



## Use Of Eggshell As Adsorbent In Elimination Of Pb (II) And Cd (II) From Aqueous Solutions

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### Abstract

Excessive discharge of toxic metals into water surfaces as a result of increased production has become the main ecological problem due to the lack of efficiency of techniques that would deal with industrial liquid waste. These metals accumulate at high toxicity levels and cause a serious impact on aquatic organisms without a visible sign. They can cause poisoning or toxic effects even in lower concentrations. Therefore, these toxic heavy metals include cadmium, manganese, copper, lead, nickel, cobalt and chromium. They are highly toxic metals when they are brought into the body and have a direct effect on humans and animals, and indirectly through the food chain. In this paper, a study was carried out to investigate the possibility of using lower biomass wastes in powdered sintered (egg shell) adsorption of lead metal Pb (II) lead, Cd (II) from aqueous solutions, and the effect of the initial concentration Pb (II) , Cd (II) on the adsorption efficiency on the surface of sintered (egg shell).

**Keywords:** Adsorption; contact time; egg shell; Pb (II); Cd (II)

### 1. Introduction

In recent years, intensive technological and industrial development has led to excessive exploitation of water resources and increased pollution of water surfaces. Many rivers and streams serve as containers for industrial liquid waste containing hazardous substances, among others heavy metals. Due to their high solubility, they are a major problem because they are highly toxic, biologically degradable and have the ability of biological accumulation in living things, with this increase leading to worrying levels among which their impact on living beings. These metals accumulate at high toxicity levels and cause a serious impact on aquatic organisms without a visible sign. They can cause poisoning or toxic effects even in lower concentrations [Vieira, R & Volesky, B, 2000], [Ahalya, N, 2003]. Recently, a number of cheaper and more efficient methods and approaches have been studied for the development of water purification and treatment techniques. An economical technique was found to remove ions of heavy metals from aqueous solutions, using household waste cheaper costs or with no cost that can easily be found to make this process safer, it certainly contributes to reducing the toxic effects of these toxic metals and make them less hazardous and toxic to the environment [Dang V.B.H, 2009]. Many earlier studies have found that egg shell itself can bind different ions of metal from aqueous solutions [Ishikawa, S. I, 2002]. Therefore, some studies have found that it is possible to work on the removal of heavy metals by shelling hens eggs through the sewage water adsorption process, and this is the result of calcium carbonate in the egg shell and who is considered responsible for adsorption of metals [Tsai, W. T, 2006]. The study of the effect of substance adsorbate concentration (adsorbate) is considered a very important factor to be studied in adsorption studies, since most polluted wastewater usually contains different amounts of metal ion. Therefore, it is necessary to determine its impact on the study to study its effect on the adsorption efficiency. Some results and interpretations obtained in earlier studies indicate that when the concentration of ions of the metal in solution increases, the number of active centers on the surface of the adsorbate decreases through interaction. At a specific concentration of the metal in the solution, the active centers on the surface of the biosorbate are saturated, with no major changes in the value of the adsorption capacity. This phase is called the equilibrium phase of the removal process [Dundar M, 2008].

## 2. MATERIALS AND METHODS

### 2.1 Preparation of Standard Solution Pb (II), Cd (II)

The standard solutions were prepared by dissolving 1.598 mg / L of lead Pb (NO<sub>3</sub>)<sup>2</sup> in 1 liter of distilled deionized water. Therefore, 1000 mg / L lead for each liter is obtained, 1.638 mg / L of Cadmium compounds CdCl<sub>2</sub>.H<sub>2</sub>O in 1 liter of distilled deionized water. Concerning the study of the influence of different concentric metals on the biosorption process, different concentrations of each metal were prepared by diluting the standard solution to concentrations between 5 and 200 mg / L and taking the required volume of the concentrated solution and diluting it in distilled water.

### 2.2 Preparation of Biomass (Eggshell)

The used adsorbents in this study were powdered egg shells collected from various hotels, restaurants and houses in the city of Masrata - Libya, then first washed with hot water from the dirt from the dirt that was glued and then washed with distilled deionized water several times for removing any ionic impurities of the suspended matter [Ghani, A, 2007], after which they were taken to dryness using a kiln for drying at a temperature of 900 °C for four hours in the oven [Ok, Y. S. 2010]. This degree of temperature was chosen to become a large surface, where some studies of biosorption showed that the temperature increase which led to the surface increase. This feature is considered to be very important in the biosorption process and has an active role in linking adsorbents with adsorbents [Panagiotou, E, 2018]. Then they were crushed and ultimately penetrated to prepare a fine powder in the form of particles of 100 µm. After this phase, it is kept in the form of a gentle egg shell powder in dry bottles for the purpose of using without any physical or chemical additive..

