

Diminution of Chromium in the Water by Natural Adsorbents

Ms. Padmapriya.K.M ^{[1]*}, Mr.Sakthivel.M ^[2], Mr.Thirunavukkarasu.B ^[3], Mr.Vijayakumar.V ^[4]

^{[1]*}Assistant Professor, Department of Civil Engineering, Adhiparasakthi College of Engineering, Kalavai, Tamil Nadu, India.

^{[2],[3],[4]} UG Students, Department of Civil Engineering, Adhiparasakthi College of Engineering, Kalavai, Tamil Nadu, India.

-----***-----

Abstract – Heavy metals in the water are poisonous and cause harmful effect to the living beings especially chromium was dangerous material which leads to death on living organisms when it exceeds the permissible values. There are various methods used to reduce the chromium present in the water but those methods are expensive, so we can use economic and natural methods to reduce chromium in water. The activated charcoal was natural material used to reduce chromium in water by adsorption. The activated means, charcoal was grained as a fine powder to increase the surface contact for effective removal of chromium with less duration and after the treatment that charcoal was used for smelting operation of chromium production from its ore so the balancing of chromium waste and chromium production is possible one without formation of sludge.

Keywords: Chromium, activated charcoal, smelting, sludge.

1. INTRODUCTION

Water is essential for both living and non-living components. It is used for various domestic, industrial and commercial purposes for human beings. Particularly in industrial use the water plays major role. Because of the development of urban culture there will be the need of water for that industrial uses. Various industrial activities such as leather tanning, chrome plating and metal manufacturing. This process are produce huge amount of wastes it contains heavy metals, this metals are mixed with rain water and pollute the water present in the lakes, rivers and other water bodies. There was some difficulties to treat the water because it contains huge amount of heavy metals such as chromium, copper, zinc and others. Especially chromium was hazardous metal

compared to other heavy metals so the removal of chromium present in the water is essential. Chromium was a transition metal and it is used for various purpose like chrome plating and other metal coating process. Chromium majorly in the form of chromium[0], chromium [III] and chromium[VI]. Where chromium[VI] was more stable and toxic compound compare to the other forms of chromium and also difficult to remove it from the water there are various ways to remove chromium formations but the methods are too expensive and that are sludge forming methods. The methods used to remove chromium in sample are ion exchange, electro dialysis, electrochemical precipitation, evaporation, solvent extraction reverse osmosis and adsorption.

2.MATERIALS AND METHODOLOGY

In this paper diminution of chromium in the sample was done by adsorptions method. There are various methods used to remove chromium but the adsorption method is simple, economic and it diminution the chromium without producing sludge. In this adsorption process, the water bed was prepared and the adsorption material here we using charcoal in activated state it means the charcoal was grained as a powder having 500micron size for effective removal of both hexavalent, trivalent and normal chromium components.

3.PROCESS AND OPERATION

The sample was collected using non-reactive plastic containers and preservation is done as per pollution control board procedure. Activated charcoal was prepared by grinding charcoal and sieved it with 500micron sieve and to remove the moisture present in the charcoal, it is placed in an oven for 24hrs at 105°C.

4. PREPARATION FOR TREATMENT

The sample was poured in the plastic container of rectangular cross section containing activated charcoal and placed it for 10 days for treatment. After adsorption, the charcoal was placed again in oven for 24hrs to remove moisture. The dried charcoal can be supplied to industries for smelting of chromium ore.

5. ADSORPTION

In adsorption, solids are used for the removal of substances from either gaseous or liquid solutions. Adsorption phenomena are operative in most natural physical, biological, and chemical systems. Separation of a substance from one phase accompanied by its accumulation or concentration at the surface of another is carried out in adsorption. Vander waals forces and electrostatic forces between adsorption molecules and the atoms which compose the adsorbent surface are involved in physical adsorption. Adsorption capacity depends on properties of adsorbent, adsorption chemical properties, temperature, pH, and etc. Several adsorbents like activated carbon, silica gel and activated alumina have been used to treat industrial wastewater.

5.1 Adsorption determination

The percentage of efficiency of the absorption is determined by following formula,

$$\% \text{ of adsorption} = \frac{C_i - C_a}{C_i} \times 100$$

After that the amount of adsorption of the total and hexavalent chromium is determined by,

$$\text{Amt. of adsorption} = \frac{(C_i - C_a)V}{W}$$

Where,

V = Volume of sample taken in lit.

C_i = Initial chromium ions in mg/L.

C_a = Absorbed chromium ions in
mg/L

W = Weight of dry adsorbent in kg.

6. EFFECTS OF CHROMIUM

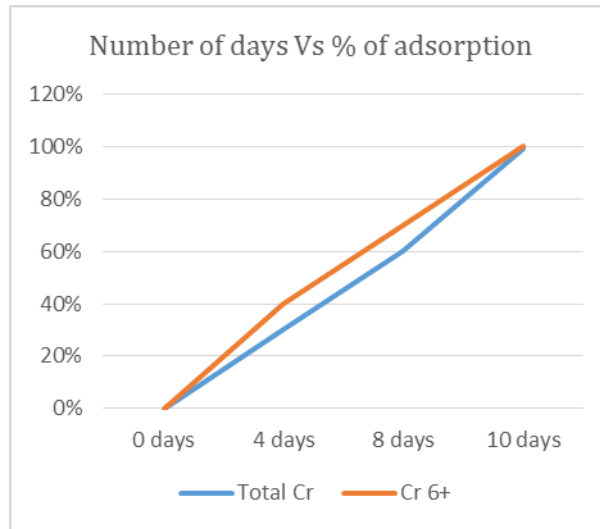
Chromium(VI) is known to cause various health effects. When it is a compound in leather products, it can cause allergic reactions, such as skin rash. After breathing, Chromium(VI) can cause nose irritations and nosebleeds. Other health problems that are caused by Chromium(VI) are,

