NOTE

Adsorption of Cr(VI) on Agricultural Byproducts

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The methi stem due to its well known adsorption characteristics has been taken for removal of Cr(VI) from the effluent. The result shows an encouraging high percentage removal of Cr(VI). Spectrophotometric method has been utilized with diphenyl carbazide as a reagent.

Heavy metals such as copper, chromium, lead and zinc are found in the effluents of metal processing, finishing and plating industries as well as other important industries such as paper and pulp, organic and inorganic chemicals, petrochemicals, fertilizers and petroleum refining. These are highly toxic. To remove these toxic metal ions from waste water the use of cheap agricultural wastes in this field is receiving attention on account of economic considerations coupled with reasonably good efficiency[1-3]. In the present study we studied the effect of various parameters on the binding of chromium ion by *Trigonella foenum graecum*. This will help in minimizing the hazardous effect of pollution and to monitor them in an eco-friendly manner.

Chemicals of AR grade manufactured by S.D. Fine were used without further purification. Solutions were prepared in double distilled water. $K_2Cr_2O_7$, diphenyl carbazide etc. were prepared as described in literature.[4-6]

Preparation of Substrate: The waste stems of methi were collected locally and dried in air. They were ground and powder was obtained. 32 mL of 2N H_2SO_4 solution was taken in a 250 mL capacity beaker and 40 mL formaldehyde solution was added to it and stirred thoroughly. About 50 g of the powder was added to this mixture separately in small portions while stirring. The beaker containing the syrupy mass thus obtained was kept in an oven at 50°C and ground to fine powder. The substrate thus prepared was used for the present study.

Preparation of adsorption column: 2 g of the substrate was transferred to beaker and 25 mL of distilled water was added to it. It was allowed to stand for 15 min. The slurry was then transferred to a glass column of length 60 cm and inner diameter 1 cm which was provided with a stopper at the bottom. After the substrate settled uniformly in the column, it was washed with 25 mL of 1 : 2 HCl solution at the rate of 5 mL/min. The column was then washed free of acid using

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distilled water. Care was taken that sufficient quantity of distilled water was present in the column so that no air bubbles were there in the column after the introduction of the adsorbent.

Calibration curve: A calibration curve was plotted by using different concentrations of $K_2Cr_2O_7$ with the help of spectrophotometer.[4,7]

Procedure: Now 50 mL of 100 ppm metal ion solution was passed through the column for different lengths of time at different temperatures and pH. The fraction of the metal ion adsorbed was determined by the difference in the initial and the final concentrations of the solution.

Effect of contact time: The effect of contact time on the uptake of chromium from the solution was studied by treating 1 g of the substrate for different lengths of time with 50 mL of 100 ppm chromium solution.

Effect of pH: Adsorption was studied over a wide range of pH from 1 to 6. The contact time was kept 1 h and temperature 25°C.

Effect of temperature: The effect of temperature on the adsorption of chromium by different substrates was studied at 25, 40, 50 and 60°C.

EFFECT OF CONTACT TIME		EFFECT OF pH		EFFECT OF TEMPERATURE	
pH	5.4	Contact time	15 min	Contact time	15 min
Temperature	25°C	Temperature	25°C	pH	5.4
Initial conc. of Cr^{6+}	100 ppm	Initial conc. of Cr^{6+}	100 ppm	Initial conc. of Cr^{6+}	100 ppm
Time (min)	Adsorption Methi stem (%)	pH	Adsorption Methi stem (%)	Temperature (°C)	Adsorption Methi stem (%)
15	75	1.0	80	25	75
30	79	2.0	85	40	70
45	79	3.0	89	50	70
60	80	4.0	89	60	70

The calibration curve shows that the Beer-Lamberts law is valid for these concentrations of potassium dichromate. The concentration of Cr(VI) in the effluent is determind by colorimetric method[4, 7]. To study the binding of Cr(VI) in the effluent by the stem of *Trigonella foenum graecum* (methi), various parameters are to be studied. The parameters are: effect of contact time, effect of pH and temperature.

Effect of contact time: At room temperature 100 ppm solution of chromium was passed through the powder of methi stem. It was observed that methi stem adsorbs 75% within 15 min. After 30 min adsorption slightly increases up to 79%. Then it becomes constant.

Effect of pH: At pH 1 the binding of chromium ion by methi stem is 80% while at pH 2 it increases up to 85%. At pH 3 it indicates 89% binding property and then it becomes constant at pH 4.

Effect of temperature: In chromium solution, as temperature increases, the adsorption property decereases. At 25°C the leaves of cauliflower indicate 75% adsorption, whereas at 60°C the adsorption decreases to 70% in methi stem.

Conclusion

Methi stem is an excellent adsorbent and can be used to remove Cr(VI) from the waste water or effluent.

At room temperature, *i.e.*, 25°C and contact time 1 h, the methi stems maximum adsorption. As pH increases methi stem indicates increasing adsorption property.

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REFERENCES

1. Ahmed Zaheer, M.N. Farooqui, Syed Sultan and Syed Abed, *Madhya Bharti Jounal,* **37A-41B** (March 1997).
2. D.V. Jahagirdar and J.N. Nigal, *Asian J. Chem.*, **9**, 122 (1997).
3. D.B. Bankar and S.S. Dara, *Chem Era*, **18,** 251 (1982).
4. Z.M. Siddiqi, *Chemistry Education* (July-September 1995).
5. P. Kumar and S.S Dara, *Chem Era*, **15**, 20 (1979).
6. D.K. Doutiani, D.J. Rode, D.J. Haware and P.U. Patil, *Res. J. of Chem. & Environment,* **3**, 33 (1999).
7. G.F. Jeffery, J. Baselt and J. Mendham, Vogel's Text Book of Quantitative Chemical Analysis, 5th Edn., ELBS, UK, p. 87 (1989).

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