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Littering waste generated from Vellore trees used as resource for removal of Cr (VI) from chromium affected water

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ABSTRACT

Littered Waste generated from trees generally contains dried leaves and floral parts. For this particular research, this waste was collected from VIT University, Vellore. The disposal of this waste is a big problem as these are produced daily and not easily compostable so, the major interest of our work deals with using this waste as resource. The collected wastes are ground and used for removal of hexavalent chromium ion from 250ml of water sample containing 50 ppm of chromium (stock water sample prepared using $K_2Cr_2O_7$). The change in concentration with respect to time is checked by AAS (atomic absorption spectroscopy). The efficiency of Cr(VI) removal is also checked at different pH and plotted with respect to time and it is found 85.8% at acidic pH. According to results obtained, this can be used for low cost treatment of chromium in affected water bodies.

Keywords: Littering waste, chromium, AAS, adsorption

INTRODUCTION

Chromium as an element exists in the trivalent and the hexavalent form in aqueous solution. In the living system, chromium VI is reduced to chromium III before entering the cells. Chromium compounds were used widely in dyes, paints, leather tanning industry and primer paint. The toxicity and hazardous nature of chromium VI has always been understood and realized by all. The maximal allowable limit for the concentration in the drinking water is 0.05 milligrams per liter. Due to this, it's extraction is highly necessary and important not just for the human beings but also in realizing the fact that toxicity if not directly would eventually trace its route to us in the form of the biological food cycle and the food webs [1]. The extraction is performed using bio sorbents. Extraction is possible using many sorbents like grape stalks and yohimbe bark [2] activated carbon from the industrial sugar waste [3], activated carbon prepared by heat treatment of lignocellulosic remains [4] and seed biomass waste[5]. There is a need for cost effective techniques for performing this method. This experiment uses biomass, specifically agricultural waste for the extraction of the metal. The main objective of this paper is to observe the extraction of chromium using mixed agricultural waste and simultaneously comparing the extraction levels at different pH levels. Agricultural wastes was particularly selected as the adsorbent since this would help reduce waste disposal cost and worries and at the same time help in keeping the environment green and clean [6].

MATERIALS AND METHODS

Materials

Leaves and tree wastes are collected from VIT University, Vellore. The collected sample is cleaned and then groundusing a mixer. This forms a paste of the sample. The ground sample is then treated with boiling water to remove the water soluble compounds and then filtered. It is finally then dried in an oven at 70°C to remove the moisture.

Stock solution

50 ppm of Stock solution of Chromium (VI) is prepared using Potassium Dichromate ($K_2Cr_2O_7$). For studying the Chromium removal at different pH, the stock solution is divided into three parts (200ml each in three conical flasks). The flasks are maintained at pH=2, 6 and 12 respectively, using 0.01M NaOH/0.01M HCl.

