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NOTE

Removal of Chromium(VI) from Electroplating Effluent by Leaves of Cauliflower

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The paper described the use of leaves of cauliflower for the removal of Cr(VI) from industrial waste stream. The dried and powdered raw materials were used for the removal of waste water. It is observed that at room temperature leaves of cauliflower show maximum adsorption property. As the pH increases the adsorption property decreases of the effluent.

Chromium in hexavalent form has been reported to be highly toxic and hence its removal from water body has been the subject of various studies. There are various methods such as precipitation, adsorption, ion exchange, etc. available to remove chrominium(VI) from the effluent, but all these methods are comparatively costly. Recently some of the researchers used tree barks, leaves, cotton capsule shell[1–3] etc. for the removal of heavy metal ions. In the present study we studied the effect of contact time, pH and temperature on the binding of chromium ion by leaves of cauliflower. This will help in minimizing the hazardous effects of pollution and to monitor them in an eco-friendly manner.

Preparation of solutions: Chemicals of AR grade of SD Fine make were used without further purification. Solutions were prepared in double distilled water. $K_2Cr_2O_7$, diphenyl carbazide etc. have been prepared as described in literature.[4–6]

Preparation of substrate: The waste leaves of cauliflower were collected locally and dried in air. They were ground and powder was obtained. 32 cm^3 of 2 N H_2SO_4 solution was taken in a 250 cm^3 capacity beaker and 40 cm^3 formaldehyde solution was added to it and stirred thoroughly. About 50 g of these powders were 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 substrate was transferred to beaker and 25 cm^3 of distilled water was added to it. It was allowed to stand for

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15 min. The slurry was then transferred to a glass column of length 60 cm and inner diame er 1 cm, which is provided with a stopper at the bottom. After the substrate set:led uniformly in the column, it was washed with 25 cm^3 of 1 : 2 HCl solution at a rate of 5 cm^3/min. The column was then washed free of acid using 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.

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 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. The contact time was kept 60 min and temperature 25°C.

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

EFFECT OF CONTACT TIME

pH	5.4
Temperature	25°C
Initial conc. of Cr^{6+}	100 ppm

S. No.	Time in min	% Adsorption, cauliflower leaves
1.	15	91
2.	30	91
3.	45	91
4.	60	91

EFFECT OF pH

Contact time	60 min
Temperature	25°C
Initial conc. of Cr^{6+}	100 ppm

S. No.	pH	% Adsorption, cauliflower leaves
1.	1	89
2.	2	85
3.	3	78
4.	4	78

EFFECT OF TEMPERATURE

Contact time	60 min
pH	5.4
Initial conc. of Cr^{6+}	100 ppm

S. No.	Time in min	% Adsorption, cauliflower leaves
1.	25	90
2.	40	85
3.	50	73
4.	60	73

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 determined by colorimetric method.[4,7] For a study of the binding of Cr(VI) in the effluent by the leaves of cauliflower various parameters are to be studied. The parameters are: effect of contact time, effect of pH and temperature.

Effect of Contact time: At room temp. 100 ppm solution of chromium was passed through the powder of leaves of cauliflower. It was observed that cauliflower leaves adsorb 90% within 15 min. After 30 min adsorption slightly increased upto 91%. Then it became constant.

Effect of pH: At pH 1 binding of chromium ion by leaves of cauliflower was 89% while at pH 2 it decrease up to 85%. At 3 pH it indicates 78% binding property and then it becomes constant at pH 4.

Effect of temperature: In chromium solution as temperature increases the adsorption property decreases. At 25°C the leaves of cauliflower indicate 90% adsorption, whereas at 60°C the adsorption decreases to 73%.

Conclusion

Leaves of cauliflower are 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 60 min, leaves of cauliflower show maximum adsorption. As pH increases, leaves of cauliflower indicate decreasing property of adsorption.

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