

Removal of Heavy Metals from Waste water Using Musa Sapientum

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Abstract : The main need for man ,plants and animals to live in this world is water. Due to the increase of industries, they release a large amount of waste waters in to the natural streams like rivers, ponds and lakes. These waste waters contains a large amount of heavy metals like copper, zinc, lead, cadmium, iron etc. These heavy metals and its derivatives show mutagenic effects such as DNA helix, inhibition of DNA synthesis in human, induction of gene mutations chromosome chromosomes aberrations etc .Many conventional methods for removal of these wastes do not show better results. Hence biosorption is used as an alternative for the removal of heavy metals from waste waters. Several prior studies have shown that biosorbents have the capacity to remove heavy metals. In this research, we are using musa sapientum as a biosorbents.

Keywords – heavy metals, biosorption, biosorbents ,industries

I .INTRODUCTION

There have been numerous technologies developed to specifically remove metal toxicants from polluted waters- silica, alumina, activated carbon, and resins have all been proven successful and expensive. While they perform in the high tech laboratories of developed countries, mass manufacturing and distribution of these products in developing nations are expensive and impractical.

One of the biggest sources of water contamination is heavy metals. Mercury, lead, copper, iron, and other naturally occurring metals find their way into our water sources by both natural and man-made means such as agricultural and industrial waste and runoff.

They are lethal to us and the unfortunate part is that they build up in our bodies slowly over time. Lead and mercury in particular build up and can damage the nervous system and, specifically, your brain.

Removal of heavy metals has always been a challenge to engineers and scientists of this field. Traditional heavy metal treatment includes chemicals and processes in surface chemistry such as precipitation, adsorption, membrane processes, ionic exchange, floatation, and others .However, these techniques are rather expensive and are not selective enough to allow the recovery of very dilute heavy metals present in the effluent. These disadvantages, coupled with the need for more economical and effective methods for the recovery of metals from waste water, have resulted in the development of alternative separation technologies .

Biosorption is potential to become a good alternative for the removal of heavy metal ions in industrial wastewater. It is economically feasible and the precursor materials are easily available. However, the problem that exists with biosorption is that there are so many materials as options, ranging from fruit peel to saw dust, it is hard to determine that which biosorbent is suitable for the removal of a selected heavy metal ion. Therefore, extensive characterization study has to be carried out on each one of precursor material, in this case banana peel (BP), in order to determine the best preparation condition which is effective in removing harmful substances (heavy metals) from industrial effluent.

There is a lot of Heavy Metal in our environment: cadmium, chromium, cobalt, copper, lead, mercury, etc. Interestingly, small amounts of these elements are common in our environment and are actually necessary for good health, but large amounts of any of them may cause acute or chronic toxicity. In small quantities, certain heavy metals are nutritionally essential for a healthy life but they become toxic when they are not metabolized by the body and accumulate in the soft tissues.

Living organisms require varying amounts of heavy metals. Iron, cobalt, copper, manganese, and zinc are required by living organisms. Other heavy metals such as mercury, plutonium, and lead are toxic metals that have no known vital or beneficial effect on organisms, and their accumulation over time in the organism can cause serious illness. Certain elements that are normally toxic are, for certain organisms or under certain conditions. Heavy metal can be exist in wastewater and enter the wastewater treatment plant.

TABLE 1 : BIOLOGICAL COMPONENTS PRESENT IN BANANA PEEL

COMPONENTS	BANANA PEELS
Proteins	0.9 %
Carbohydrates	59 %
Lipids	1.7 %
Lignin	--
Cellulose	--
Hemicelluloses	--
crude fibers	3.7 %
Minerals	Potassium , manganese ,iron ,sodium ,calcium

II . PREPARATION OF MUSA SAPIENTUM

The banana peel (Musa Sapientum) biomass was collected from the local market .The biomass was dried in sun for 15 days .Then the buds were removed and further dried in sun for another 15 days. The biomass was washed with tap water to remove any dust or foreign particles attached to the biomass and thoroughly rinsed with distilled water. The washed biomass was dried at 500 C and ground to powder .The bisorbent was sieved using meshes. The less size particles and maximum size particles were

rejected because less size was too less and maximum size will show less efficiency



