RESEARCHARTICLE OPENACCESS

ADSORPTION OF RHODAMIN B DYES USING ACTIVE CARBON OF LONGAN SHELL (Euphoria longan Lour) WITH BATCH METHOD

Silfia Yonika, Desy Kurniawati*, Miftahul Khair, Alizar
Department of Chemistry, Faculty of Mathematics and Natural Sciences, Universitas Negeri Padang Jl. Prof. Hamka,AirTawar, Padang,West Sumatera,Indonesia, 25131
*Email:silfia142@gmail.com,
desy.chem@gmail.com*
desykurniawati@fmipa.unp.ac.id*

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Abstract:

Rhodamine B dyes that enter excessively into the environment can change the pH of the waters so that they interfere with aquatic animals, plants and microorganisms. To humans this dye can cause poisoning, damage to the kidneys, impaired liver function to cancer. The adsorption method is one of the most efficient and effective ways to learn about dye removal. Longan shell can be processed into activated carbon and used as an adsorbent. Activated carbon from longan fruit peel was activated with 0.1 M NaOH and characterized using FTIR. . This study aims to determine the effect of stirring speed with variations (50, 100, 150, 200, 250) rpm and contact time with variations (30, 60, 90, 120, 150) minutes on the adsorption of Rhodamine B dye by activated carbon from the Longan shell. The optimum stirring speed occurs at a speed of 200 rpm with an absorption capacity is 5.4447 mg/g and the maximum capacity occurs at the variation of the contact time to 150 minutes is 6.9825 mg/g.

Keywords—**Activated Carbon, longan shell, Rhodamin B, adsorbtion**

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I. INTRODUCTION

Along with the times, the use of dyes in various industries that require coloring in their products also continues to increase. Its use is quite a lot in industry due to its low price and also a basic dye. So that the amount of liquid waste dye is quite a lot. Its complex nature causes this substance to be difficult to degrade after contact with water. Synthetic dyes are designed to be strong against chemical, biological and light reactions. So that the dye waste in high concentrations is difficult to remove. Rhodamine B that enters excessively into the environment can change the pH of the waters so that it interferes with aquatic animals, plants and microorganisms.The azo content in Rhodamine B dyes causes poisoning, kidney damage, impaired liver function and cancer. Therefore, the presence of these dyes in liquid waste needs to be minimized [1].

Many methods have been used to treat water pollution caused by synthetic dyes, some of which are adsorption, membrane filtration, electrochemical methods, precipitation, coagulation techniques, advanced oxidation, membrane filtration, advanced oxidation and ion exchange [2]. The reduction of dyestuffs such as coagulation methods, ion exchange and ozonation requires relatively high costs. Subramani and Byrappa have successfully used photocatalytic ZnO and TiO2 to lower *Rhodamine B* levels . However, this process is considered to be less effective to be applied to the home industry due to its relatively high cost [3] .

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The adsorption method is one of the most efficient and effective ways to learn about dye removal. This method can remove dyes well, does not form sludge, besides that the adsorbent can also be reused after the adsorbent is regenerated. One of the adsorbents that is widely used in the processing of dye wastewater is activated carbon [4] . Some of the biomass that can be processed into activated carbon and used as an adsorbent include durian skin [5] , peanut shells [6] , gumitir stems [7] , corn cobs [8] , candlenut shells [9] , cassava peel waste [10] , white sugar [11] longan fruit seeds and mangosteen rind [2] . This activated carbon is relatively cheaper, more effective, more selective and the approach is also more competitive [1] .

Longan skin is one of the agricultural wastes that is still rarely used. However, there have been studies on the biosorption of Cu and Pb metal ions using the skin and seeds of longan fruit containing functional groups with excellent adsorption capabilities of heavy metal ions in aqueous solution [12] [13] . Meanwhile, research on the absorption of green malachite, red congo and Rhodamine B dyes has been carried out in the absorption of substances [14] .

In addition to the use of functional groups in the longan rind that can interact directly with the adsorbate, the use of longan rind biomass to produce porous carbon offers a comprehensive and high-value solution for utilization. Hong et al, have conducted research on the utilization of activated carbon from longan seeds activated using KOH at high temperatures in the absorption of Rhodamine B and Pb (II) ions with maximum monolayer adsorption capabilities of 1265.82 and 117.65 mg/g adsorbent [2].

