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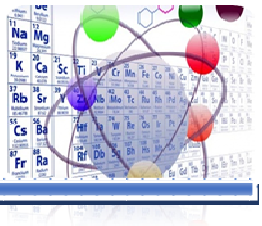

Effect Of Biomass Dosage on Biosorption *Malachite Green* Using Immobilized Langsat Shell (*Lansium Domesticum* Corr))

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ABSTRACT

Malachite green dye waste is one of the wastes that is genotoxic and carcinogenic to humans. Biosorption is an effective process for the removal and recovery of Malachite green dye waste from aqueous solutions. In this study, the biomass used was langsat shell which had been immobilized with sodium silicate. The obtained biosorbents were characterized using Fourier Transform Infra Red (FTIR). In this research, we determine the effect of biomass dosage on biosorption Malachite green using column method. The results showed that the optimum conditions for absorption occurred at biomass dosage 2 gram . The maximum biosorption efficiency of 96,85%

Keywords: consist of 3-5 words or phrases (ex : chemistry, gas chromatography, pure intensity

1. INTRODUCTION

The development of industrial processes in Indonesia, it will cause environmental problems, one of them is pollution from industrial liquid waste. Improper processing industrial liquid waste can have a negative impact on the aquatic environment, especially water resources. One of the most frequently used materials in industrial process is dye, The reasons that cause most industries to use dyes are cheap, easy to obtain and easy to apply.[1]

Malachite green is a cationic dye and is classified as a triphenylmethane dye.*Malachite green* form in dark green crystalline solid dan mostly used as a dye in the silk industry, wool, jute, cotton, paper and acrylic. *Malachite green* is one of the dangerous dyes if present in waters with concentrations exceeding the permitted threshold, ie 0,01 ppm. In mammals *malachite green* can have a negative impact on growth and fertility rates, can cause damage to the kidneys, spleen, liver, heart, lungs and bones.[2,3]

Several conventional methods that have been carried out to overcome pollution from dyestuffs include ion exchange, membrane technology, coagulation and biosorption. In the application of the biosorption method, it does not require high costs, easy to apply and safe for the environment because the biosorbent

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used comes from natural ingredients, so that biosorpy is an alternative in overcoming this problem. Biosorption is a physico-chemical process that can reduce levels and can remove a pollutant substance from water using biological materials. This process involves an adsorbent in the form of a solid phase and a liquid phase (solvent) containing dissolved or suspended substances to be absorbed. Several biosorbents that have been used for the adsorption process of Malachite green include banana peel, cocoa fruit peel, orange peel and langsat fruit peel.[4,5,6]

Langsat shell has the potential to be used as a biosorbent because it contains triterpenoids, flavonoids and saponinsand there is a functional group O-H, C=O, N-H, and COOH. The triterpenoid compounds contained are lansic acid and lansiolate acid which can interact to form ligands with dye solution. In the study of biosorption of Malachite green dye using langsat shell, obtained an absorption capacity of 26,0 mg/g.[7]

To improve the ability of the biosorption process, one of the modifications is immobilization. Modification of the surface of the biomass greatly affects the efficiency of biosorption because the main process of biosorption occurs on the surface of the biomass.[4]

Based on the description above, the researcher wanted to examine the effect of biomass dosage on the absorption of *Malachite green* dye using immobilized langsat shell biosorbent.

2. EXPERIMENTAL

2.1. Chemicals, Equipment and Instrumentation

The materials used in this study were langsat peel, sodium silicate, *Malachite green dyes,* NaOH, H_2SO_4, $BaCl_2$ and HNO_3 p.a. Equipment that is used in this study consisted of glassware, blender, spray bottle, column, pH meter (HI2211), analytical balance (ABS 220-4), filter paper (Whatman number 42), micro sieve (BS410), oven , and a desiccator, FTIR instrument (PerkinElmer Spectrum IR Version 10.6.1) and UV-Vis spectrophotometer T-70.

2.2. Research Procedure

The first step is sample preparation. The langsat shell is cleaned of dirt, cut into small pieces and dried at room temperature. The dried langsat shell was crushed and sieved with a 150 µm sieve..

The second step is immobilization of langsat shell using sodium silicate. Mix 75 mL of 5% H_2SO_4 with sodium silicate solution to pH 2. Add 5 g of langsat shell powder into the mixture and stir for 15 minutes. Then the sodium silicate solution was added slowly until it reached pH 7. The polymer formed was washed with distilled water so that when 2 drops of barium chloride ($BaCl_2$) were added, it did not form a white precipitate. The immobilized langsat shell powder was dried at 60ºC. [8]

The third step, the mobilized langsat skin was characterized using Fourier Transform Infrared Spectroscopy (FTIR).

