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Removal efficiency assessment of absorbent based on banana peel for methylene blue

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Abstract
The objective of this research is to analyze the efficiency of banana peel based activated carbon as an adsorbent for leaching out methylene blue. Fresh banana peels was been dried and grinded into powder, both activated and inactivated. Dehydration, carbonization at 350 ℃ for 1 hour, and chemical activation with different concentrations of H_2SO_4 solution at 85 ℃ for 1 hour has been used to make activated carbon. The iodine number test has used to characterize activated carbon. The adsorption tests were carried out under various PH, adsorbent dosage, and contact time conditions. When the dosage of the adsorbent was raised from 1 grams to 8 grams, the percentage removal in activated adsorbent rose from 45 percent to 90 percent, and in inactivated adsorbent it increased from 30 percent to 84 percent. The greatest percentage removal was reached at 60 minutes when the contact duration was prolonged from 20 minutes to 60 minutes, with 94 percent adsorption in the case of activated adsorbent and 80 percent adsorption in the case of inactivated adsorbent.

Keywords: methylene blue, activated banana peel powder, inactivated banana peel powder, adsorption

Introduction
The removal of dyes from wastewater has become a major problem in recent years. Coagulation, flocculation, membrane separation, ion-exchange, oxidation, and biomass are some of the most widely utilized dye removal techniques, although they are all costly [Ibrahim and Sani 2014] [1]. Because of its simple, adaptable design and ease of use, adsorption is an effective and cost-effective colour removal method [Zendehel *et al*., 2010] [2]. Methylene Blue was the dye employed in this experiment (MB). Although MB is used in various medical treatments and textile dyeing, it can cause eye damage, nausea, vomiting, excessive perspiration, diarrhoea, gastritis, mental disorientation, and other side effects. As a result, removing MB from industrial effluents has become one of the most pressing environmental issues.

One recent study used ZnCl2 as an activating agent to make activated carbons from banana peel waste for adsorbed natural gas applications [Nasurddin *et al*., 2017] [3]. This study's generation of activated carbons from banana peel waste is based on that research. However, the method of application and the chemical activation agent differ. In this work, activated carbons are used to absorb adsorbed methylene blue from waste water.

Sulphuric acid was used as the chemical activation agent in this investigation (H_2SO_4). It is well known that H_2SO_4 is preferred over $ZnCl_2$ as an activating agent due to concerns about environmental contamination with zinc (Zn) compounds [Guo *et al*, 2005] [4]. By decomposing the amorphous domains of cellulosic materials and aromatizing the carbon framework, H_2SO_4 as a chemical activating agent can generate porous structure [Yuliusman *et al*, 2006] [5].

2. Material and Methods
The peel of a ripe banana was utilized as the raw material for making activated carbon. H_2SO_4 solution at concentrations was employed as a chemical activating agent in the chemical activation process. At one of the treatment variations of the sample during the carbonization process, The activated carbon was rinsed with distilled water until the pH was in the neutral zone.

2.1 Dehydration of banana peels
Before the dehydration process, banana peels garbage was cleansed and sorted from any other rubbish that could have been mixed up with them when they were collected.

The cleaned banana peels were then dried in a 105 ºC oven until they were completely dry. The goal of this step is to decrease the quantity of water in the banana skin. After drying the banana peels, they were crushed using a mortar and pestle to decrease the size of the dried banana peels.

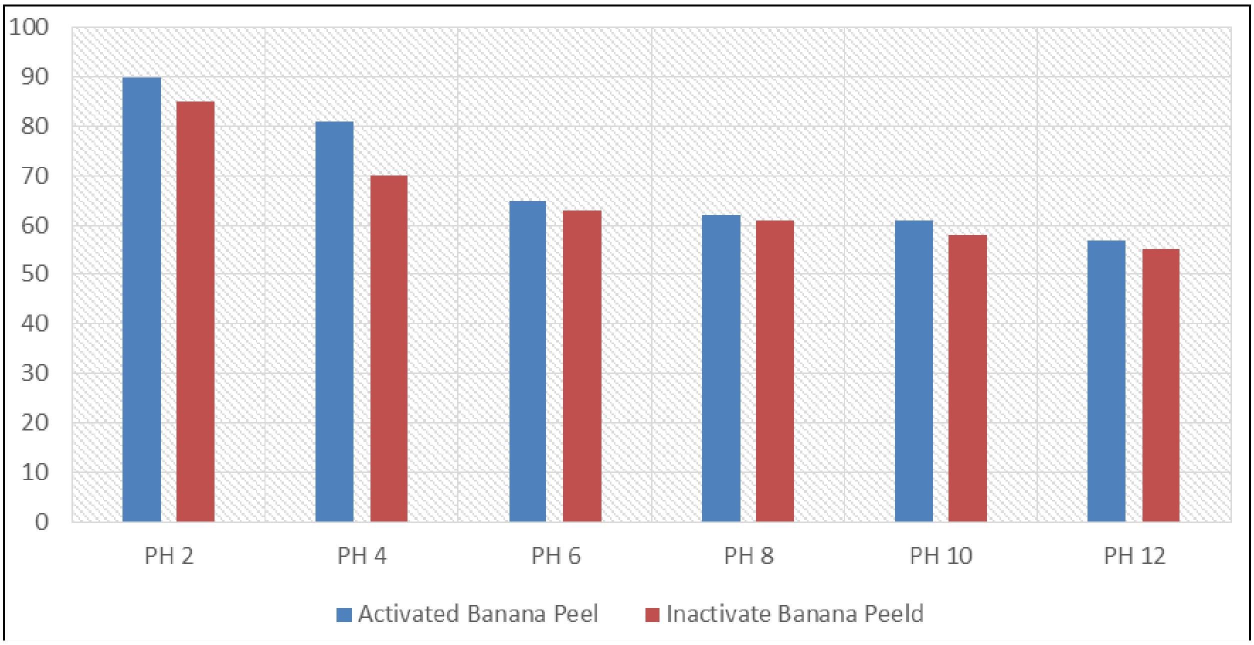
2.2 Carbonization of dried banana peels
The dried banana peels that had been reduced in size were split into two halves. One was intended to be used as reserved and the other half was carbonized in a furnace for 1 hour at 350 ºC. In the absence of a nitrogen gas stream, the carbonization process generates carbon that has not yet been activated. After carbonization, the carbons were crushed again using laboratory grinder, then sieved with a 30-mesh sieve to ensure that the carbons generated were consistent in size.

