The Study of Blocking Agent on Lengkeng (Euphoria Logan Lour) Fruit Shell and Seed for Adsorption of Pb (II) from Aqueous Solution

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Abstract. The study focuses on the roles played by mayor functional groups (carboxyl) in the lengkeng shell for sorption of Pb (II). The biosorbent was characterized by FTIR and elemental analyses. The parameters such as pH, initial concentration, particle sizes, adsorbent dose and flow rate were also studied. The results showed that the optimum condition was at pH = 3, concentration 400 mg/l, 250 µm particle sizes, adsorbent dose 0.5 g and 2 ml/min flow rate with adsorption capacity 4.8933 mg/g(shell) and 5.2720 mg/g(seed). It is show that ion exchange play as a more important role in the sorption of Pb (II) on lengkeng shell and seed. Blocking of COOH groups by chemical esterification resulted in Pb important reduction in metal binding. The result showed that adsorption capacity of lengkeng shell uncreases until 63.67 % and lengkeng seed uncreases 98.70%.

1. Introduction

Heavy metal ions, such as zinc, cadmium, nickel copper, lead ions at all are commonly found in Industrial effluents [1]. From the health and economical points of view. It is of great interest to be able to effectively remove these heavy metal ion from the waste waters before their discharging and if possible, separate them for recovery and reuse. Conventional methods used to remove toxic heavy metals from aquatic environment include reverse osmosis, electro-dialysis, ultra-filtration, ion exchange, and chemical preparation [2,3]. The method based on metal binding capacities of various functional groups present in biological materials. In this study, the biosorption of lead by lengkeng (Euphoria logan lour) shell and seed from single and binary mixtures were investigated.

The aim of the present work is to study blocking agent of fungsional group from lengkeng shell and seed as adsorbent for removal of Pb(II) cation from aqueous solution. The cation exchange properties of there residues may be attributed to the present of carboxylic fungsional group. To reach this aim, several parameters controlling the adsorption capacity of Pb(II) cation on to the surface of lengkeng shell and seed were study here.

2. Material and Methods

2.1. Treatment of lengkeng shell and seeds

In present work, biosorption experiments were conducted by using stock standard solution (1000 mg/L) of lead ion in 1 % HNO₃. Shell and seed of lengkeng (Euphoria logan lour) were used as biomaterial in this study. Euphoria logan lour fruit were collected from the market of Padang city. The sheel and seed of Euphoria logan lour were washed with deionized water, air-dried for 3 days and...
ground using crusher. The working powder was activated by a 20 gr biomass in excess of 80 ml HNO$_3$ 0.01 M for 2 h, followed by washing thoroughly with deionized water and then air-dried [4]

2.2. Blocking Biosobent treatment procedures
The carboxyl group of the biosorbent was blocked with methanol blocking agent. Blocking was carried out by shaking, at room temperature, 8 g of the raw biosorbent in 100, 150 and 200 mL of 99.9% pure methanol and concentrated hydrochloric acid (HCl), given a final acidic concentration of 0.1 M HCl for 6 h at 200 rpm. Then the biosorbent was thoroughly washed with deionized water and then air-dried. The biosorbent was dried and ready to used.

3. Results and discussions
3.1. Effect of solution of pH on metal ion uptake
To study the effect of pH on sorption, the pH of the Pb(II) solution is adjusted to values in pH range of 2-6. Figure 1 shows the maximum pH at 3.

![Figure 1. Effect of pH on Pb (II) biosorption by Euphoria logan lour seed and shell, particle size 150 µm, mass of biosorbent 0.5 gr, concentration 40 mg/L with column method.](image)

It is well documented that solution pH is an important parameter that affects the biosorption of heavy metal ion [1, 5, 6]. At lower pH, the higher concentration of the hydrogen ions effectively leads to fewer ligands being available for the binding of metal ions [1]. In the present study, biosorption of Pb could not be carried out beyond pH 6 due to precipitation of Pb(OH)$_2$ at higher pH. The effect of solution pH on the uptake of lead ions from aqueous solution showed an decreased in adsobtion capacity removal from 0.3252 mg/g to 0.2275 mg/g of lead ion solution for lengkeng shell and seeds.

3.2. Effect of initial concentration on metal ion uptake
The effect of initial concentration on the sorption of lead ion is presented in Figure 2. Different concentrations of the adsorbate from 20 to 600 mg/L were use study the effect of initial lead concentration on the mechanism of adsorption by lengkeng shell and seed. The sorbate removal increased with increase in the initial concentration until finally the constant at 400 mg/g on the lengkeng shell and seeds.
Figure 2. Effect of concentration on Pb (II) biosorption by Euphoria logan lour seed and sheel, particle size 150 µm, mass of biosorbent 0.5 gr, optimum pH 3 with column method.