### 2.3 Effect of Time on Efficiency Adsorption (R %)

In these experiments, a fixed amount of egg shell 4mg / L was placed within a 100 ml bottle containing the primary lead and cadmium concentration of 5 mg / L individually mixed in a shaker at 200 rpm 200 rpm, 40 ° C and at pH 6. Samples are taken in predetermined periods of time (from 10 to 120 minutes), whereby the measurement of the amount of biosorption is performed at each time period using the adsorption of atoms (each measurement is repeated three times) and monitors the amount of adsorption of the lead removed from the solution over a certain period .

The equation is used to calculate the adsorption efficiency and determine the percentage of metal removal R% :

$$R\% = [C_0 - C_e] / C_0 \times 100$$

Where R% is the percentage of the adsorption efficiency, the amount of biosorption for each mass of eggshell powder (mg / g), C<sub>0</sub> and C<sub>e</sub> (mg / L) is the initial concentration for the metal (control - before treatment), the respective final concentration treatment)

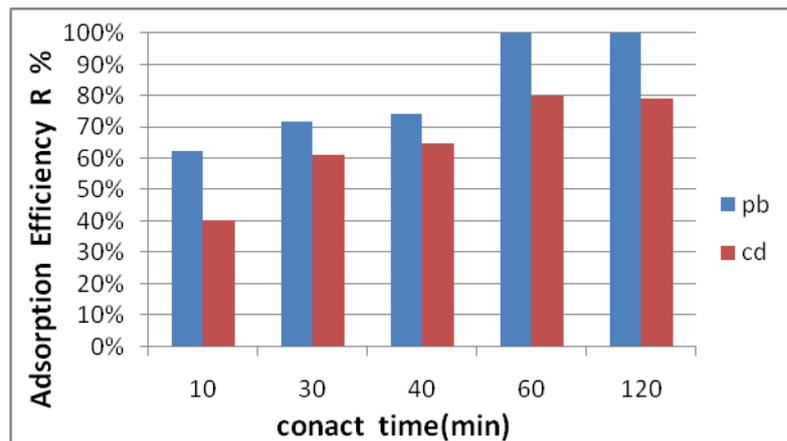
## 3. RESULTS AND DISCUSSION

Connection time is one of the most important criteria to pay attention to in the application of sanitary water treatment, where the connection time plays an important role in the Adsorption process. This experiment explains how to get acquainted with the percentage of removal of metal ions (lead and cadmium) with the help of shell eggs at different connecting times. The influence of contact time on the adsorption efficiency by studying the linking time from 10 to 120 minutes was studied. The percentage of adsorption of lead and cadmium at different times of contact with egg shells is presented in **Table 1**, with the results indicating that adsorption of lead has reached approximately 99.973% and cadmium adsorption about 79.973% at a time of 60 minutes.

**Table 1. - Influence of contact time on the efficiency of Pb and Cd adsorption on the eggshell.**

| heavy metals | eggshell (Biomass) m=mg | (°C) T= temperature | control of heavy metals (mg/L) C <sub>0</sub> | pH | contact time (min)         |        |        |        |       |
|--------------|-------------------------|---------------------|---|----|----------------------------|--------|--------|--------|-------|
|              |                         |                     |   |    | 10                         | 30     | 40     | 60     | 120   |
|              |                         |                     |   |    | Adsorption Efficiency (R%) |        |        |        |       |
| Pb           | 4                       | 40                  | 5   | 6  | 62.26                      | 71.933 | 74.147 | 99.973 | 99.94 |
| Cd           |                         |                     |   |    | 40.14                      | 61.28  | 64.68  | 79.973 | 79.34 |

**Figure 1** shows that every time the connection time has increased, the elimination of lead and cadmium has also increased rapidly. However, after the passage of time, the level of adsorption decreased. This mechanism can be explained by the fact that it is the result of a heavy metal ion ion exchange with existing active sites on egg shell surfaces, and with the passage of time, the balance occurs during the connection time. Active sites become saturated and insufficient for adsorption of new ions, therefore there is a decrease in the level of Adsorption. The time for linking the elimination equilibrium with the egg shell is reached in a period approximately 60 to 120 minutes. This indicates that the connection time is related to the effectiveness of the removal [Bailey SE, 1999], [Goyal, P, 2008]. These results are similar to results [Arunlertaree, C, 2007] which confirmed that the time for the equilibrium to remove lead in sanitary wastewater by shell eggs can be achieved in about 80 minutes



**Figure 1.** -Uticaj Influence of contact time on the efficiency of Pb and Cd adsorption on the eggshell.

#### 4. CONCLUSION

The capacity and the efficiency of the metal ion (cadmium and cadmium) biosorption process on egg shell powder in various working conditions such as pH, amount of adsorbents, initial metal ion concentration in solution, time of connection of I degree of temperature in the biosorption system were examined. We learned that these criteria have a very strong impact on the biosorption processes. Based on the experimental data obtained. This was confirmed by the results of this study, where the equilibrium time for egg shells was achieved in 60 minutes. This indicates that the removal efficiency is increased with an increase in the connection time.

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