FIG 1 : DRYING OF BANANA PEEL IN SUN



FIG 2: BEFORE SIEVING MUSA SAPIENTUM



FIG 3: AFTER SIEVING MUSA SAPIENTUM

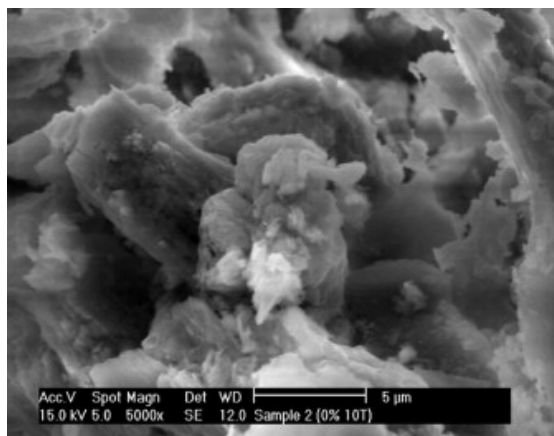


FIG 4 ; SEM IMAGE OF MUSA SAPIENTUM

III. ATOMIC ABSORPTION SPECTROSCOPY (AAS)

Atomic absorption spectroscopy is a method particularly suited to the measurement of small amounts of elements, usually metals, in a sample. The element to be determined is dissociated from its environment so that it exists as free atoms in the ground state. Atoms in this state readily absorb electromagnetic radiation at wavelengths corresponding to excitation to higher energy levels. The extent of this energy absorption from a radiation source is measured photo metrically and compared with standard samples containing known amounts of the element. The method is unusually simple, sensitive and selective. The dissociation of an element from its initial matrix is generally accomplished by putting the sample into solution and aspirating it into a flame. The flame is located between a radiation source of the required wavelength and a detector in a manner analogous to a spectrophotometer cell . The sample solution is drawn into the burner-nebulizer by a stream of air and mixed with air and fuel . Most of the sample solution passes into the nebulizer chamber as droplets, which settle out and pass down the drain tube. The remaining solvent passes as a mist to the burner head, where the solvent evaporates and the solute is dissociated into atoms by the heat of the flame. The number of atoms reaching this point in the operation is only a small fraction of the total. Although atomic absorption has caught on quickly as a rapid, useful analytical method, it does have limitations. The chief problems are instrument drift

due to changes in lamp intensity or wavelength calibration with time and, because of the extreme sensitivity of the method, trace contamination from reagents, water, and surroundings during sample preparation and analysis. Frequent rechecks of instrument operation with standard solutions and care in the preparation and handling of both standard and sample solutions contribute to improved accuracy and precision of the technique.

Calculation of metal uptake :

$$Q = V(c_i - c_f) / S$$

Where Q = metal ion capacity (mgg⁻¹)

c_i = initial concentration of metal in solution , before sorption analysis (mgL⁻¹)

c_f = final concentration of metal in solution , after sorption analysis(mgL⁻¹)

S = dry weight of biosorbent (g)

V = solution volume(L)

Varying concentration (mg / L)	C_i	Q	% removal
25	24.68	4.28	86.81
50	51.9	8.71	83.99
75	73.10	11.94	80.78
100	102.5	16.55	81.08
125	123.98	19.93	80.30
150	147.50	23.39	79.55

TABLE 2 :REMOVAL OF EFFICIENCY OF COPPER FOR TRIAL 1

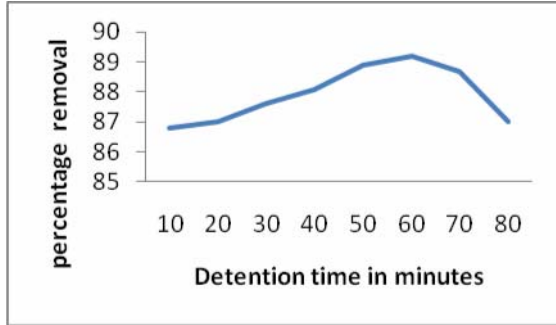


FIG 5: SHOWING CHART FOR % REMOVAL OF COPPER WITH DETENTION TIME IN MINUTES

Varying concentration (mg / L)	C_i	Q	% removal
25	24.65	4.28	86.81
50	51.87	8.71	83.99
75	73.90	11.94	80.78
100	102.05	16.55	81.08
125	124.14	19.93	80.30
150	147.00	23.44	79.59

TABLE 4: REMOVAL OF EFFICIENCY OF COPPER FOR TRIAL 3

Varying concentration (mg / L)	C_i	Q	% removal
25	24.65	4.50	87.37
50	51.87	8.47	83.61
75	73.90	12.15	81.05
100	102.05	16.41	81.01
125	124.14	20.08	80.37
150	147.00	23.65	79.74

