International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 05 | May -2017 www.irjet.net p-ISSN: 2395-0072

"REMOVAL OF CHROMIUM FROM AQUEOUS SOLUTION BY USING DIFFERENT METHODOLOGIES"

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Abstract – *The present study provide the comparative study of removal of chromium from drinking water by using different methodologies. Chromium is found in all natural water bodies in hexavalent (Cr VI) as well as trivalent (Cr III) from. It has proof to be hazardous even fatal to human being, plants, animals and even to microorganisms. It creates risk of cancer, eye damage, kidney damage etc. as per environmental protection authority(EPA) permissible limit chromium is mg/l and world Health organization has set the permissible as 0.05 mg/l. in absorption phenomenon the absorbent absorb the tresses of chromium which required a simple physical process. The objective of study is to examine the feasibility of using different types mehodologies to check their efficiency in removal of chromium.*

Key Words: chromium, absorption, efficiency, hexavalent, trivalent.

1. INTRODUCTION

Water is one of the most essential elements of life. Without water there would be no any survival on earth. In its purest form, water is odorless, colorless and tasteless. But due to human and animal activities it is usually contaminated. Human waste, effluents from chemical industries and dissolved gases are the sources of contamination of water. Now a days the major problem being faced by major metropolitan cities is environmental pollution due to toxic metals. It has become an ever increasing problem. Bioaccumulation, geoaccumulation and bio magnifications are the result of toxic metals entering the ecosystem. Iron, copper, zinc, chromium, cadmium, fluorides and other trace metals are important for proper functioning of biological systems. The deficiency or excess concentration of these metals could lead to a number of disorders.

Chromium is a transition metal. Atomic number and average atomic weight of chromium are 24 and 52 respectively. Chromium belongs to group VI B in the periodic table with molybdenum and tungsten. The electronic configuration is [Ar] 3d5 4s1. Chromium is a redox active-elements. Its oxidation states range from -2 to +6, but in aqueous phase only 3 and 6 states are prevalent. Trivalent [Cr(III)] and hexavalent [Cr(VI)] are environmentally stable oxidation states which exhibits different toxicities and mobilities. Comparatively, Cr(III) are less soluble (relatively insoluble) and exhibits little or no toxicity. In contrast chromium VI usually occurs as highly soluble and comprises toxic chromate anions which are suspected carcinogens and mutagens.

Chromium is a heavy metal which is toxic and carcinogenic in nature. It is non-biodegradable and leads to bioaccumulation in living organisms, resulting in various diseases and disorders. The excess of chromium causes diarrhea, nausea, low blood pressure, lung irritation, CNS diseases, cancer, dermatitis, etc.in human beings. Also the serious effects of chromium are mutation of cells, chromosomal disorders and genetic disorders. It also affects plants.

2. OBJECTIVES

1. To study the efficiency of removal of chromium by using different types of physical and chemical methods.
2. To study the economic feasibility of different types of physical and chemical methods for removal of chromium.

3. LITERATURE REVIEW

Various methodologies such membrane filtration, ion exchange nano filtration,etc. are used in removal of heavy from water. From study we observe that each method has its own merits and limitation. A few factors such as versatility, simplicity, cost effectiveness and technical feasibility are to be considered while selecting a considerable method. Further various low cost absorbent were studied for their efficiency in removal of heavy metals form aqueous solution.

In 2010, B. D. Gharde et.al [] studied the removal of heavy metals from aqueous solution using Tectona grandis bark substrate. It was observed that Tectona grandis bark substrate can remove heavy metals like copper and nickel at lower concentration. It was observed that adsorption of the

metals increases with increase in doses of absorbent. It was also seen that substrate from solution removes more than 60 % Metal ion instantaneously by using packed column of bark substrate.**In 2015, Nishanta Mridul et.al** [] studied the removal of chromium VI from aqueous solution by using mango, neem and eucalyptus tree parts. He studied the effects of various parameter like dosage of adsorbent, Ph and effect of contact time by batch absorption experiments and found that these absorbent give their result in 180 min. at PH 2. Also the percentage removal is increased with increase in contact time. On an average 90% removal efficiency was observe by using these three absorbent. **In 2014, V H. Waghmare et.al** studied the removal of hexavalent chromium from aqueous solution by obsorption on commiphora myrrha bark. From their experiments they concluded that the adsorbent material can be used to remove chromium from aqueous solution successfully. Due to high efficiency, it is considered as an ideal adsorbent. Percentage removal of chromium found to be maximum at ph2. Also increase in dosage increases the rate of removal of chromium from aqueous solution. **In 2013, Mayuri Jain et.al** [] studied the phytochemical screening and bioremediation using Ocimum sanctum collected from VIT university nursery. They studied the phytochemical properties of Ocimum sanctum by using fresh and dry leaves of it. This studied percentage removal by varying the contact time as well as dosages and found that stem is more efficient in removing chromium (69.432%) than leaves (56.67 %) in two days.