Adsorption experiments

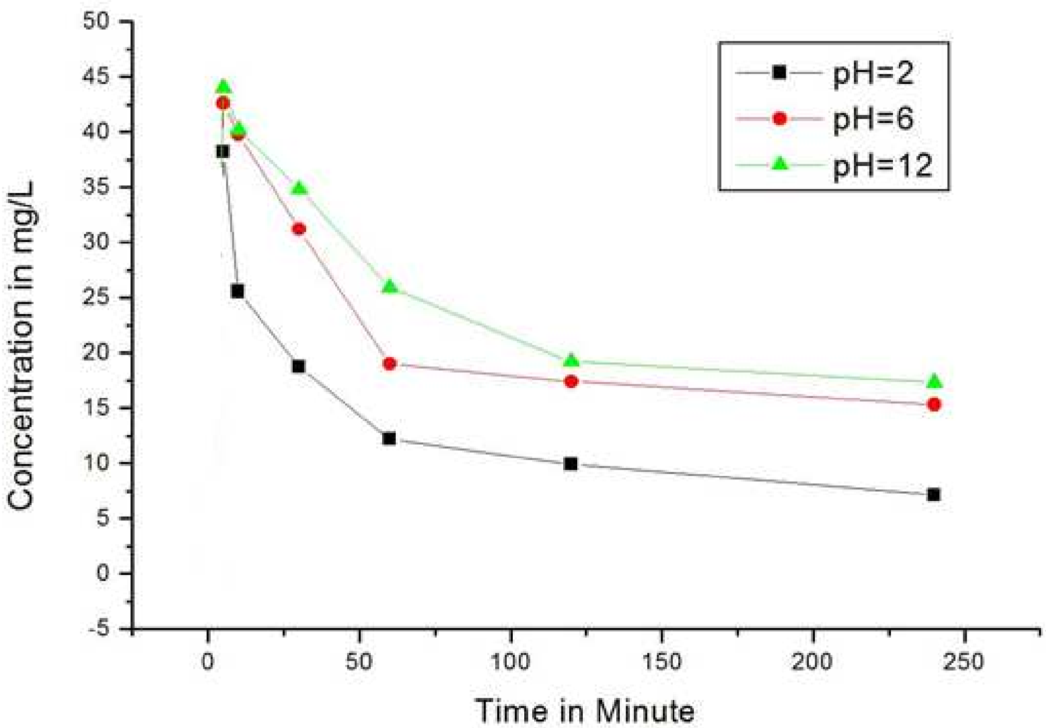
The experiment was carried out on an orbital shaker which was operated at 100 rpm. 5 grams of treated absorbent is put inall three Chromium affected water and as mentioned before is maintained at three different pH. 2 ml of Chromium solution is taken out at different time interval to check the decrease in Chromium concentration, by atomic absorption spectroscopy.The entire experiment is run for 240 min.

RESULTS AND DISCUSSION

Tree waste is generally composed of cellulose, hemi-cellulose, pectin and other organic polymers which help as a good absorbent.

Chromium removal with time

The graph (Graph 1)is a concentration verses time graph showing that the adsorption of Chromium is more efficient at lower pH as we obtained adsorption at pH 2, 6 and 12 respectively. The saturation time of adsorption reached240 minutes. Thus the best adsorption is at pH 2 which brings down the Cr(VI) concentration from 50mg/L to 7.1mg/l.



Graph I: Graph showing the variation of concentration of Chromium(VI) with respect to time

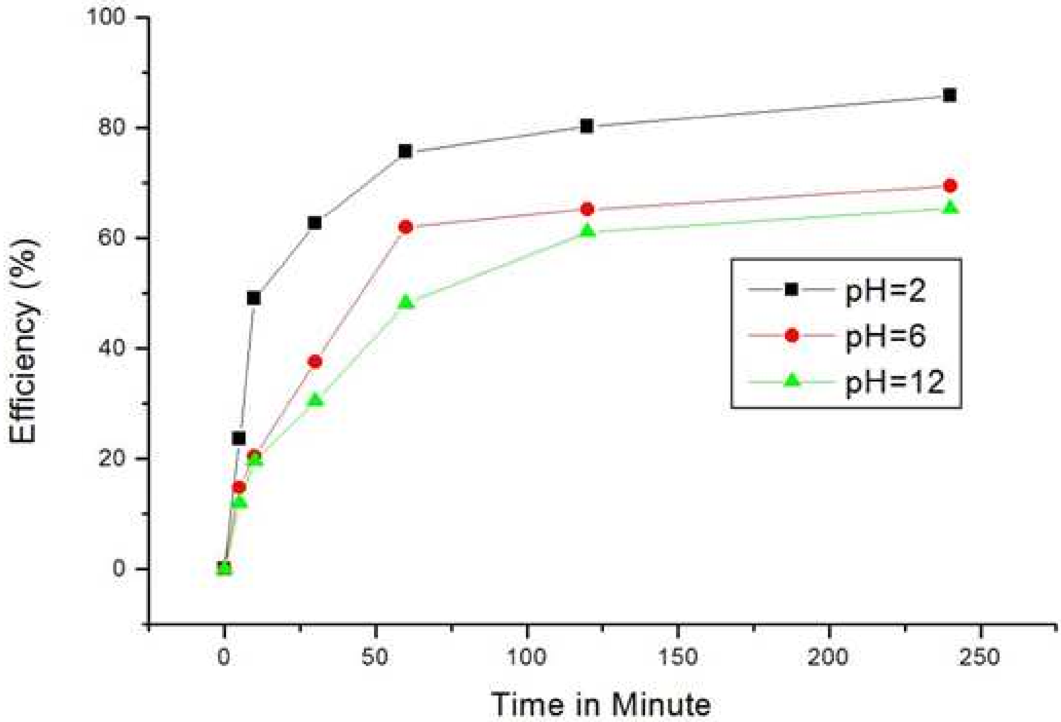
Table I: Table showing the gradual decrease in Concentration of Chromium in the different samples with respect to pH and time