From the description above, the authors are interested in making activated carbon from longan fruit peel activated with 0.1 M NaOH as research material in the adsorption of *Rhodamine B* dye by *batch* method .This study aims to determine the effect of stirring speed and contact time on the adsorption of Rhodamine B dye by activated carbon from longan skin. In this study, artificial liquid waste was used by preparing a solution of Rhodamine B dye with a certain concentration so that research on the ability and condition of absorption of *Rhodamine B* dye by activated carbon of longan fruit peel can be carried out measurably.

II. MATERIALS AND METHODS

A. Tools

In addition to glassware which is generally used in laboratories, other tools used are magnetic stirrer (Cole-Palmer brand), porcelain cup, sieve (BS410) mortar, pestle, analytical balance (Shimadzu AW220), pH meter, shaker (model : VRN-480), spray flask made of plastic, filter paper, UV-Vis spectrophotometer, furnace (Muffle Furnace type 6000) and also aluminum foil.

B. Materials

The materials used in this study were longan rind biomass waste, distilled water, sodium hydroxide (NaOH), HNO_3 , Rhodamine B dye.

C. Preparation of Activated Carbon from Longan Skin

The longan skin is cleaned of dirt and then dried until a constant mass is obtained. After that, the longan skin sample was carbonized using a furnace at 400ºC for 60 minutes [15] . The charcoal obtained was ground and then sieved using a 350 mesh sieve. A total of 20 grams of longan rind charcoal was activated using 0.1 M NaOH [15] in a ratio of 1:5 (carbon:activating agent). The mixture was filtered and washed repeatedly to obtain a filtrate with a neutral pH (pH 7) after the mixture was stirred and left for 2 hours. The filtrate in the mixture was discarded [16] . Then the activated carbon is air-dried until a constant mass of activated carbon is obtained. Then proceed with the FTIR analysis stage on activated carbon.

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D. Characterization

IR measurements were carried out on an infrared Thermo Nicolet 5700 Fourier-transform (FTIR) spectrophotometer.

E. Adsorption Experiment

Each solution of Rhodamine B dye with a concentration of 230 ppm and pH 2 was prepared as much as 25 mL. Then the solution was contacted with 0.25 grams of activated carbon longan skin using a batch system. This mixture was *shaken* for 30 minutes at a speed of (50, 100, 150, 200, 250) rpm and for variations in the speed of stirring in a *shaker* for (30, 60, 90, 120, 150) minutes with the optimum stirring speed. Then the solution is filtered and the filtrate is collected. The concentration of the filtrate was measured using a UV-VIS spectrophotometer so that the level of Rhodamine B that was not absorbed in the adsorption process could be measured, the optimum stirring speed and maximum absorption capacity were obtained from the effect of contact time.

II. RESULTS AND DISCUSSION

Characterization

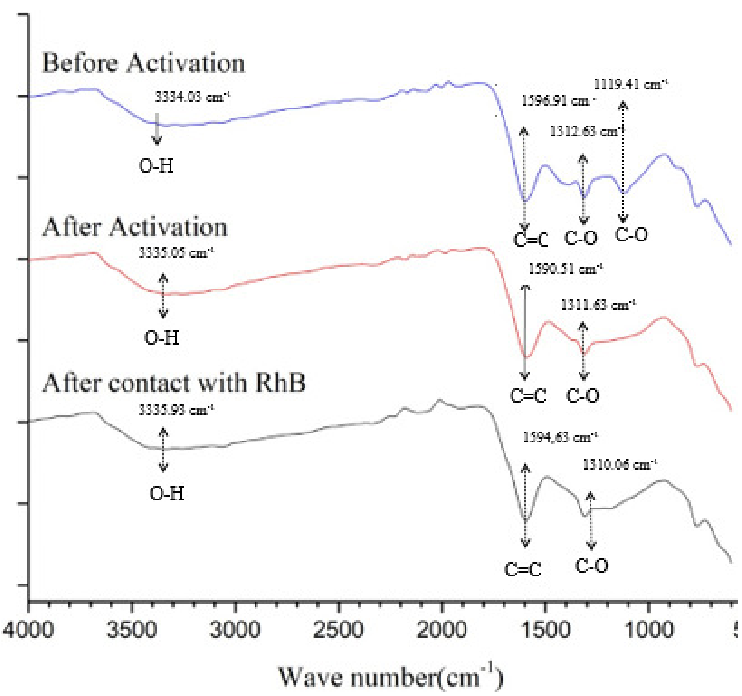

Figure 1. FT-IR spectra of long skin activated carbon

The FTIR spectrum has been used to detect the functional groups of the longan peel activated carbon as shown in Figure 1. At the wave number 3000-3500 cm -1 there is a stretching OH functional group. At wave numbers 1500-1650 cm -1 there is an aromatic C=C functional group. And at wave number 1300-900 cm -1 there is a functional group of CO stretching. The peakshift indicates the interaction between Rhodamine B dye ions and the adsorbent surface[19].

