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Effect of Biosorbent Particle Size on Biosorption of Lead (II) from Lengkeng Seeds and Shell (Euphoria logan Lour)

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Abstract - A study about the effect of biosorbent particle size on adsorption Pb ions from seeds and shell lengkeng (*Euphoria longan* lour) has been conducted. Shell and seeds lengkeng were activated with HNO_3 and characterized by FTIR to analyze the mayor functional groups in biosorbent. The effect of seed and shell lengkeng (*Euphoria longan* lour) on the adsorption capacity of Pb (II) metal ions was carried out with variation 106 µm, 150 µm, 250 µm, and 300 µm. The results obtained from the particle size 106 µm of seed and shell lengkeng have a greater adsorpsition of 25,626 mg/g dan 30,095 mg/g respectively. This study shows that the biosorbent particle size afffects the amount of adsorption of metal ions.

Keywords - Biosorption, Pb (II), Lengkeng (*Euphoria logan lour*) Seed and Shell.

I. INTRODUCTION

Toxic metals levels in the waters have become a major problem in the world in recent years [1]. Heavy metals that accumulate in water waste they can endanger living thing both in the waters, plants, animals and human health because heavy metals cannot be biodegradable [2].

Of the many heavy metals, lead metal is one of the heavy metals which is toxic. Determined by USEPA the limit of Pb allowed in drinking water is 0.05 mg / L [3]. Toxicity effect of lead metal is very broad for human life and cause health problems such as hypertension, kidney and brain disorders [4].

Removal of heavy metals in the waters is more often used adsorption than techniques such as chemical precipitation, extraction, ion exchange, filtration, electrodeposition, and reverse osmosis [5]. But in fact, These methods are infeasible because they are not effective and suitable at high concentartions, are expensive to maintain and also result in production of large quantities of secondary pollutants such as sludge [6].

Adsorption is one of the methods most often used because it is efffective and economical in removing metal ions in the waters [7]. Adsorption occurs because of the interaction between metal ions and functional groups such as -OH, -SH, -NH and COOH on the solid surface of the adsorbent [8].

Biosorbent commonly used come from agricultural waste as durian (*Durio zibethinus*) seed [9], papaya (*Carica* **papaya** L) leaves [10], papaya peel [11], banana [12], mahkotadewa [13].

Lengkeng seeds and shell cloves have bioactive compounds that can be used to absorb metal ions. Lengkeng identified as functional groups using FTIR spectroscopy [14]. This Study will examine the effect of particle sizes on the adsorption of lead by lengkeng seed and shell.

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II. EXPERIMENTAL

1.1. Chemical and Equipment

All the chemicals used in this work were of analytical grade, Shaker (VRN-480 model), pH meter (HI2211), Analytical balance (ABS 220-4), filter paper, magnetic stirer (MR Hei Standard), sieve (BS410). The standard Pb solution of 1000 mg / L is made by dissolving 1.5985 grams of $Pb(NO_3)_2$ in volumetric 1L. The solution of HNO_3 used bioserbent actived and to set the pH solution. Equilibrium concentration in the sample was measured by using laboratory glassware. Initial metal ion concentration was measured by Atomic Absorption Spectrophotometer (AAS).

1.2. Sample preparation

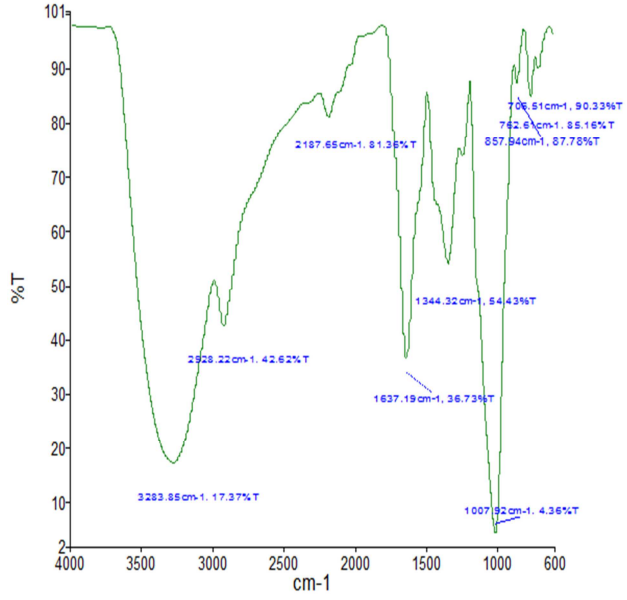
Lengkeng seed and shell are collected and cleaned from dirtand washed with deionized water and then dried. The sample was mashed using mortar and sieved with a size of 106 µm, 150 µm, 250 µm, and 300 µm. A total of 20 grams of longan seed and shell were activated with 80 mL 0.01 M HNO_3 for 2 hours. Then lengkeng washed with aquadest until neutral [14].