TABLE 3 : REMOVAL OF EFFICIENCY OF COPPER FOR TRIAL 2

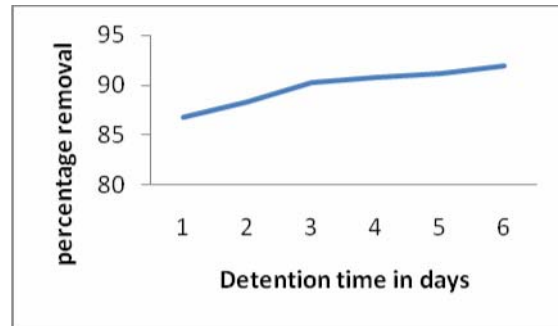


FIG 7 : SHOWING CHART FOR % REMOVAL OF COPPER WITH DETENTION TIME IN DAYS

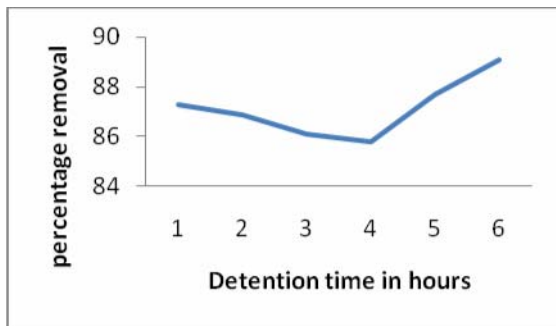


FIG 6: SHOWING CHART FOR % REMOVAL OF COPPER WITH DETENTION TIME IN HOURS

Varying concentration (mg / L)	C_i	Q	% removal
25	24.08	4.69	94.50
50	47.12	9.26	94.12
75	68.57	13.96	93.8
100	96.6	17.98	94.6
125	120.56	22.70	93.6
150	146.88	26.36	92.16

TABLE 5 : REMOVAL OF EFFICIENCY OF LEAD FOR TRIAL 1

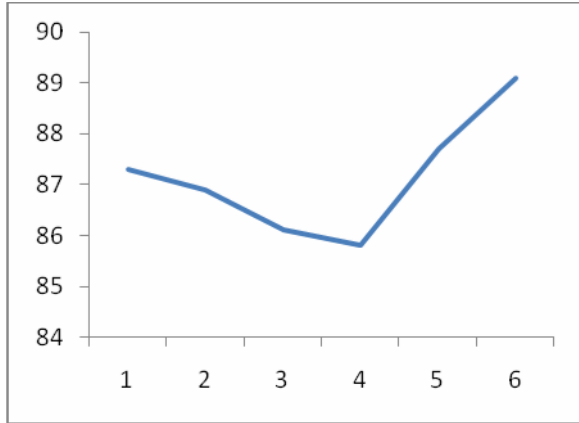


FIG 8 : SHOWING CHART FOR % REMOVAL OF LEAD WITH DETENTION TIME IN MINUTES

Varying concentration (mg / L)	C_i	Q	% removal
25	24.08	4.57	94.45
50	47.12	8.69	95.6
75	68.57	12.56	94.9
100	96.6	16.9	94.1
125	120.56	22.36	93.6
150	146.88	26.87	93.2

TABLE 6 : REMOVAL OF EFFICIENCY OF LEAD FOR TRIAL 2

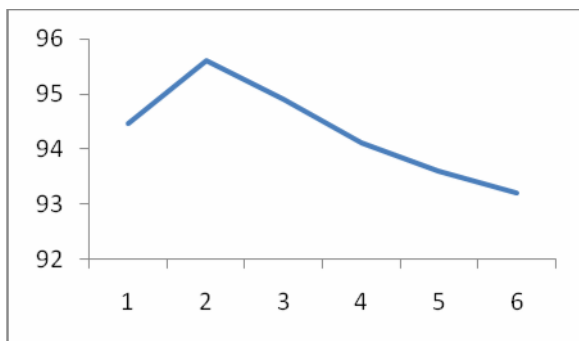


FIG 9 : SHOWING CHART FOR % REMOVAL OF LEAD WITH DETENTION TIME IN HOURS

Varying concentration (mg / L)	C_i	Q	% removal
25	24.08	3.8	86.1
50	47.12	6.9	79.3
75	68.57	12.8	78.1
100	96.6	14.2	77.6
125	120.56	18.6	76.5
150	146.88	19.1	76.1