The fourth step is to determine the effect of biomass weight on the absorption of Malachite green dye. Prepared langsat shell that has been immobilized with various weight variations of biomass (0.1-0.25) grams then put into the column and flowed 15 mL of Malachite green solution with pH and concentration into the column sequentially. The obtained filtrate concentration was measured using spectronics.

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3. RESULTS AND DISCUSSION

3.1. Langsat shell immobilization process

The process of immobilization of langsat shell with sodium silicate uses the addition of strong acid, it aims to form free silicic acid and siloxane groups. The spectra of immobilized langsat skin and skin can be seen in Figure 1.[9]

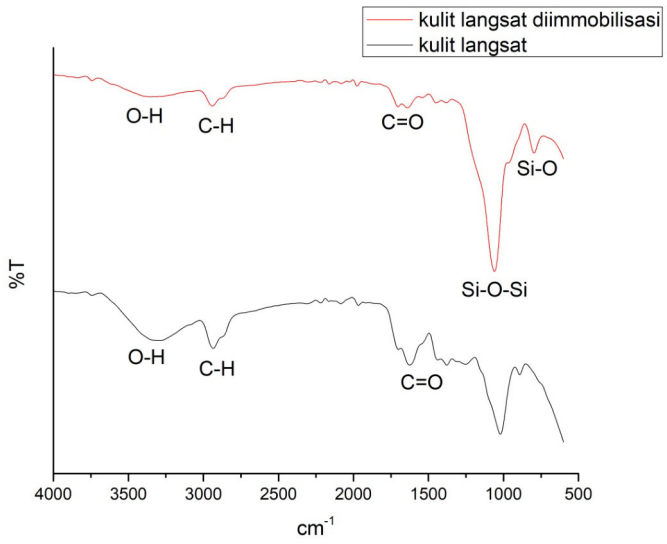

Figure 1. The spectrum of langsat shell before and after immobilization

Spectra analysis of langsat shell before immobilization showed stretching vibrations of O-H at a wave number of 3287.77 cm-1. at the wave number 2934.01 cm-1 there is a C-H bond. on langsat skin before immobilization also showed the presence of C=O bonds at a wave number of 1625.62 cm-1 . IR spectra analysis showed that before immobilization, there was no silanol functional group (S-OH).

The result of spectral analysis on immobilized langsat skin showed that in the O-H group there was a shift in wave number to 3335.50 cm-1 . In the C-H group, the wave number shift becomes 2939.67 cm-1. In the C=O group there is also a shift in the wave number to 1639.84 cm-1. the presence of a new group was indicated by the absorption in the wave number area of 1060.35 cm-1 which was identified as a Si-O-Si group and in the area of wave number 795.90 cm-1 which was identified as a Si-O group, where the identified active group was which is expected to interact with Malachite green dye during the biosorption process.

3.2. Effect of biomass dosage

Seen in Figure 2, in biosorption the dose of biomass can affect the value of the absorption capacity. The highest absorption capacity was obtained with an absorption capacity value of 63.53 mg/g at a quantity of 2.5 grams of biomass. The absorption capacity decreases as the quantity of biomass increases. Reduction of absorption capacity with increasing quantity of biosorbent will cause unsaturation of a number of active sites

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in biosorbent. The decrease in adsorption capacity could also be attributed to the particle aggregation resulting from the increase in the biosorbent dose.

