



# REMOVAL OF HEXA VALENT CHROMIUM IONS FROM WASTE WATER USING BOILED CHICKEN EGG SHELL WASTE

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## Abstract

Batch adsorption of Chromium (VI) using untreated powdered eggshell under the influences of mixing time, pH, particle size and dose of powdered eggshell was investigated. Eggshells were collected from daily household usage, washed with distilled water, air dried, and then ground into powder of different particle sizes. Experiments were carried out at different pH, and it was observed that pH plays an important role in the adsorption of Chromium (VI) compounds. It was also observed that particles size has no significant effect on the adsorption of Chromium (VI) compounds.

**Keywords:** Chromium Ions, Properties, Chicken egg shell waste, Waste water

## 1.0 MATERIALS AND METHODS

### 1.1 COLLECTION OF RAW MATERIALS:

Chicken eggshells were collected from the daily household waste. The membranes were separated from the eggshells by hand. The eggshells were then washed with distilled water, air-dried, powdered and stored in desiccators. Sodium hydroxide and hydrochloric acid were used to adjust pH. In order to assess the performance of eggshell and to avoid interference by other elements in waste water, the experiments were conducted with aqueous solution of hexavalent chromium in double distilled water. Samples of various initial chromium concentrations were prepared by dissolving potassium dichromate (K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>) in water.

### 1.2 SORPTION STUDIES:

Adsorption experiments were carried out in 100 mL flasks immersed in a thermostatic shaker bath at 25°C for 2, 5, 10, 15, and 30 minutes. Chicken eggshell samples of 5, 10, 15, 20 and 25 g were mixed with 1 mL hexavalent chromium 5 mg/L. At the end of each adsorption period, the suspension was centrifuged. The concentrations of hexavalent chromium compounds in the supernatant solutions after and before adsorption were determined spectrophotometrically, at 29 nm.

### 1.3 EFFECT OF POWDERED EGGSHELL DOSAGE:

To determine the effect of powdered eggshell dosage, the experiments were carried out at seven different dosages (5, 10, 15 and 20, 25g) for 9 minutes at pH 3. The effect of particle size was investigated by using

different particle-sizes: 5, 1, 1.5, 2, 2.5 and 3 $\mu$ m of powdered chicken eggshells. The experiments were carried out using 5 g of powdered eggshell for 9 minutes.

## 2.0 RESULT AND DISCUSSION:

### 2.1 EFFECT OF POWDERED EGG SHELL DOSAGE:

In order to obtain optimum adsorption with high efficiency, we need to obtain the optimum mixing time of adsorbent and hexavalent chromium solution. The adsorption of chromium solution reached equilibrium. The effect of powdered eggshell for different dosages was better at higher concentration

### 2.2 EFFECT OF PH:

It was observed that the adsorption of Cr (VI) decreased with increase in initial pH from 2.0 to 7.0. The maximum removal was occurred at initial pH 3. At lower pH the surface area of the adsorbent was more protonated and competitive negative ions adsorption occurred between positive surface and free chromate ion. Adsorption of Cr (VI) at pH 3.0 showed the bind of the negatively charged chromium species ( $\text{HCrO}_4^-$ ) occurred through electrostatic attraction to the positively charged (due to more  $\text{H}^+$  ions) surface functional groups of the adsorbent. But in highly acidic medium (pH  $\approx$ 2)  $\text{H}_2\text{CrO}_4$  (neutral form) is the predominant species of Cr (VI) as reported in the earlier studies [10]. Hence, at pH 2.0 percentage adsorption was decreased due to the involvement of less number of  $\text{HCrO}_4^-$  anions on the positive surface. At higher pH due to more  $\text{OH}^-$  ions adsorbent surface carrying net negative charges, which tend to repulse the metal anions ( $\text{CrO}_4^{2-}$ ) [11]. Therefore, maximum removal of Cr (VI) from aqueous solution was achieved at pH 3 and all the further studies were carried out by maintaining the solution at pH 3.

## 3.0 CONCLUSION

From this study we came to know that pH has an important role in the adsorption of hexavalent chromium compounds. In addition, the particle size of powdered eggshell has no significant effect on the adsorption of hexavalent chromium compounds. Sorption tends to attain equilibrium in nearly 9 minutes. The optimum dosage of powdered eggshell was 5 g of 5 mg/L hexavalent chromium solution. The adsorption isotherm data could be fitted with the Langmuir model. The results of this study suggest that powdered eggshell, with its low cost and abundant availability has a potential for being used as an adsorbent for contaminants, such as hexavalent chromium compounds.

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