# USE OF (*POMACEA CANALICULANTA)* SHELL FOR THE REMOVAL OF LEAD FORM AQUEOUS SOLUTIONS

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**ABSTRACT**

**This study was aimed to find a new, cheap available adsorbent for the removing of Pb from water, using shells of Mollusca (*Pomacea canaliculanta*). In order to estimate the efficiency of the new adsorbent in removing the heavy metal, batch experiments were achived. At the beginning the best contact time was determined which is equal to 2 hours. then the effect of the initial lead concentrations was studied which demonstrated a direct correlation between the removal efficiency of the adsorbent and the Pb concentration up to 93.98 percent at lead concentration of 60 ppm. After that the effect of adsorbent weight on the removal of the metal was examined which show that 0.75 gm give the best removal efficiency up to 79.08 of the lead initial concentration, as well as the pH value effect on the lead adsorption was evaluated. The results show that the proposed adsorbent has a very good ability for removing the lead, through the whole experiments.**

**Keywords: adsorption, water treatment, mollusca, heavy metal removal**



## استعمال اصداف حلزون التفاح الذهبي لإزالة الرصاص من المحاليل المائية

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**المستخلص:**

تم اجراء هذه الدراسة لإيجاد مادة مازة جديدة رخيصة ومتوفرة ولها قدرة جيدة في إزالة الرصاص من المحاليل المائية وتم استعمال اصداف حلزون التفاح الذهبي لهذا الغرض. تم اجراء أربعة تجارب لمعرفة مدى كفاءة اصداف حلزون التفاح الذهبي في إزالة الرصاص. في التجربة الأولى تم تحديد وقت التلامس او الاتصال الأمثل بين اصداف الحلزون المطحونة ومادة الرصاص حيث وجد ان وقت التلامس الأفضل هو ساعتين. بينما التجربة الثانية أجريت لمعرفة مدى تأثير التركيز الأولي للرصاص حيث وجد ان كفاءة الازالة تزداد مع زيادة التركيز الاولي للملوث لتصل الى 93.98 بالمئة من التركيز الأولي للرصاص عند التركيز 60 ppm. وفي التجربة الثالثة تم دراسة مدى تأثير زيادة كمية المادة المازة على كفاءة الازالة حيث وجد ان أفضل إزالة كانت عند إضافة 0.75 غم من اصداف الحلزون و بنسبة ازالة تصل الى 79.08. وفي التجربة الأخيرة تم دراسة مدى تأثير الاس الهيدروجيني للمحلول على كفاءة الإزالة. بينت نتائج هذه الدراسة ان اصداف حلزون التفاح الذهبي لها قابلية جيدة جدا في إزالة معدن الرصاص.

الكلمات المفتاحية: امتزاز، معالجات المياه، رخويات، معادن ثقيلة

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## INTRODUCTION

It is important for living organisms to have a fresh clean water source, since water is being polluted extensively due to the outcomes of different sources such as industries and factories (6, 8), over population as well as drought. The waste water produced by various factories and industrial application usually contain pollutants, these pollutants can be classified into: organic, inorganic and biological pollutants (8). Both organic and inorganic pollutants can increase the production of free radical in the body of living organisms, inorganic pollutants including toxic heavy metals such as lead and copper are released from different industrial and municipal sources (17). Heavy metal is a term used to describe each and every metal and metalloid which has a relative density of 3.5 to 7 g $cm^{-3}$ and can at low concentrations be toxic or poisonous to living organism, carcinogenic such as mercury, cadmium, arsenic, and lead. Heavy metals are non-biodegradable and bio-accumulative they also can access to human through water, food and air (1, 15). Lead considers as the most widespread heavy metal, consisting about 13 mg/kg of the crust of plant earth, it is used in many aspects such as welding solder, batteries, various alloys, in dyes, rust preventing dyes as well as in plastic stabilizer and in antiknock in fuel. Lead can also be used in major water distribution and drain systems (16, 22). *Pomacea canaliculate* known commonly as golden apple snail is a freshwater, it is usually presented in tropical and subtropical area. *P. canaliculata* was introduced commercially Asia as food and in aqua-culture but with low success, some of them were released to water source (11). The problem of this snail was so obvious in the rice field as pest (13). Many studies have been conducted on the adsorption of lead (3, 4, 10, 14, 18, 19) with different degrees of success. this study aimed to use shells of *P. canaliculata* as novel adsorbent for the removal or reducing of lead from aqueous solutions in order to reduce the harmful effects of this metal on the human health and the environment.

