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Optimization of Physio-Chemical Parameters for Biosorption of Heavy Metals Using Allium Sativum and Zingiber Offiscinale

Sharanabasava R S, Suresh M, Tanush B, Sripanth H S., Prof. Spoorthy S S(Asst prof)

Department of Civil Engineering, Dayananda Sagar College of Engineering, Bengaluru (560078), Karnataka, India.

ABSTRACT:

In recent years, growing industries and their waste management has been the main concern for many environmental scientists. That too treating wastewater has become a tough solvable problem in this era, failing to do so has parented many problems, including diseases and causing disabilities for the upcoming generation. This has led many researchers on the path to solve the problems with low cast and high efficiency to fulfill the requirements of portable water. Presence of heavy metals in water is one of those problems and concern of the society. Our project helps to take out such metal ions from the waste water with cost, using abundant available resources and with maximum efficiency. We focus on removing two of such metal ions from the waste water and the method and coagulants can be extended in removing such heavy metal ions. This paper reviews the materials required, methodology involved, outcomes and the discussion of pros and consequences of the project.

Keywords: Waste water, heavy metal ions, absorption, biosorption, absorbent.

Introduction:

The term Heavy Metals refer to any metallic chemical element that has relatively high density and is toxic at even low concentrations. E.g. Mercury (Hg), Cadmium(Cd), Arsenic(As), Chromium(Cr), Lead(Pb) etc. The contamination of water by these heavy metal ions is one of the most serious problems caused by the rapid development of many industries such as mining, fertilisers, surface fishing, energy and fuel producing, iron and steel etc. These heavy metals at higher concentration in drinking water may lead to food poisoning, bioaccumulation in food chain etc. These metal ions in human or living organism's body will lead to many diseases and extremely threatening to lives. Removal of some of these heavy metals like Cadmium (Cd) and Lead (Pb) using Officinale (Ginger) and Zingiber Allium sativum (Garlic) will help to tame these spreading diseases. This method proves to be low costly and highly efficient in removing of heavy metal ions.

Conventional methods for heavy metal removal from aqueous solution and soil include chemical precipitation, electrolytic recovery, ion exchange/chelation, etc. But these methods are often cost prohibitive having inadequate efficiencies at low metal concentrations. Therefore, new technologies are required to reduce heavy metal concentrations to environmentally acceptable levels at affordable costs. Hence, biosorption with low-cost materials (industrial, agricultural or urban residues) has emerged as a promising technology for recovering heavy metals from contaminated industrial effluents (Sud et al., 2008).

Biosorption is not based on only one mechanism. It consists of several ones that differ quantitatively and qualitatively according to the type of biomass, its origin and its processing. This study may generate useful information for the utilisation of native agricultural products for the removal of heavy metals from wastewater. The crops ginger and garlic, as agricultural products from market and food canning industries could be used as heavy metal adsorbents. In this study, the capabilities of the above biomass for adsorption of heavy metal ions were tested at several experimental conditions. The methodology of the project when applied to large scale like, waste water outflown from the industries and treating them will be useful for the society and environment health.

LITERATURE REVIEW

Title of paper: Removal of heavy metals from contaminated water by biopolymer crab shell chitosan.

- The study focuses on potential of using crab shell chitosan as a low cost biosorbent, for heavy metals removal from aqueous solutions in an adsorption filtration system. Chitosan was synthesized from chitin by treatment of strong alkali solution under reflux condition. Spectrometric (AA and UV) was employed to detect heavy metals.
- The research revealed that prepared chitosan showed better removal performance for Mn, Cd, Zn whereas the removal efficiency was satisfactory for Co, Ni, Fe but it exhibited relatively least performance for Pb and Cr.

Title of paper: heavy metal pollution removal from water using cost effective biosorbent.

