Analysis of Organic Flocculants in Lead and Cadmium Biosorption in Laboratory-Level Samples

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Abstract. The intention of the work is to evaluate the absorption of lead and cadmium in water, by means of controlled tests, by means of a protocol based on the preparation of 3 types of concentrations of the indicated metals, in a water sample of 1 liter, the used dose of flocculants was made in 5 groups, with varied times of rest of are from 5 minutes to 30 minutes, the method that is presented to evaluate these concentrations, is characterized in being able to use different concentrations, with situations of controlled environment, the most encouraging result was the one that presents a level of concentration of 2. 5 grams of natural flocculant. In order to eliminate cadmium, we have a better response using flocculants based on coconut, grapefruit, tangerine, cucumber and apple fruits.

Keywords: Flocculant, cadmium, coconut, grapefruit, tangerine and cucumber.

1. Introduction

The National Water Authority carried out a monitoring in April 2012 on the Rimac River and its tributaries. Detecting the presence of heavy metals such as Arsenic, Lead, Cadmium, Chromium, among others in amounts above the Environmental Quality Standards.Indicating that the waters of the Rimac River are contaminated with Cadmium, with a greater incidence in the middle basin, while Lead is found with a greater incidence in the lower part of the basin (Ministry of Agriculture, 2012).
According to the Ministry of Health (2010), stations E-06 and E-6A where the Tamboraque area is monitored in August came to quantify concentrations of this parameter with values that exceeded the limit value. In the case of lead, concentrations that exceeded the value established in the standard were reported in the same stations and in September.

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Lima is supplied with water in a large percentage of the Rimac River, which is why the contamination of this river would seriously affect the health of Lima, with the appearance of diseases derived from the consumption of heavy metals in high quantities.

According to the Ministry of Health in our country among the main pollutants identified we have: lead, mercury, aluminum, arsenic, magnesium, manganese, iron, copper, cyanide. In addition to that we have the growing presence of the populations located within the area of influence of productive activities including mining.

Through research it is proposed to use organic flocculants that allow the adsorption of heavy metals such as lead and cadmium, using 15 fruit peels. In this way the treatment in the effluent would be cheaper than the traditional one and it would be possible to reduce the concentration levels complying, with the environmental quality standards and the maximum permissible limits.

Bioadsorption of lead and chromium ions from wastewater using the tangerine peel. It evaluated the capacity of bioadsorción in the treatment of residual waters contaminated with lead and chromium by means of the tangerine peel (Citrus reticuata var. Clementina). The study consisted in the elaboration of solutions with metals at a concentration of 5 ppm, likewise with Stirring for two hours stipulated that the optimum pH to remove lead and chromium is 4, it should be mentioned that the size of the tangerine peels that were worked were: less than 0.3 mm; greater than 0.6 mm andbetween 0.3 - 0.6mm. The first efficiency results were 71.9% of lead and 54.4% of chromium and applying statistical methods confirms that particle sizes have a significant difference of ($p < 0.05$) in the bioadsorption of Pb and Cr, the most optimal being particles smaller than 0.3mm [V].

Evaluation of the absorbing power of citrus peels "lemon and grapefruit" for heavy metal removal; lead (Pb) and Mercury (Hg) in synthetic wastewater. They studied the process of lead and mercury biosorption using citrus peels(lemon and grapefruit), as for the experimental design, it consisted of working two phases and for this purpose two variables were taken, the amount of bioadsorbent they were (0.5 g, 1.0 g, 1.5 g. 2.0 g and 3 g) and the particle size (315 and 630 µm). The first phase was to work with crushed citrus peels without articulation but only to regulate the pH slightlyacid between 4 - 6 which is favorable for biosorption and the second phase consisted of working with crosslinked husks regulated at a pH of 5. Achieving the efficiency - percentage, as for the grapefruit shell removed 93.54% of biosorption of lead and 8.80% mercury using a 630 µm particle size and 3.0 g of bioadsorbent [I].

2. Materials and methods

2.1. Heavy Metals

According to the periodic table, heavy metal comes to make a chemical element with mass - atomic weight greater than 20 and high density greater than 4 g / cm3. Argues that "metals are divided into two groups: non-essential and essential for life", where non-essentials are considered harmful because they cannot be metabolically degraded. And these accumulate in the tissues causing severe damage. It should be noted that the main problem is when pollution arises from anthropogenic processes and these metals enter natural channels.

2.2. Lead

It is a metal that is being used for many years due to its corrosion resistance, ease of forming alloys. According to (Albert, 1997, pp. 45) "Lead is a water- insoluble, highly malleable, odorless metal that has a silver color with a bluish hue and is resistant to corrosion, however it is not an electrical conductor."