Property	Cr	$CrCl_3$	$K_2Cr_2O_4$	Cr_2O_3	CrO_3
Melting point(C)	1857	1152	968.3	2266	196
Boiling point(C)	2672	-	-	4000	-
Solubility (g/litre)	Insoluble	Slightly soluble	790	Insoluble	624
Density	7.14	2.76	2.73	5.21	2.7

Table no. 1: Physicochemical properties

In 2014, Babita Labh Kayastha et.al[] studied the evaluation of antimicrobial activity of Ocimum Sanctum leaf extract in normal tap water. Tulsi protects against and reduces stress enhances stamina and endurance; increases the body's efficient use of oxygen; boosts the immune system; reduces inflammation and many more. Overall tulsi is a premier adaptogen, helping the mind and body to adapt and cope with wide range of physical, chemical and infectious stresses. The tulsi leaf extract has great potential as antimicrobial agent for the treatment of water. The treatment is simple, cost-effective, ecofriendly, reachable for all and the components present in it have no side effects to humans as compared to chemical treatment. Moreover water treated with tulsi extract serve not only as germ free but also as medicinal water. **In 2014, G. Gebrehawaria et.al** [] studied removal of hexavalent chromium ions [Cr (VI)] from aqueous solutions by adsorbents prepared from bark of Acacia albida of Fabaceae family and leaves of Euclea schimperi of Ebenaceae family has been studied by batch adsorption technique. Effects of different parameters such as contact time, pH, amount of adsorbents and initial chromium (VI) concentrations were investigated for the removal of Cr (VI) ions using these adsorbents. Among these parameters, pH was found to be the most important parameter that influences the adsorption process. These adsorbents can be employed as low-cost alternatives to commercial adsorbents for removal of Cr (VI) from effluents. In conclusion it may be stated that the biosorbents prepared from the bark of A.albida and leaves of E.schimperi are found to be very effective for Cr (VI) removal from industrial effluents, thus providing a cost-effective, viable substitute for the commercially available adsorbents generally used in the industry.

4. CONCLUSION

High cost and technical complications are the problems associated with membrane filtration. Ion exchange method is comparatively costly. Chemical precipitation generates high volume sludge and involves high capital cost. Absorption processes are technically uncomplicated and economical. Hence these processes can be used to treat the chromium affected water. There is a lot of scope in using low cost absorbents for further advancement.

5. REFERENCES

1. Ashraf Ali, Khalid Saeed, Fazal Mabood (11 May 2016), "Removal of chromium VI from aqueous medium using chemically modified banana peels as efficient low cost adsorbents", Alexandria Engineering Journal.
2. Babita Labh Kayastha (2014), " Queen of herbs tulsi (Ocimum sanctrum) removes impurities from water and plays disinfectant role", Journal of medicinal plant studies, vol. 2 issue 2.
3. Chromium in drinking water, WHO guidelines for drinking water quality, vol.2, 2012.
4. G.Gebrehawaria, A.Hussein, V.M. Rao (March 7,2014) "removal of hexavalent chromium from aqueous solution using bark of acacia albida and leaves of Euclea schimperi" , Int. J. Environ. Sci. Technol.
5. Geetha K. S., Belagali S.L. (June 2013)," Removal of heavy metals and dyes using low cost adsorbents from aqueous medium- A review" ,IOSR-JESTFT, vol. 4, issue 3
6. Journal of central water commission, May 2015.

7. Khaldoun Al-Sou'od, (January 2012), " Adsorption Isotherm studies of Chromium VI from aqueous solution using Jordanian pottery materials", APCBEE.
8. Kristi Sorsa, (January 2011) "advantages and disadvantages of removing chrome 6 by reverse osmosis", public health journal.
9. Mayuri Jain, Suneetha V. (2013), " Phytochemical screening and bioremediation using Ocimum sanctrum collected from VIT university nursery", Der Pharmacis Lettre, vol. 5, issue 5.sss
10. Pavel Kocurerk, Karek Kolomaznik and Michaela Barinova. (2014) "chromium removal by reverse osmosis, " WSES TRANSACTIONS on ENVIRONMENT and DEVELOPMENT , 10
11. Pratima Meshram, Sushanta Kumr, banshidhar Pandey, Vinay Kumar, (August 2011), "removal of chromium III by IR 120 resin",International journal of non-ferrous metallurgy.
12. Sabino De Gisi, Guisy Lofrano, Mariangela Grassi, Michele Notarnicola, (June 2016), 'characteristics of adsorption capacities of low cost adsorbents for waste water treatment : A review, Sustainable materials and technologies.
13. V .H Waghmare, UE Chaudhari, (March 2014), "removal of hexavalent chromium from aqueous solution by adsorption on commiphora myrrha bark, RASAYAN J. chem,7.