One of the worldwide issues is that water bodies are polluted with toxic heavy metals, copper is considered one of the mostcommon method of heavy metal pollution of water bodies from industries. It has potential on ecosystem and environment.
The biosorbent is prepared by washing the Westland Irish peat moss with acidic bath for half an hour with the continuousshaken process.
The maxiamum copper removal of 94.6percent was obtainedcat a pH of 6, optimum adsorption time of 80 minutes, peat mossdosage of 7.5gper liter.

Title of paper: Study of physio chemical parameters of waste water generated from Aurangabad city of MaharashtraAuthor: Dr Mb mule.

- Khan river is a seasonal river, which is passing through same part of Aurangabad city, the sewage generated is disposed everywhere without any treatment.
- Present study is the effort to study change in water quality of Kham River due to disposal of waste water and sewage the water samples are collected from the river at two different locations.
- The water quality is studied in terms of its physio chemical properties like temperature, Ph., dissolved oxygen, biochemicaloxygen demand, chemical oxygen demand, total hardness electrical conductivity etc.
- The produced results are compared with the standard parameters for identification of its suitability for specific water use such asdomestic water uses and to decide range of its pollution load.
- It was observed that water quality is changed significantly due to contamination of sewage waste water it it and not suitable fordirectdomesticac use without treatment.

Biosorption of Heavy metals from industrial waste water by "GeobacillusThermodenitrificans".

- The Thermophilic bacteria geobacillusThermodenitrificans isolated from Damodar river.
- India was assessed using synthetic metal solutions and Industrial waste water.
- Metals are removed in fe+3(90%), cr+3(80%), cu+2(57.14%), zn+2(55.14%), cd+2(49.02%), in optimum ph. within 720min.
- Sample collection site Damodar river.
- Water samplece collection Kalajharia industrial outfall, sample were taken a depth of 15cm below the surface triplicate and mixed to get a composite sample.

Removal of heavy metals from tannery waste water by using natural absorbents.

Tannery waste water is highly complex and are characterized by high contents of organic, inorganic and nitrogenouscompounds, chromium, sulfides, suspended solids and dissolved solids.

- In this journal paper removal of heavy metals from tannery industry waste water by charcoal discharging of tannery waste water into a any water body effect the aquatic animals, life &human health • The tannery industry is releases harmful heavy metals 20to40 then the standard values.
- Heavy metal is one of the major cyclic pollutants which effects human health &soil fertility .
- Formation of sludge is more effective to cause land &river pollution
- Recycling of tannery waste water with bark canker, chlorophyll dead and neem leaf's as a mixing absorbent.
- Bark canker, coffee husk, dried water melon peel, charcoal as a filtration bed along with slow sand filter.
- Heavy metal like, chromium, cadmium, lead and nickel metals are up to 90%.

A Review on Removal of Heavy Metal Ions from Waste Water using Natural/ Modified Bentonite
The increasing been surging importance in the production of a variety of economical adsorbents for water treatment. Outcome fromthe latest advances in using bentonites and modified bentonite shows the adaptable nature of the clay and its environment friendly nature. main purpose of this review is to describe the flexible way of natural bentonite and modified bentonite and its ability to absorb array of inorganic pollutants, which are present in the waste water. Number of research publications on adsorption of heavy metals using modified bentonite leads to the fact that there has.
Removal of Heavy Metals from Water and Waste Water by Electrocoagulation Process.

- Among the various heavy metal's arsenic, lead, zinc and chromium are considered to be more toxic due to their more harmful effects in living beings.
- Various techniques for heavy metal removal from water/ wastewater are being employed such as ion- exchange, adsorption, Membrane filtration a coagulation/flocculation.
- All these techniques are not cost effective, and also produces secondary sludge, which creates environmental hazard.
- Electrocoagulation has gaining attentions a potential electrochemical technique for treating water/ wastewater que to its versatility and environmental compatibility.
- It is evident from the literature survey articles that electrocoagulation is the most frequently used and proficient for the treatment of heavy metal containing water/ wastewater.