Effect of Stirring Speed

In the adsorption process, the stirring speed can affect the value of the adsorption capacity. The faster the stirring, the greater the value of the absorption capacity. The effect can be seen in the picture.

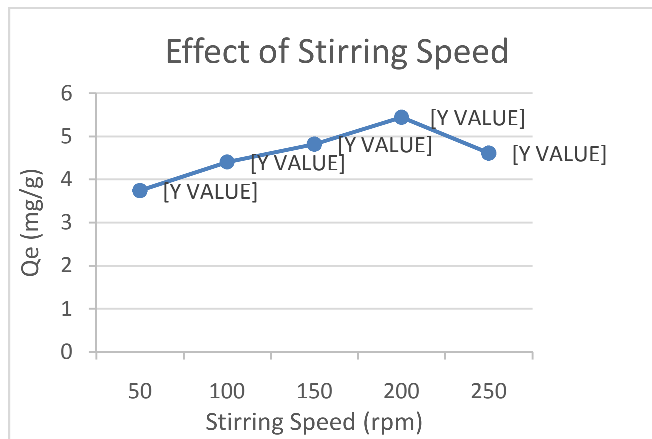

Figure 2. Effect of Stirring Speed

Based on the graph in the figure, it can be seen that the optimal conditions in the Rhodamine B dye adsorption process occurred at a stirring speed of 200 rpm. The absorption capacity obtained was 5.4447 mg/g with the percentage of absorption of 25.86%. The absorption capacity from a speed of 50 to 200 rpm continued to increase and decreased absorption at a speed of 250 rpm to 4.6134 mg/g. This was due to the presence of stirring which meant that the particles in the solution were in contact with the activated carbon particles. Stirring this provides the opportunity for active carbon to intersect with partike l uptake [8] . This decrease in absorption

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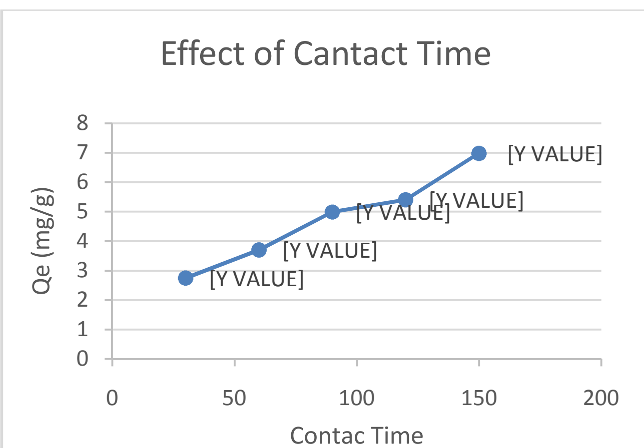
capacity can be caused by the stirring speed that is too fast so that it interferes with the adsorption process and causes absorption that occurs not optimally [17] .

Effect of Contact Time

The interaction time between the adsorbent and the adsorbate also affects the absorption capacity of Rhodamine B dye. The longer the contact time between the adsorbent and the adsorbate, the higher the transfer or absorption of the adsorbate by the adsorbent [18] . The effect of the contact time of activated carbon from longan skin on the adsorption of Rhodamine B dye was measured by varying the adsorption time, namely 30,60,90,120 and 150 minutes. Rhodamine B dye solution was used with a concentration of 230 ppm and then the acidity was adjusted to pH 2 with the optimum stirring speed of 200 rpm.

The effect of Rhodamine B contact time on the absorption of Rhodamine B dye by activated carbon of longan skin can be seen in the figure.



In the graph it can be seen that the longer the interaction time between activated carbon and Rhodamine B dye, the more active side of the adsorbent binds to the adsorbate molecule, so that the absorption increases as the contact time between activated carbon and Rhodamine B dye increases. maximum absorption capacity is 6.9825 mg/g with absorption percentage 31.2036 %. The saturated adsorbent binds to the dye ion will cause no increase in the resulting absorption capacity or is relatively constant.

VI. CONCLUSION

The maximum adsorption capacity of Rhodamine B dye with a solution concentration of 230 mg/L, stirring speed of 200 rpm and contact time of 150 minutes was 6.9825 mg/g with an absorption percentage of 31.2036 %.

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