1.3. Batch Method

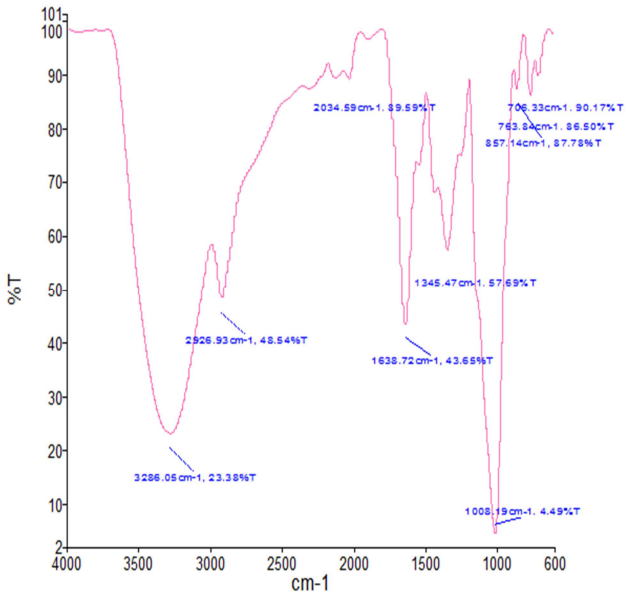
0.2 **grams** of longan shell and seed activated were contacted with 25 mL of Pb (II) solution, then stirred using a shaker (VRN-480 model). The sample is contacted at pH 5, concentration of 400 ppm, and contact time for 75 minutes. After contact, separate the filtrate and solution with filter paper. The initial concentration of Pb(II) solution and unabsorbed Pb (II) concentration is measured by AAS (Atomic Absorption Spechtrophotometer).

III. RESULTS AND DISCUSSION

FTIR is an analysis technique used to detect functional groups of a **sample** based on Infrared ray absorption spectra. Some functional groups found in biosorbents seeds and shell lengkeng are found in the –OH group at wavelength 3300-3600 cm^{-1}, -CH function groups at wavelength 2800-3000 cm^{-1}, Carbonyl C=O functional groups at wavelangth 1640-1820 cm^{-1} and –CO at wavelength 900-1300 cm^{-1}.



(a)



(b)

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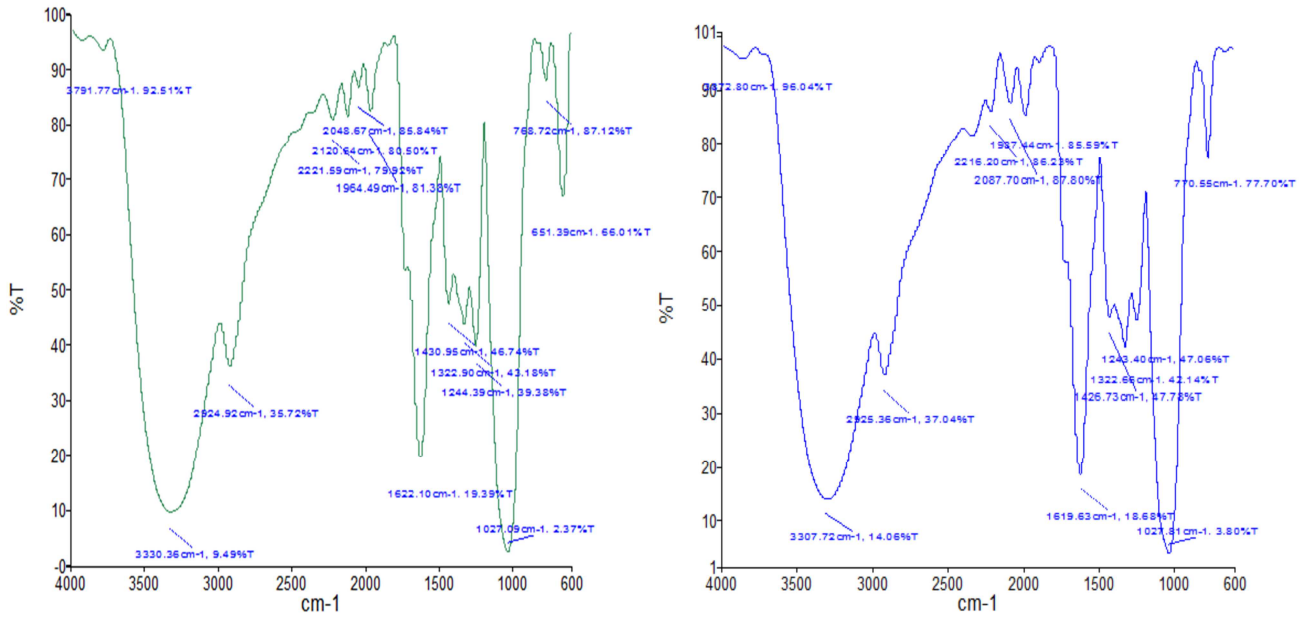


