

# ASSESSMENT OF WATER QUALITY AND REMOVAL OF HEAVY METAL “CHROMIUM” FROM GROUND WATER RESOURCES USING *Vetiveria zizanioides*

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## **ABSTRACT**

Due to rapid Industrialisation on this earth for achieving highest growth rate Man is continuously over exploiting the natural resources without taking care of the future generations and sustainable development. Industries does not treat their effluents before discharging it in the rivers nor they have an effective effluent treatment systems which contaminates the water at below. Contaminants which are highly cancerous in nature gets assimilated into the soil as well as in our food chain and water table thereby creating number of diseases which are beyond treatment too, thus people lose their lives.

Hence analysis of Underground Water pre and post monsoon has been explored by pre and post monsoon sampling to test its fitness for human consumption by performing all the standard physico-chemical tests on various drinking water parameters and to test the presence and removal of chromium metal in it by using well known natural adsorbent Vetiver grass roots in a complete unique way which is highly potential carbonaceous in nature. Study included the effect of contact time, temperature, solution pH, elution studies, adsorbent dosage and effect of metal concentration by using isotherms. Field Emission Scanning Electron Microscope Fourier Transform Infrared Spectroscopy and Atomic Adsorption Spectroscopy on water sample of selected location. Using the data and performing standard procedures of VOC, pyrolysis and ash content estimation with surface modification and conditioning as per various research papers and it was concluded that vetiver grass roots were effective in reducing the chromium concentration by about 80% in the samples.

Keywords : Pre And Post Monsoon Sampling Chromium Vetiver grass roots, Bioadsorption, Isothermal Study, Atomic Adsorption Spectroscopy, Removal Of Chromium

## **1. INTRODUCTION**

Due to rapid Industrialisation treatment of toxic heavy metals from water for their removal is necessary. Out of them chromium has received great attention due to its toxic effect on human body. Various sources of chromium are industrial water waste discharged untreated. Earlier ion exchange method through reverse osmosis was widely used for removal of heavy metals but it is highly costly, therefore researchers concluded the use of natural adsorbent as they show property of biosorption on their surface due to their high biomass system and carbon rich content hence remove these toxic metals. Various research work was conducted like use of pea nut covering in the removal of zinc and it was found that vetiver grass roots in modified conditions adsorb Zn Cd and other impurities like nitrates and sulphates etc waste water and render water free from impurities likewise. Similarly vetiver grass roots acting as natural adsorbents also removed chromium from Industrial waste water. Hence Above technology of Biosorption in enhanced and more effective way was deployed for biosorption of Chromium From Ground water Bodies in selected Areas marked as Sampling Stations.

## **2. MATERIAL AND METHOD**

To enhance the bioadsorption potential of Vetiver Grass Roots various Methods pertaining to physicochemical analysis of water samples and preparation of Bioadsorbent optimisation isothermal studies with other were performed. For the above purpose Pre and Post Monsoon sampling was done along with water quality analysis and data was plotted and treatment was done with Bioadsorbent vetiver grass roots.

## 2.1 PHYSICOCHEMICAL ANALYSIS

Water samples were collected From some selected locations in a city and its analysis was done as per APHA Code and standard Lab Methods for various parameters such as Total Hardness and Dissolved Solids, Ph, Alkalinity, Conductivity, Chloride Content, Sulphate Content, Iron Content, Manganese Content Fluoride Content, Nitrate Content And Chromium Content along with its estimation.

## 2.2 ESTIMATION OF CHROMIUM

The chromium present in the given samples was studied spectrophotometrically using standard solutions and using 0.18 M sulphuric Acid and then addition of diphenylcarbazide solution and then waiting for 5-10 minutes for colour development. Then measure the absorbance of each sample solution at 540 nm and plot a standard curve .