		Concentration (mg/L)		
Sr.no	**Time(min)**	**pH=2**	**pH=6**	**pH=12**
01	0	50	50	50
02	5	38.2	42.6	44.0
03	10	25.5	39.8	40.2
04	30	18.7	31.2	34.8
05	60	12.2	19.0	25.9
06	120	9.9	17.4	19.2
07	240	7.1	15.3	17.3

Efficiency of removal
The efficiency of the process is calculated by the following formula

Efficiency ={(Conc$_{\text{. At T =0}}$)-(Conc. $_{\text{At T=t}}$)}/ (Conc. $_{\text{At T =0}}$)] x 100

The efficiency verses time is shown in Graph 2which shows that at pH=2, efficiency of Chromium removal is 85.8%. This shows that the biosorbent used, which is garden waste in this experiment has the capability to be used as low cost adsorbent for large scale Chromium treatment. Many rural areas of the country which cannot afford big plants to remove the element contaminating the water bodies can establish this method for simple and easy removal of chromium.



Graph II: Graph showing the variation of Efficiency with respect to time

Table II: Table showing the efficiency of removal of Chromium at different pH and different time interval

		Efficiency (%)		
Sr.no	**Time(min)**	**pH=2**	**pH=6**	**pH=12**
01	0	0	0	0
02	5	23.6	14.8	12.0
03	10	49.0	20.4	19.6
04	30	62.6	37.6	30.4
05	60	75.6	62.0	48.2
06	120	80.2	65.2	61.1
07	240	85.8	69.4	65.4

CONCLUSION

The above experiment shows an array of perspective on something called the garden waste or the waste generated by the trees. This makes clear the value of littered waste in the form of extraction of a toxic metal from the water bodies for the benefit of all. The optimal pH in which the extraction is maximum was also observed. Thus this garden waste has various advantages other than been commonly known as one that is used as compost. This can now be used on a small scale in rural areas where the economy behind any big process is often thought over many times before it’s actual execution. After all, an easy and feasible process is one that lasts long.

REFERENCES

[1] K. Mukherjee, R. Saha, A. Ghoshand B. Saha,*Research on Chemical Intermediates*, **2013**, 39, issue 6, 2267
[2] N. Fiol, C. Escudero, I.Villaescusa, *Biosource Technology*, **2008**, 99, 11, 5030
[3] N.F. Fahim, B.N. Barsoumb, A.E. Eid , M.S. Khalil, *Journal of Hazardous Materials*, **2006**, 136, 2, 303
[4] P. A´lvarez, C. Blanco, M.Granda, *Journal of Hazardous Materials*, **2007**, 144, 1-2, 400.
[5] M. O. Omorogie, J. O. Babalola, E. I. Unuabonah, W. Song, J. R. Gong, *Journal of Saudi Chemical Society*, **2012**, (in press)
[6] A. Bhatnagar, M. Sillanpaa, *Chemical Engineering Journal*, **2010**, 157, 2-3, 277.
[7] M.Bansala, D.Singha, V.K. Gargb, *Journal of Hazardous Materials*, **2009**, 171, 1-3, 83
[8] K. Ranganathan, *Biosource Technology*,**2000**, 73, 2, 99
[9] M. Jain, V.K. Garga, K. Kadirvelub, *Journal of Hazardous Materials*, **2009**, 162, 1, 365
[10] G.S. Agarwal, H. K. Bhuptawat , S.Chaudhari, *Biosource Technology*, **2006**, 97, 7, 949