(c) **(d)**

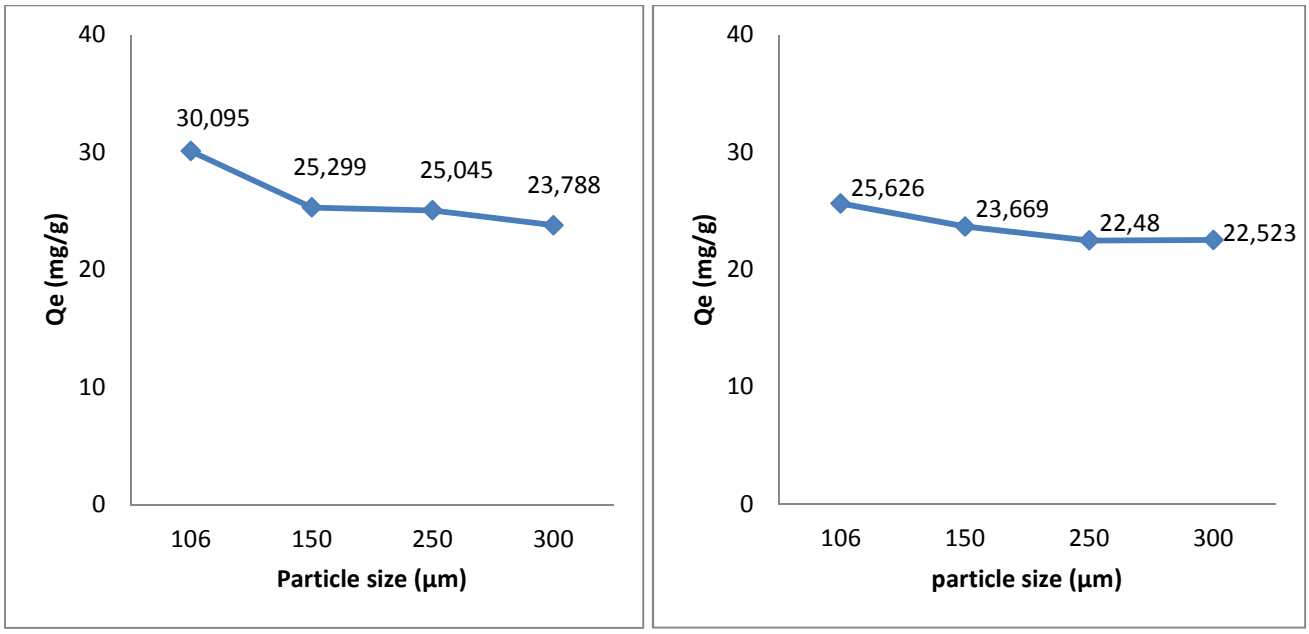
Figure. 1. FTIR spectrum from Longan seeds (a), active Longan Seeds (b), Longan Shell (c) and active Longan Shell (d)

The results of FTIR Spectrum are changes in transmittance values **between** functional groups in shells and pure longan seeds after activation. In figure 1 shows that on the longan shell vibration occurs in the -OH function group with a shift on lengkeng shell 3330.36 cm^{-1} to 3307.72 cm^{-1} and –CO group with a shift of 1027.09 cm^{-1} to 1027.81 cm^{-1}. Where as in the longan seeds there was a shift in the -OH group 3283.85 cm^{-1} to 3286.05 cm^{-1} and the –CO group 1007.92 cm^{-1} to 1008.19 cm^{-1}.

Effect of Biosorbent Particle Size

Particle size biosorbent greatly influences the absorption capacity of biosorbent metal ions. Adsorptions capacity **depends** on the available surface area for the interaction between the solution and the surface of the biosorbent. Materials that have smaller particle size can adsorp more than larger particles. The effect of particle size is carried out with size variations 106 µm, 150 µm, 250 µm, and 300 µm.

From the graph shows that the optimum adsorption capacity occurs at particle size 106 µm. The optimum adsorption capacity of lengkeng shell against Pb (II) ions occurred at biosorbent size 106 µm of 30,095 mg/g. The larger the particle size the smaller the adsorption capacity. Small particle size has a large surface area of the adsorbent, so that the adsorption will be greater and more metal ions will be adsorbed [15]. This also happens in the optimum adsorption of lengkeng seeds at biosorbent 106 µm with adsorption rate of 25,626 mg/g. The ability of the shell and lengkeng seeds to adsorp Pb (II) ions is very good as shown by the amount of adsorptions capacity produced.



a **b**

Figure. 2. Capacity for adsorption of Pb (II) metal ions by Lengkeng Shells (a), Lengkeng Seeds (b)

IV. Conclusion

Particle size is one of the important factors in the biosorption process. The particle size 106 µm has an optimum uptake of lengkeng shell is **30**,095 mg/g and lengkeng seed is 25,626. Shell and lengkeng seeds are very well used to remove Pb (II) ions in the waters with a large adsorption capacity.

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