The distribution of the solute Pb(II) metal ion between the liquid phase and solid phase can be described by several mathematical relationships such as the standard Langmuir-Freundlich isotherm model [7,8]. From the experimental data for binding metal ions lengkeng shell and seed system with the maximum sorption capacities is 4.8933 mg/g for shell and 5.270 mg/g for seed.

3.3. Effect of particle size of lengkeng shells and seeds
The effect of particle size on the sorption capacities has been carried out by using various sizes 106, 150, 250 and 425 µm. The result is shown in Figure 3. The result indicated that the amount adsorbed by each individual particle size showed that 250 µm particle size give optimum condition for effective adsorption on shell and seed adsorbent with sorption capacity 4.9050 mg/g for shell, 4.7710 mg/g for seed, respectively. The increase in size for lengkeng seed and shell corresponds to a higher adsorption capacity this may be caused due to the fibrous properties of lengkeng shell and seed which may have given rise to better adsorption surface area [9, 10]. It is also influenced by the method of column because of style of ILCOVIC when metal ions is flowed into the column. The smaller the particle size cause the flow of metal ion is not about all the surface of the adsorbent. So the particle size of 250 µm the absorption of metal ion by sheel and seeds of lengkeng fruit are optimum at this study. Therefore for the next experiment 250 µm of particle size has been selected in blocking agent process.
3.4. *Effect of adsorbent dose of lengkeng shells and seeds*

The effect of dosage clearly plays a significant role on the ability of lengkeng shell and seed powder to remove metal ion from solution. A dosage increase of 0.1 g 0.5 g gives capacity increase from 13.03 % - 68.81 % for shell and 7.98 % - 60.37 % for seed, but capacity adsorbent decreased from 14.2 mg/g - 5.58 mg/g for shell and 8.4 mg/g - 5.54 mg/g for seeds in Figure 4.

![Graph showing the effect of particle size on Pb (II) biosorption by *Euphoria logan* lour seed and shell, mass of biosorbent 0.5 gr, concentration 400 mg/L, pH 3 with column method.]

**Figure 3.** Effect of particle size on Pb (II) biosorption by *Euphoria logan* lour seed and shell, mass of biosorbent 0.5 gr, concentration 400 mg/L, pH 3 with column method.

![Graph showing the effect of dose adsorbent on Pb (II) biosorption by *Euphoria logan* lour seed and shell, particle size 150 µm, mass of biosorbent 0.5 gr, concentration 400 mg/L, pH 3 with column method.]

**Figure 4.** Effect of dose adsorbent on Pb (II) biosorption by *Euphoria logan* lour seed and shell, particle size 150 µm, mass of biosorbent 0.5 gr, concentration 400 mg/L, pH 3 with column method.
3.5. *Effect of flow rate on metal ion uptake*

The effect of flow rate on adsorption the metal ion on to the lengkeng shell and seed in Figure 5. The results indicated that absorption capacity is optimum at flow rate of 2 ml/min. There is no change in the significant at the flow rate of 1-6 ml/min.

![Figure 5](image)

**Figure 5.** Effect of flow rate on Pb (II) biosorption by *Euphoria logan* lour seed and shell, mass of biosorbent 0.5 gr, concentration 400 mg/L, pH 3 with column method.

3.6. *Effect of blocking agent of lengkeng shell and seed*

The results obtained show that the blocking agent the functional group in the carboxyl group cause a decrease in the absorption capacity metal ion Pb(II) from 4.905 to 1.792 mg/g for shell and 4.771 to 0.062 mg/g for seeds. The optimization volume for blocking is taken at a volume of 150 mL for Pb$^{2+}$ on the lengkeng shell (Figure 6) and seeds (Figure 7).

![Figure 6](image)

**Figure 6.** Effect of the volume blocking of carboxyl groups to biosorption capacity of Pb (II) ion by lengkeng shell.
Figure 7. Effect of the volume blocking of carboxyl groups to biosorption capacity of Pb (II) ion by lengkeng seed.

This reasead that the carboxylic group from biosrben the shell and seeds of lengkeng has an important role in binding metal ions Pb(II) [11, 12]

4. Conclusion
The results that lengkeng shell and seed are an effective biosorbent to remove lead (II) from aqueous solution. The maximum biosorption capacity was found to be 4.8933 mg/g for lengkeng shell and 5.2720 mg/g for lengkeng seed in column experiments. Biosorption proses was affected by pH 3, concentration 400 mg/l, 250 µm particle size, 0,5 gr biosorbent and 3 ml/min flow rate. While in shell and seeds of lengkeng fruit which carboxyl functional groups are blocked with methanol showed that the metal ion absorption capacity decreased from 4.9050 mg/g to 1.7916 mg/g (63.67%) and 4.7110 mg/g to 0.0620 mg/g (98.7 %). Based on the research, the conclusion drawn are as follows carboxyl group in lengkeng shell and seed very important in the proses of biosorption. The study revealed that lengkeng shell and seed biosorbent could be used as an adsorbent for removal of other heavy metals on large scale.

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