi & B. Hima Bindu
Aurora's Technological and Research Institute, Uppal, Hyderabad

Abstract: *Musiriver water is contaminated with various pollutants including toxic heavy metals which cause various health hazards. The green leafy vegetables cultivated using Musi water are found to contain the toxic heavy metals. When the heavy metals in Musi water used for cultivation,are absorbed by zeolites, the amount of heavy metals in leafy vegetables are very much reduced.*
Key words:*Heavy metals, Musi, Clinoptilolite, Sorption, Sodium lauryl sulphate*

Date of Submission: 26-09-2017 Date of acceptance: 06-10-2017

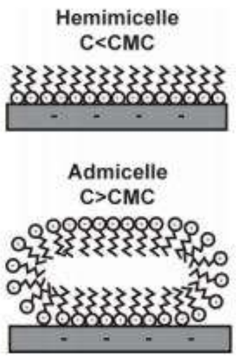
I. Introduction

Despite several attempts by various governments, the river Musi, which cuts across Hyderabad, continues to be one of the most polluted rivers in the country(1). A recent study discovered high levels of heavy metals like cadmium, chromium, nickel, lead, arsenic in the vegetables cultivated using Musi river water. These toxic heavy metals cause kidney, cardiovascular, nervous and bone diseases including cancer and ulcer. Heavy metals are persistent, bio accumulative and able to disrupt the metabolic functions and vital organs in humans and animals. Cadmium is a human carcinogen with an impact on respiratory system and liver. Chromium causes gastro intestinal, renal and neurological damage. Nickel's serious health effects may include chronic bronchitis and lung cancer. Lead affects reproductive and nervous systems and it accumulates in the teeth and bones. Arsenic is a carcinogen that affects renal and respiratory systems and accumulates in hair follicle. Mercury affects the immune and cardiovascular systems(2).

Heavy metals can be absorbed from water using zeolites. However in order to increase the affinity, the zeolites are chemically modified using chemicals or surfactants.

Natural clinoptilolite zeolite(3) is an arrangement of silica and alumina tetrahedra. On a microscopic level it has a 3-dimensional honeycomb-shaped crystalline structure that maintains a negative magnetic charge, which acts like a "cage", drawing in and capturing positively charged heavy metal ions.

A general model of the modification of a solid surface via the sorption of an ionic surfactant is shown in the figure given below. When low surfactant concentrations are applied onto the zeolite surface, surfactant molecules exist as monomers that are exchanged with the exchangeable cations of the zeolite until a hemimicelle of surfactant molecules is established at its external surface. At concentration above the CMC, the surfactant molecules will form an admicelle attached to the external surface of the zeolite.



II. Methodology& Results

Fresh leafy amaranthus leaves were randomly collected from farms of Puranapul, Chaderghat, Daberpura, Amberpet and Uppal grown using Musi River water. First the leaves were harvested by hand. After plucking, the leaves were laid out to wither for few hours. The leaves were crushed and then oxidized in the presence of air. Then the leaves were heated and fired.

An atomic absorptionspectrophotometer (AA-2759, Shimadzu) was used to determine the heavy metals. Pyrolytic graphite tube was used to detect As, Cr and Se where high density graphite was used in the case of Pb and Cd. The concentration of the heavy metals in these leaf extracts are obtained from the calibration curves for Pb, Cd, As, Cr and Se at different concentrations (0.0, 0.1, 0.5, 1.0, 10.0, 50.0 mg/g)

The Concentration of Heavy Metals in Amaranthus grown using Musi Water

Place	Pb(mg/g)	Cd(mg/g)	As(mg/g)	Cr(mg/g)	Se(mg/g)
Purana Pul	0.0052	0.0073	0.0120	0.0031	0.0090
Chader Ghat	0.0057	0.0068	0.0180	0.0027	0.0120
Dabeerpura	0.0039	0.0051	0.0080	0.0015	0.0052
Amberpet	0.0042	0.0051	0.0100	0.0011	0.0031
Uppal	0.0058	0.0069	0.0230	0.0042	0.0100

Clinoptilolite has received extensive attention due to its attractive sorption capacity for several heavy metal cations.
Minerological composition: 55% Clinoptilolite, 6% quartz, 13% montmorillonit, 26% ash

III. Modification of Clinoptilolite

25g of Clinoptilolite + 10 ml Sodium lauryl sulphate + 90 ml HCl solution (2.5 mole/lit) taken in 500 ml conical flask (C1)
25g of Clinoptilolite + 10 ml Sodium lauryl sulphate + 90 ml NaOH solution (2.5 mole/lit) taken in 500 ml conical flask(C2)

The suspension is stirred at 65^{O}C for 24 hrs, centrifuged at 4000 rpm for 10 min. The solid is removed, washed with distilled water. Then the solid is dried at 105^{0}C for 12 hours, sieved and stored. The modified Clinoptilolite (C1 & C2) are mixed separately with Musi River water in the concentrations of 0.1 mg/lit, 0.5 mg/lit, 1.0 mg/lit, 10 mg/lit, 50 mg/lit) and agitated continuously for 2hrs at 22^{O}C. The treated water is used to cultivate amaranthus. Then the concentration of heavy metals in the amaranthus leaves grown using treated water is measured using Atomic Absorption Spectrophotometer. A blank solution without Clinoptilolite is prepared in order to examine the possible precipitation of heavy metals.

All the experiments were performed three times and average experimental error was 3.5%.

Sorption capacity $A = \frac{C_0 - C_k}{m} x\ v$

C_0 is the initial concentration , C_k is the final concentration, v is the volume of the sample , m is the weight of Clinoptilolite.

The Concentration of Heavy Metals in Amaranthus grown using treated Musi Water

Place	Pb(mg/g)	Cd(mg/g)	As(mg/g)	Cr(mg/g)	Se(mg/g)d
Purana Pul	0.0003	0.0017	0.0010	0.0004	0.0011
Chader Ghat	0.0010	0.0009	0.0021	0.0004	0.0020
Dabeerpura	0.0007	0.0003	0.0012	0.0002	0.0006
Amberpet	0.0009	0.0011	0.0020	0.0000	0.0005
Uppal	0.0011	0.0006	0.0008	0.0006	0.0007

IV. Conclusion

The heavy metals are absorbed by surfactant modified Clinoptilolite from Musi water which show a drastic drop of heavy metals in the amaranthus grown. The average sorption capacity of surfactant modified Clinoptilolite was found to be 420 mg/lit of water in both acidic and alkaline media.

References

[1] Musi River Pollution Its Impact on Health and Economic Conditions of Down Stream Villages-A Study, IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT) Volume 1, 2012, 40-51.
[2] Effect of toxic metals on human health, Varsha Mudgal , Nidhi Madaan ,The Open Nutraceuticals Journal, 2010, 3, 94-99
[3] Removal of heavy metals from aqueous solution using clinoptilolite and stilbite, Mirjana, Golomeova, International Journal of Engineering research and technology,3, 2014.

K. Nagajyothi. " Absorption of heavy metals from leafy vegetables grown using Musi Water." IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT), vol. 11, no. 10, 2017, pp. 30–31.