## MATERIALS AND METHODS

The experimental work in this study was done according to (5, 21) as follow:

**stock solution**

The stock solution was prepared from dissolving lead nitrate salt in distillated water to prepare a stock solution of lead with concentration of 1000 ppm and then a series of dilution was carried out to reach the required concentration of lead which was 50 ppm.

**adsorbent**

The adsorbent was prepared by washing the shells of *P. canaliculate*, dry them. then the shells were activated by socking them in nitric acid (5% rather than the usually used 10% since the snail shell was rich in calcium carbonate that con be melted in high concentration of nitric acid). Following those the snails' shells were dried in the oven at 100 $C^0$, after that it was grinded to powder by grinder.

**Laboratory measurements**

The following four experiments were done as follow:

1- measuring the best contact time by using a series of time [15, 30, 60, 90, 120 minutes] respectively and a sample size 50 ml, initial lead concentration of 50 ppm in a 500 ml conical flasks and adsorbent weight 0.75gm and kept in the shaker at 120 rpm, pH value 7.

2- find the effect of the increase in the weight of the adsorbent on the adsorption process be using a series of adsorbent weight [0.25, 0.5, 0.75, 1, 1.25 and 1.5 gm] respectively, sample size 50ml, initial lead concentration of 50 ppm in 500ml conical flasks and kept in the shaker at 120 rpm for two hours, pH value 7.

3- changing the initial lead concentration by using a series of [10, 20, 30, 40, 50, and 60 ppm] respectively, sample size 50 ml, adsorbent weight 0.75 gm in 500 ml conical flask and kept in the shaker at 120 rpm for two hours, pH value 7.

4- the final experiment was done to find the effects of the pH value on the adsorption of lead from the aqueous solutions by using pH value of [3, 7, 9] respectively, sample size 50 ml, initial lead concentration of 50 ppm, adsorbent weight 0.75 gm in 500mlconical flasks and kept in the shaker at 120 rpm for two hours.

All the samples from the four experiments are transferred to the centrifuge at 1000 rpm for 10 minutes and the supernatant were taken and the precipitate was dismissed and then the lead concentration was measure by using atomic adsorption spectrophotometer.

## RESULTS AND DISCUSSION

This study was done to find the *P. canaliculate* shell ability to eliminate or reduce the lead from aqueous solutions, in order to do this, four experiments were done. At first it was important to find the best contact time between the adsorbent and lead, the results in Fig.1 show that there was a direct correlation between the increase in contact time and the removal efficiency (R%) of lead, with the best contact time being two hours achieving a removal efficiency of 92% of lead initial concentration. At the beginning of the adsorption of lead was fast at the first 15 minutes and then the increase in R% become more gradual and that can be simply explain be fact that the with the increase in time the adsorption site on the adsorbent surface reduced, while still vacant sites are not accessible for lead (2). The study findings are in agreement with the results found by (7) which find that there is an increase in the removal of lead as the contact time increase up to 120 minutes and after that it reach an equilibrium and the increase in time does not produce any increase in the removal of the lead.

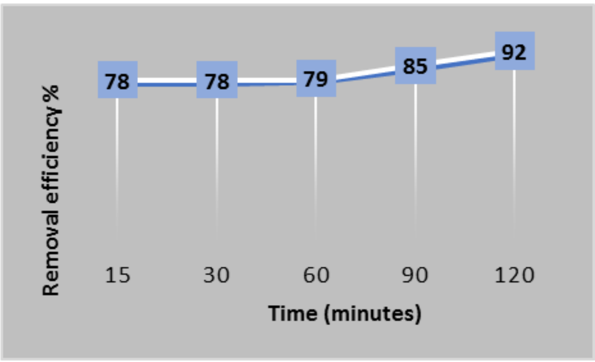


**Fig. 1. The best contact time for lead adsorption**

Second experiment was done to find the outcome of changing the initial concentration of lead on the adsorption process. As shown in Fig.2 there was a direct correlation between the elevation in the initial pb concentration and the increase in R%. this can be due to the fact that the rise in the initial lead concentration led to boost the driving force of the adsorption force of the adsorption process. In other words, the increase in the pb concentration mean a higher percent of pb ions accessible for adsorption (18). this study outcomes are similar to the results of (10).