MATERIALS AND METHADOLOGY

PREPARATION OF BIOSORPTION

The fine and fresh samples of Alluvium sativum and Zingiber offiscinale(Garlic) from the market were taken for the experiment purpose and then to remove the impure substances like dusts present on their surface, the samples were washed with the double deionized water in the laboratory. Double distilled water can also be used for this purpose. The samples were next put up to the sunlight for fifteen to twenty days least for the drying purpose. In this period it was ensured that this process was not disrupted by the touch of water to the samples. The dried sample were taken separately and grinded and made to amorphous powder of small particles. This powders were sued with the mesh to remove bigger particles and unwanted by products.

CONDUCTING BASIC PARAMETERS ON WATER SAMPLES

Water samples were taken and the pH tests were conducted by pHmeter on the water samplesand were noted down for further analyzes. Basic parameters like turbidity and hardness were also done and noted to notice the changes if there are any.Concentration of heavy metals like potassium, sodium and nitrate were also noted down.Mainly the ion concentration of heavy metals of lead and cadmium were also noted and they were 0.026 and 0.019 respectively.

Passing the solution through fixed-bed column:

At first a fixed bed column was prepared by the natural materials in a bottle or water can. Four layers of approximately 1.5 to 2cm height layers were formed. The four layers were of granules, charcoal, coarse aggregate and fine aggregate. Two meshes were put at the bottom and top layer. Last layer was separated by a cotton cloth and 180 gms of sand were mixed with zinger and garlic with different portions. And the prepared solution is passed through fixed bed adsorption column. Fixed-bed adsorption removes the dissolved heavy metal ions from water sample.

ANALYZING BY AAS

Atomic absorption spectroscopy(AAS) is a spectroanalytical procedure for the quantitative determination of chemical elements using the absorption of optical radiation(light) by free atoms in gaseous state.AAS can be used determine 70 different elements in solution or solid samples.

AAS makes use of absorption spectrometry to access the concentration of an analyte in a sample. It requires standars with known analyte to establish relation with analyte concentration and relies on a Beer-Lambert law.

RESULT AND COCLUSIONS:

After analyzing the sample through AAS machine, the concentration of lead and cadmium present in the industrial wastewater is noted down that is 0.026mg/L for lead and 0.019mg/L cadmium was present. After that the sample filtered conventionally without the presence of Alluvium sativum and Zingiber offiscinale was 15.38% and 15.76% respectively for lead and cadmium. As the progression of batch studies the powders were mixed with the top layer fine aggregate in ratios of 1:1, 1:2, and 2:1 by their weight and the heavy metal absorption in percentage is given below in the table.

	Conventional Filter	Dosage ratio 1:2	Dosage ratio 2:1	Dosage ratio 1:1
Lead(in %)	15.38	34.43	52.30	72.91
Cadmium(in %)	15.78	42.54	47.36	93.37

The filtered sample showed the efficiency in removing the heavy metals, although the efficiency in adsorption of heavy metals is not highly efficient. It perfectly helps to remove heavy metals fine and helps to maintain the healthy environment and it is of great use in steel industries etc which are releasing their waste to natural sources without treating the heavy metal ions oresent in them.

CONCLUSION:

This preliminary study concerning the adsorption capacities of onion and garlic wastes indicates great potential for the reduction of metal ions in wastewater. The biosorption process followed Langmuir model for all metals, which indicates that ion exchange took place on the surface of adsorbent. The adsorption mechanism of metal ions on the above biomass involves either cation exchange or complexation between the metal cation and Biosorption of heavy metals by utilising ginger and garlic. The maximum sequestrations of metal ions were found to be at dosage 1:1 mixture. This may also provide an affordable, environmental friendly and low maintenance technology for small and medium scale industries in developing countries to remove heavy metal ions of cadmium and lead. Which helps to maintain a good health in the country.

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