TABLE 7 : REMOVAL OF EFFICIENCY OF LEAD FOR TRIAL 3

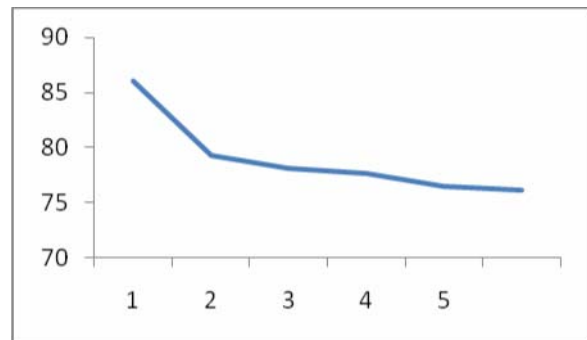


FIG 10 : SHOWING CHART FOR % REMOVAL OF LEAD WITH DETENTION TIME IN DAYS

Varying concentration (mg / L)	C_i	Q	% removal
25	23.6	3.1	81.6
50	47.4	7.2	79.5
75	72.1	11.4	77.3
100	98.69	13.9	76.1
125	124.2	16.7	74.8
150	148.38	20.8	75.3

TABLE 8 : REMOVAL OF EFFICIENCY OF NICKEL FOR TRIAL 1

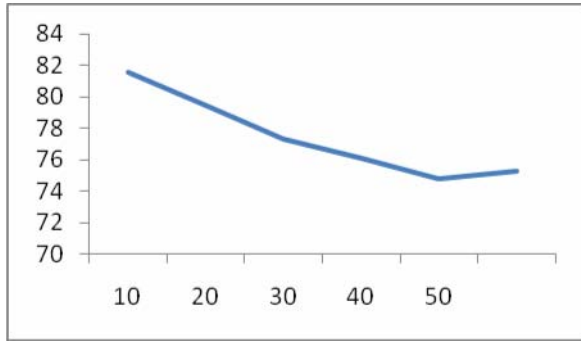


FIG 11 : SHOWING CHART FOR % REMOVAL OF NICKEL WITH DETENTION TIME IN MINUTES

Varying concentration (mg / L)	C_i	Q	% removal
25	23.6	3.6	80.1
50	47.4	7.4	79.7
75	72.1	11.2	76.2
100	98.69	12.8	73.4
125	124.2	17.6	72.1
150	148.38	19.7	70.7

TABLE 9 : REMOVAL OF EFFICIENCY OF NICKEL FOR TRIAL 2

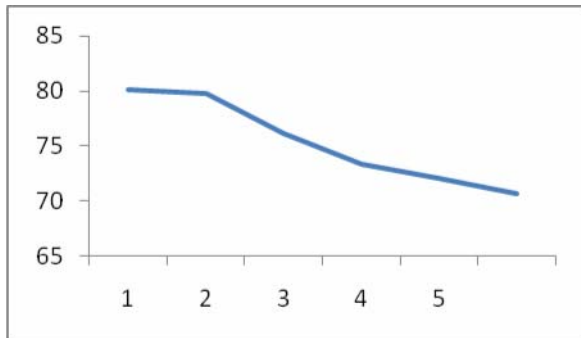


FIG 12 : SHOWING CHART FOR % REMOVAL OF NICKEL WITH DETENTION TIME IN HOURS

Varying concentration (mg / L)	C_i	Q	% removal
25	23.6	4.2	82.5
50	47.4	7.7	78.7
75	72.1	10.7	78.2
100	98.69	13.8	70.4
125	124.2	16.6	68.1
150	148.38	20.1	67.7

TABLE 10 : REMOVAL OF EFFICIENCY OF NICKEL FOR TRIAL 3

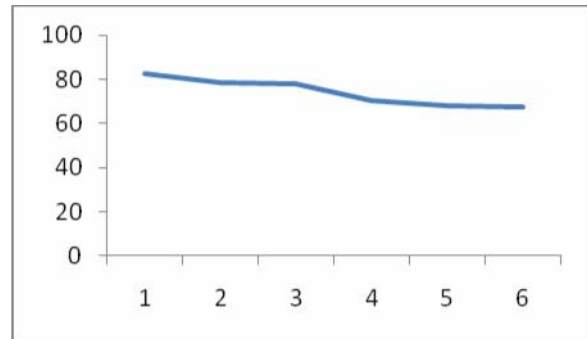


FIG 13 : SHOWING CHART FOR % REMOVAL OF NICKEL WITH DETENTION TIME IN DAYS

Varying concentration (mg / L)	C_i	Q	% removal
25	24.1	3.9	83.9
50	48.4	6.8	82.6
75	75.6	11.07	80.1
100	99.3	14.7	76.8
125	120.4	17.8	74.2