- Skin rashes
- Upset stomachs and ulcers
- Respiratory problems
- Weakened immune systems
- Kidney and liver damages
- Alteration of generic material
- Lung cancer
- Death

6.1. Environmental effects

Through coal combustion chromium will also end up in air and through waste disposal chromium will end up in soils and chromium in aquatic life decreases growth of aquatic organisms and cause various environmental effects also.

Effect of adsorption for 10 days



7. CHROMIUM PRODUCTION

The chromium production having various stages but it starts from separation of it from ore to form pure metal or alloy. The process used to produce chromium from its ore was smelting.

7.1 Smelting

Smelting is a process of applying heat to ore in order to extract out a base metal. It is used to extract many metals from their ores, including silver, iron, chromium, copper, and other base metals.

7.2 Chromium production by smelting

The chromium produced by smelting was oxidation and reduction reactions. More ores smelted with coke in an electric furnace produce metals that are saturated with carbon. For example the heavy carbon rate ferrochromium having 12% of carbon content and it was derived from ash of coke.

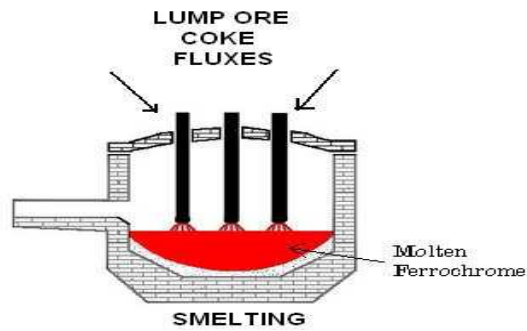


figure1.Smelting

TABLE-1

TEST REPORT BEFORE TREATMENT

S.No	Type	Amount in mg/L	Permissible limit in mg/L	% of efficiency
1	Total chromium	36	<0.001	0
2	Hexavalent chromium	24	<0.001	0

TABLE-2

TEST REPORT AFTER TREATMENT

S.No	Type	Amount in mg/L	Permissible limit in mg/L	% of efficiency
1	Total chromium	0.0006	<0.001	99.99
2	Hexavalent chromium	0	<0.001	100

TABLE-3**COMPARATIVE PROPERTIES OF COKE AND CHARCOAL IN SMELTING OPERATION**

Properties	Coke	Charcoal
Water	5	5.9
Ash	12.6	6.2
Fixed carbon	85.8	87.9
Low calorific value	29.26	30.09

SUGGESTION

Based on various references we expect the treated charcoal was also used in smelting operation in the extraction of chromium. The various properties of the charcoal was nearly matched with the coke properties.

CONCLUSION

The study and analysis of the diminution of chromium in the sample was carried out and the results are satisfying with our analysis, except smelting operation using treated charcoal and also the chance of using that charcoal was increased by our study.

REFERENCES

- [1] Removal of Hexavalent Chromium Contaminated Water and Wastewater. Mojdeh Owallad & Mohamed Kheireddine Aroua & Wan Ashri Wan Daud .
- [2] Removal of Hexavalent Chromium by Adsorption Using Natural Wastes. Yogeshwaran V1* and Priya AK2.
- [3] Chromium removal using various Biosorbents.* 1 M. Sen , 2 M. Ghosh Dastidar.
- [4] Various techniques for the removal of Chromium and lead from Waste water. Pranay A Raut1, Anup Chahande 2 , Yogesh Moharkar3.
- [5] Removal of Cr (VI) using orange peel as an adsorbent. Jisha.T.J1, Lubna.C.H2, Habeeba.V3.
- [6] Chromium(VI) removal by using orange peel powder in batch adsorption. Nitin M Rane* and R S Sapkal1.
- [7] Adsorption for the removal of chromium using natural adsorbents. V.B.Mane1, M.A.Suryawanshi2, G.B.Kumbhar3, Prashant.L.Sahu4, Pratiksha.S.Gajbhiye5.
- [8] Wastewater Treatment for Chromium Removal. Rutuja Joshi, Sonali Raut, Sunil Kulkarni, Sonali Dhokpande.
- [9] Comparison of Banana Peel Biosorbents for the Removal of Cr (VI) from Water. Candelaria Tejada-Tovar1, Ángel González-Delgado2, Ángel Villabona-Ortiz1.

- [10] Methods of Removing Heavy Metals from Industrial Wastewater. Gunatilake S.K.
- [11] Heavy Metals Removal from Wastewater by Adsorption Process. Veena Bobade¹ and Nicky Eshtiagi^{1*}.
- [12] Banana Peel: A Green Solution for Metal Removal from Contaminated Waters. KKIU Arunakumara,¹ Buddhi Charana Walpola² and Min-Ho Yoon^{2*}.
- [13] Reduction of Coke Consumption in High-Temperature Gasifying and Direct Melting System. UCHIYAMA Takeshi[†] OKUYAMA Keiichi^{*2} AKIYAMA Hajime^{*}.