## 2.3 INTERPRETATION AND DISCUSSION

Analytical data of water samples collected during pre-monsoon and post-monsoon are collected in The quality of groundwater of study area was assessed as per standard specification given by BIS 2012. The variation of 12 physico-chemical parameters namely pH, Cl<sup>-</sup>, NO<sup>-</sup>, F<sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, TH, Ca<sup>2+</sup>, Mg<sup>2+</sup>, TDS, TA, Fe and Cr in different samples taken from each sampling stations . All the sampling were done pre-monsoon and then all the parameter were analysed in the laboratory and the at post monsoon sampling were done and the samples were analysed and it was observed that there is a little decrease in the pH values from pre monsoon to post monsoon while alkalinity of the samples also shows the increment after monsoon. TDS shows the increase in concentration after monsoon and especially at the sampling station U1 and as far as chromium is concerned at the sampling station U3 and U4 it is exceeding the limits before and after monsoon and since chromium is a heavy metal a proper water treatment is strongly recommended for this place . Other chemicals such as Cl, F, NO<sub>3</sub>, Fe, SO<sub>4</sub> & Mg are found to be in permissible limit but have there is a decrease in the concentration after the monsoon like in Mg at U8 and in NO<sub>3</sub> & SO<sub>4</sub> at U5 and in NO<sub>3</sub>, Fe, F at U3. Due to increase in the concentration of chromium at two sampling station from permissible limit a proper water treatment system is required and there is a large availability of vetiver grass in the study area so it becomes easy to proceed for the adsorbent from the roots of vetiver grass

## 2.4 PREPARATION OF BIOADSORBENT

For the preparation Of Bioadsorbent after washing and distilling of Grass roots Pyrolysis of Vetiver Grass Roots was done for activating the Carbon Content at about 515 degree Celsius . Then Volatile Organic Carbon Content and Ash Content is estimated again by heating at about 800 degree Celsius for 2 hours.

$$\text{Ash content} = \frac{W_{\text{initial}} - W_{\text{final}}}{W_{\text{initial}}} \times 100$$

Then surface modification of Biochar Produced is done by treating it with 100ml Of Sulphuric acid and then placed into Teflon autoclave Vessel followed by placing into hot air oven for 2 hrs at 140 degree Celsius . After cooling it was washed until neutral Ph is Obtained . Then again it was placed into oven dried and crushed into mortar and pestle and sealed in bag. After this Bioadsorbent Conditioning is done by Using Manganese Oxide and acidic group estimation. Then It was put to FESEM and FTIR analysis. Stable structure was found.

## 2.5 ADSORPTION STUDY

For the purpose effect of Ph, Agitation time, Adsorbent Dosage were studied and it was found that with increase in Ph, adsorption does not increased however at 3.5 Ph maximum adsorption took place. Similarly in case of increased adsorbent dosage biosorption increased and with increase in adsorbent dosage biosorption also increased.

## 2.6 ADSORPTION ISOTHERMS

In the study Freundlich Isotherm was studied using the relationship  $q_e = K_F C_e^{1/n}$   $\log(q_e) = \log(K_F) + 1/n \log(C_e)$  where  $q_e$  = Equilibrium concentration of adsorbent ( $\text{mgg}^{-1}$ )  $K_F$  = Freundlich constant ( $\text{mgg}^{-1}$ ) ( $\text{Lg}^{-1}$ )<sup>1/n</sup>,  $C_e$  = Equilibrium concentration of solution ( $\text{mgL}^{-1}$ )  $n$  = Freundlich adsorption isotherm constant. Using the relation a table of data was collected and it was found that  $n > 1$  showing favourable adsorption of chromium. Langmuir Isotherm was studied which was originally and as per

$$\frac{C_e}{Q_e} = \frac{1}{K_L Q_m} + \frac{C_e}{Q_m}$$

$R_L = \frac{1}{1 + K_L C_0}$  where  $Q_m$  = maximum monolayer adsorption capacity,  $K_L$  = Langmuir constant  $C_e$  = Equilibrium concentration of solution If  $R_L > 1$  it is unfavourable condition, If  $0 < R < 1$  it is favourable condition In the present table, the  $R_L$  values for chromium was greater than zero and less than unity which designated the favourable adsorption of chromium onto all adsorbents.

## 2.7. REMOVAL STUDY OF ADSORBENT

The adsorbent was effective in removal of chromium from the water sample and it was found that at 25 gms of dosage chromium adsorption in 1 litre of water sample was maximum i.e. about 80%

### 3. CONCLUSION

It was found that selected Bioadsorbent vetiver grass roots which is well conditioned before being used have provided maximum adsorption data and shows high association with Langmuir and Freundlich Isotherms. This present Study can conclude that vetiver grass roots are favourable and cost effective alternate for chromium adsorption from ground water resources.

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