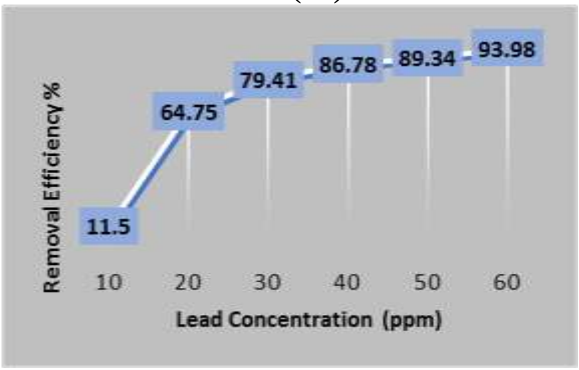


**Fig. 2. The effect of lead initial concentration on the adsorption process**

After that the effect of the adsorbent weight (amount of adsorbent added to the aqueous solutions) was studied, the results show that the increase in the adsorbent weight up to 0.75 gm cause an increase in the R% up to 79 %, as illustrated in Fig.3. After that R% was beginning to decrease and that can be due to at the onset of the experiment the increase in the adsorbent weight led to increase the available surface area for adsorption and up 0.75 gm of the *P. canaliculata* shell, above that amount the increase in the adsorbent weight dose not increase the adsorption of lead due to saturation of the available adsorption sites (9). The results of this study are analogous to the findings of (9,12) which find that the increase in the snail shell dosage will increase the removal of lead at it reach an equilibrium and above that concentration there is no benefit of increasing the dose of the adsorbent.

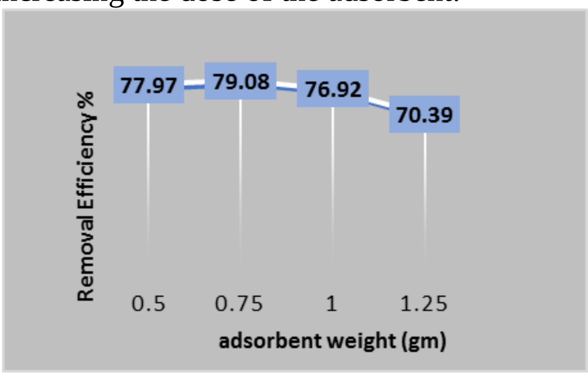


**Fig. 3. Relationship between adsorbent weight and removal efficiency**

The fourth and final experiment was to find the outcome of changing the solution pH value on the adsorption process as shown in Fig.4 the adsorption of the lead was the highest at alkaline site and that because rising pH value will led to charge the adsorping site on the *P. canaliculate* shell with a negative charge which lead to increase the attraction between lead and the adsorbent and subsequently increase R%, this study findings goes along with the findings of (20)

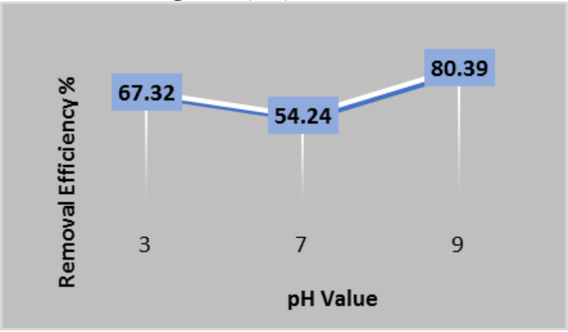


**Fig. 4. pH value effect on the removal efficiency**

## CONCLUSIONS

Through out the whole work the *P. Cansliculanta* show a very good ability in removing lead. Its ability was not hander by the increase in the initial lead concentration on the contrary it shows a direct correlation between the increase in the lead concentration and the removal efficiency. The removal efficiency was also increase with the increase in the pH value (alkaline) and may also result from the precipitation of lead at high alkaline medium.

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