According to the periodic table, lead is divalent, it has 82 atomic numbers, a relative density of 11.4 g / cc and an atomic weight of 207.19.

Figure 1: Mosquito breeding cycle.

2.3. Effects of Lead on Living Things

Lead adsorption is a very high risk to the health of living things. (Castro, 2015, pp.) He mentions that "they are affected due to their intake of lead salts causing poisoning, this is caused by eating processed food or the containers release lead (…) it is estimated that they enter the body is a 65% through food". Nowadays foods such as vegetables, fruit, among others. Mentions "ingesting or inhaling lead does not only generate poisoning but also brain damage, cardiovascular disease, hypertension, effects on the nervous system, inhibition of hemoglobin iosynthesis and anemia and even abortion problems" Although poisoning can even cause death presenting symptoms such as nausea, abdominal pain, kidney disorders, weakness, fatigue and muscle pain.

2.4. Plomo Environmental effects of Lead

Lead occurs naturally in the environment, however high concentrations of lead (Wase and Forster, 1997, pp.) indicate that the lead contained in gasoline generates an unnatural cycle that results in the burnt lead produced by vehicle engines". Therefore, these salts come into contact with the environment, which will be perceived as permeating the environment, i.e. large particles will precipitate to the ground while smaller particles will come into contact with the air while remaining in the atmosphere.

2.5. Bioadsorption

Bioadsorption consists in the use of organic waste as an adsorbent material to remove concentrations of metals. (Pinzón and Vera, 2009. pp. 95) makes references that "in recent years bioadsorption has been defined as a new technology, based on the capture of various chemical species, through ion exchange and adsorption". (Cañizares, 2000, pp. 131). He explains that this "process involves a solid phase (adsorbent) and a liquid (solvent), for this process to be carried out there must be a correlation of the absorbent by the adsorbates, that is, where by different mechanisms the latter are transported to the solid " It should be noted that this method is applied until a balance is established between the adsorbee bound to the solid and adsorbed dissolved. He also maintains that this method involves the interaction of the contaminant and the surface of the material.

2.6. Methodology

- Thefollowinginstruments are used:
- Atomicabsorptionspecfotometerequippedwith a lamp Hollowcathodecadmium and a nebulizerassembly - air burner - acetylene.
- 500 ml decantationfunnels.
- Automaticreciprocatingagitator (stirringfrequency 60). Centrifuge
- pH meter.
- Procedures

2.7. Sample Preparation

We used 1000 mg/l or ppm of lead and cadmium, which proved to generate solutions of 50 mg/l, 100 mg/l and 200 mg/l. Concentration 1 is based on the Maximum Permissible Limits for the discharge of liquid effluents from mining and metallurgical activities, according to D.S. Nº 010-2010- MINAM. Concentrations 2 and 3 are considered higher than the aforementioned MPLs because the effluents have a higher concentration of heavy metals. Sample treatment: The jar method was used, considering the volume (v = 1l), concentration, initial test (v1 = 250 RPM for 15 minutes), resting time 1 (tr1 = 5 minutes), next test (50 RPM for 5) constant minutes), final resting minutes (Trf = 30 minutes); what will vary will be the weight of the natural flocculant.

2.8. Sample Analysis

Once the sample was treated, an aliquot of 100 ml was taken, to which 5 ml of nitric acid cc was added, to take it to the heating plate, the working temperature was 95ºC, applying it for an average of 50 minutes, reducing the volume from 20 to 30 ml.

Then it is allowed to cool, for a time of 30 minutes, so that it can be filtered for it then be encased in a 100 ml row.
Due to the quantity of the samples, we worked in 04 groups and these were stored in a refrigerator at 5°C.

After all this process the respective analyzes were made, with the atomic absorption spectrophotometer equipment, where a blank and 3 standard solutions (0.5 mg / l, 1 mg / l and 2 mg / l) were used to calibrate the equipment, using as fuel acetylene gas and then be able to determine the final concentration of each of the samples.