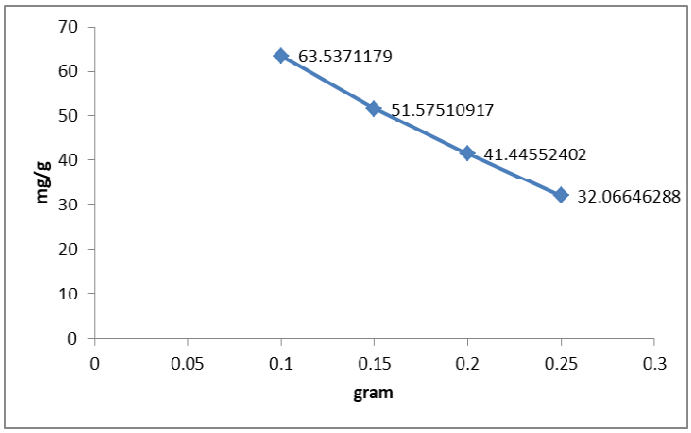

Figure 2. The Effect of biomass dosage on adsorption capacity

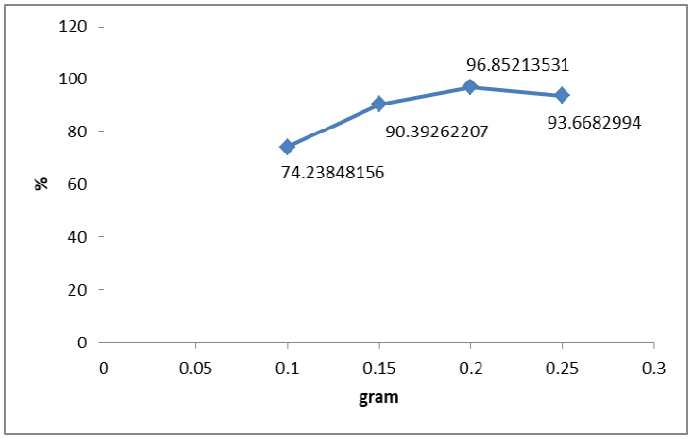

Figure 3. The Effect of biomass dosage on adsorption efficiency

In Figure 3, it can be seen that there is an increase in the biosorption efficiency of Malachite green dye with the highest efficiency value of 96.85% at a quantity of 2 grams of biomass, this is because at a low quantity of biomass, the available absorption sites are not sufficient to be inhabited by biosorbate and while the quantity of biosorbent is low. At high concentrations, there are sufficient absorption sites for the biosorbate to be occupied. An increase in the percentage of malachite green absorbed was associated with an increase in the number of accessible active sites and an increased surface area. However, the efficiency value decreased at 2.5 grams of biomass, this may be due to a decrease in the total biosorption surface area available for Malachite green dye due to overlapping or aggregation of adsorption sites.[10,11]

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4. CONCLUSION

In this study, langsat shell immobilized using sodium silicate contained a Si-O group. Biosorption of Malachite green dye using immobilized langsat shell, obtained the optimum condition on the dosage of the biomass 0,2 gram.

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REFERENCES

1. Haryono, Faizal D. M., Liamita N. C., Rostika A. (**2018**). Pengolahan Limbah Zat Warna Tekstil Terdispersi dengan Metode Elektroflotasi. *EduChemia (Jurnal Kim dan Pendidikan)*, 3(1):94.
2. Ismadji S., Suwandi A.C., Indraswati N., Ismadji S. (**2011**). Modifikasi kaolin dengan menggunakan surfaktan alami dari buah lerak untuk menghilangkan zat warna malachite green. *Pros Semin Nas Fundam dan Apl Tek Kim*. Published online 2011.
3. Srivastava S., Sinha R., Roy D. (**2004**). Toxicological effects of malachite green. *Aquat Toxicol*. 66:319-329.
4. Fomina M., Gadd G.M. (2014). Biosorption: Current perspectives on concept, definition and application. *Bioresour Technol*,160:3-14.
5. Silvia R., Nasra E., Oktavia B., Etika S.B. (**2020**). Optimasi Penyerapan Zat Warna Malachite Green Menggunakan Kulit Pisang Kepok (Musa Balbisiana Colla) Sebagai Biosorben. *Chem J Univ negeri padang*, 9(2):1-66.
6. Zhul-quarnain A, Kingsley Ogemdi I., Modupe I., Gold E., Emmanuel Chidubem E. Ekpunobi Emmanuel C. (**2018**). Adsorption of Malachite Green Dye Using Orange Peel. *Abdussalam Zhul-quarnain*, 2(2):31-
7. Putri A.H. (**2021**). Biosorption of Mal Malachite Green Dye Using Langsat Peel (Lansium domesticum) Biosorbent. , 4(2):1155-1158.
8. Gardea-Torresdey J.L., Tiemann K.J., Gonzalez J.H., Cano-Aguilera I., Henning J.A., Townsend M.S. (**1995**). Ability of Medicago Sativa (Alfalfa) To Remove Nickel Ions From Aqueous Solution. *Proc 10th Annu Conf Hazard Waste Res*. Published online, 239-248.
9. Anggrenistia F., Wahyuni N., Zaharah T. (**2015**). Adsorpsi Ion Logam Zn (II) Menggunakan Biomassa Chlorella Sp . *Jkk*., 4(3):94-99.
10. Nethaji S., Sivasamy A., Thennarasu G., Saravanan S.. (**2010**). Adsorption of Malachite Green dye onto activated carbon derived from Borassus aethiopum flower biomass. *J Hazard Mater*, 181(1-3):271-280.
11. Sudarni D.H.A, Aigbe U.O., and Ukhurebor K.E. (**2021**). Malachite Green Removal by Activated Potassium Hydroxide Clove Leaf Agrowaste Biosorbent: Characterization, Kinetic, Isotherm, and Thermodynamic Studies. *Adsorpt Sci Technol*. 2021.

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