150	146.7	19.5	72.1
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FIG 15 : SHOWING CHART FOR % REMOVAL OF ZINC WITH DETENTION TIME IN HOURS

TABLE 11 : REMOVAL OF EFFICIENCY OF ZINC FOR TRIAL 1

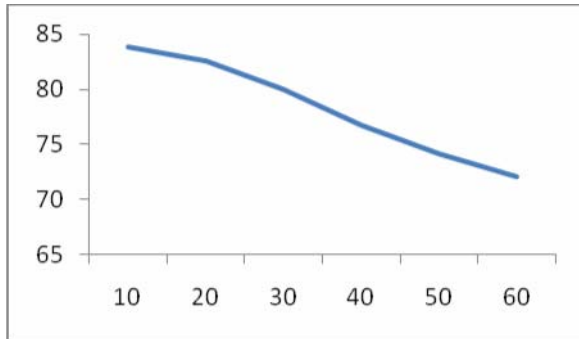


FIG 14 : SHOWING CHART FOR % REMOVAL OF ZINC WITH DETENTION TIME IN MINUTES

Varying concentration (mg / L)	C_i	Q	% removal
25	24.0	4.7	86.1
50	48.6	7.2	81.2
75	75.7	11.2	79.4
100	99.7	13.8	76.8
125	122.4	18.4	70.4
150	147.1	19.1	68.7

TABLE 13 : REMOVAL OF EFFICIENCY OF ZINC FOR TRIAL 3

Varying concentration (mg / L)	C_i	Q	% removal
25	24.0	4.5	84.5
50	48.6	6.1	79.2
75	75.7	10.8	78.5
100	99.7	13.6	75.2
125	122.4	17.9	71.6
150	147.1	18.5	69.1

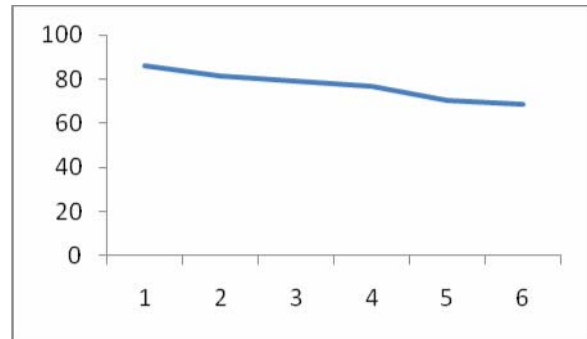
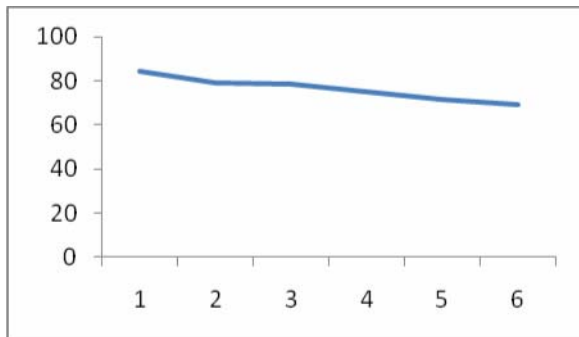


TABLE 12 : REMOVAL OF EFFICIENCY OF ZINC FOR TRIAL 2

FIG 16 : SHOWING CHART FOR % REMOVAL OF ZINC WITH DETENTION TIME IN DAYS



IV. CONCLUSION

The percentage removal of copper shows that the percentage removal decreases as the concentration of musa sapientum powder in waste water increases. This is because of the fact that percentage removal is probably caused by the saturation of some adsorption sites.

At low concentrations, biosorbent sites take up the available metals more quickly. However at high concentrations, metal ions need to diffuse to the biomass surface by intra particle diffusion and greatly hydrolyzed ions will diffuse at a slow rate.

This might be the reason for the lower percentage removal as the concentration increases..

These studies on biosorbent application, if successful, will be greatly beneficial to the environment since the waste material is reduced and reused in a way that can help preserve the environment while adding economic value to the otherwise worthless waste material.

The results of the heavy metals is of the following order :

$Pb > Cu > Ni > Zn$

V . REFERENCES

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