3. Results

From the findings discovered, the efficiency of lead and cadmium biosorption was given from organic flocculants which were developed from the shell of various fruits, which determined that the optimal dose is shown with 2 and 2.5gr / L for both the removal of cadmium and lead, that is, for the removal of cadmium with a concentration of 2.5g in fruits such as grapefruit, tangerine, cucumber and apple reached a removal of 0.011mg / L at 0.309mg / L , similarly for lead with a concentration of 2.5g in fruits such as orange, grape, cucumber and apple, a removal of 0.026mg / L to 0.0236mg / L was achieved, as mentioned (Zapién, 2013) who in His research worked with 10 different doses (0.1, 0.5, 1, 2, 4, 5, 6, 8, 10 and 12g / L), each of them being significant, however the first four doses worked were the best results in Metal removal presented, which coincides with this research. It is worth mentioning that in this investigation we worked at 5 different doses, the aforementioned concentration being the most optimal and without detracting from the other concentrations, such as 1g / L, it also has a high percentage of removal for both cadmium and lead metals reaching 0.032mg for cadmium / 0.118mg / l and for lead 0.029mg / 0.236mg / l withWith respect to cucumber, this dose is related to what it claims (Netzahuatl et al.2009) who in his research used the cucumber peel determined that the 1g / L dose is also effective, which is consistent with the values obtained.

The results found regarding lead removal are related to what Ilina et al. 2009, Rumi et al. 2009, Marshall et al. 2016 and Muñoz, 2007, who studied different fruits such as orange, passion fruit, grapefruit and grape, reaching a conclusion that these fruit peels have a 40% efficiency up to 96.08% in lead removal (Pb). On the other hand, authors such as Verdugo, 2017 in their study using the tangerine peel, removed 71.9% of lead, which also coincides with what was obtained in this investigation, 67.58% removal with the tangerine peel, presenting a percentage of below the others, likewise Pandey et al. 2014 and Netzahuatl et al. 2009 who studied cucumber, cocona and apple, concluded that the peels of the following fruits achieve up to 93.5% of Pb removal, these authors express that the mentioned fruits reach a high level of significance in the removal of lead, highlighting the efficiency of the apple with 88.88%.

4. Conclusions

In this present investigation the efficiency of lead and cadmium biosorption was evaluated by means of organic flocculants. For this purpose, the optimal concentration of each of them was determined, which is why it depends on an efficient dose for colloids and other compounds to settle, thus improving water quality.

The optimal dose presented by this research for lead adsorption was 2g to 2.5g for the different fruits and at the three concentrations worked, resulting in the case of the apple with the 2.5g dose managed to remove in the first treatment in a concentration of 0.2mg / l reached 0.026, in the second treatment at a concentration of 0.5mg / l reached 0.054 and in the third treatment at a concentration of 1.0mg / l reached 0.111, proving that this dose is the most effective to remove Lead and in the same way tends to relate to the other natural flocculants.

The optimal dose for cadmium adsorption was 2g to 2.5g for the different fruits and at the three concentrations worked, resulting in the case of the apple with the 2.5g dose managed to remove in the first treatment at a concentration of 0.2 mg / l reached 0.011, in the second treatment at a concentration of 0.5mg / l reached 0.037 and in the third treatment at a concentration of 1.0mg / l reached 0.057, proving that this dose is the most effective for removing lead and The same way tends to relate to the other natural flocculants.

The results show that flocculants from organic material to remove lead have an efficiency of 28.37% to 88.33%, carambola presents lower efficiency in the removal of lead and orange, grape, cucumber, cocona.

The apple shows the highest efficiency in the three concentration levels observed in this research, so for a concentration of 0.2 mg/l the highest efficiency is observed in the apple with 86.93%, followed by the cucumber with an efficiency of 84.62% and in third place the cocona with 81.54%. 54%; for a concentration of 0 For a concentration of 0.5 mg/l, the highest efficiency is again found in apple with 89.18%, followed by grape with 87.13% and in third place cocona with 86.64%; for a concentration of 1.0 mg/l it was found that the highest efficiency is again in apple with 88.88%, followed by grape with 85.80% and in third place cocona with 82.24%.

Likewise, it is concluded that for the treatment of cadmium the organic flocculants have an efficiency of 41.93% to 83.82%, with the grape being the one with the lowest efficiency in the removal of cadmium, while for a concentration of 0.2 mg / l the efficiency more high that is observed with the tamarind with 78.51%, followed by the apple with an efficiency of 77.65% and thirdly the tangerine with a 77.40%; for a concentration of 0.5 mg / l the highest efficiency is found with mandarin orange with 94.08%, followed by grapefruit with 86.50% and thirdly cucumber with 85.35%; for a concentration of 1.0 mg / l it was found that the highest efficiency is found with the apple with 88.69%, followed by the cocona with 85.57% and thirdly the quince with 84.98% as a final conclusion we can indicate that when subjected to long game times, young people have many emotions in short periods of time and these emotions in most cases tend to be antagonistic, from being happy to

becoming frustrated, all feeling The pressure of the group, it is recommended to manage the emotional states of young people who play for long periods of time, as well as if they show fatigue, agitation, when they play that could be a sign of a later problem that may affect the respiratory cardio system.

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