2.3 Chemical activation of carbon
Because carbonization was carried in normal muffle furnace which do not has provision for maintaining an inert nitrogen environment activation of carbonized product was required. Carbon after grinding and sieving were divided into four components. Each component was submerged in a varied concentration of H_2SO_4 solution. At all concentrations tested, the volume of H_2SO_4 solution to the carbon mass utilized was 3 mL of H_2SO_4 solution for each 1 g carbon mass used. The carbon and H_2SO_4 solution were then heated for 1 hour at 85 °C. The carbon is physically activated as adsorbent once it has been chemically activated.

3. Results and Discussion
3.1 Dehydration of banana peels
The banana peels are dehydrated in the oven for 24 hours. Before and after dehydration, the condition of banana peels varies. Banana peels were yellow-colored, mushy, and not particularly light before they were dehydrated. Banana peels, on the other hand, were black, hard, and lighter after being dehydrated. This occurred due to a decrease in the water content of banana peels. The mushy state of banana peels indicates that the peels still have a high water content, but the water content has been removed, causing the peels to become harder and lighter. The high temperature of the oven causes the water in the banana peels to evaporate into the air and fall away from the banana peels.

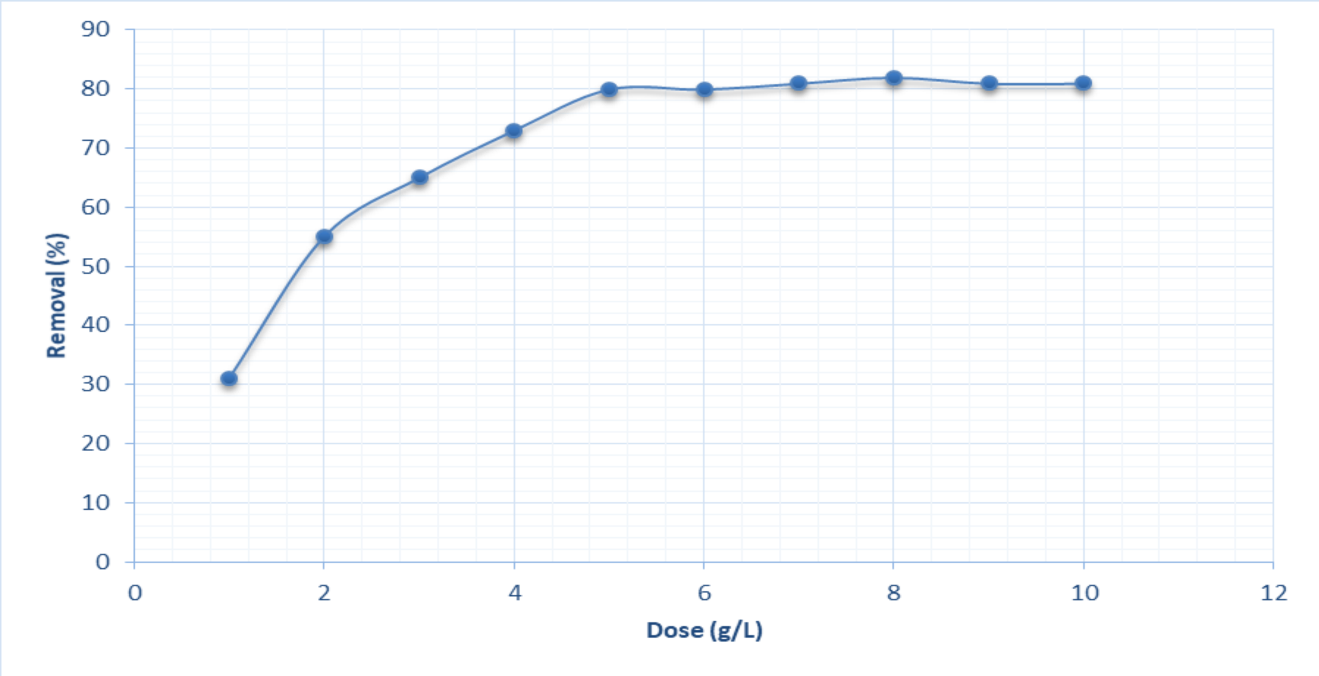
3.2 Carbonization of dried banana peels
The carbon final mass generated by the carbonization process, at 350 ºC at the retention time of 1 hr. showed an average carbon yield of 47.39 percent. This yield of 47.39% remained constant upon increasing carbonization temperature and time. In the meanwhile, the average mass of carbonization product at 200 ºC for 1 hr. was 66.20 percent. This show that carbonization should be done at least at 350 ºC for 1 hr.

3.3 Effect of pH
With increasing PH, the percentage adsorption falls from 87 percent to 65 percent (in the inactivated condition) and from 90 percent to 71 percent (in activated state). This is explained by the fact that dye ions enter the pores of the adsorbent readily at first, but when the PH rises, the zwitter ion prevents the dye from entering the pores of the adsorbent [Ramuthai *et al*., 2006] [6].



Effect of PH on Percent Removal OF MB

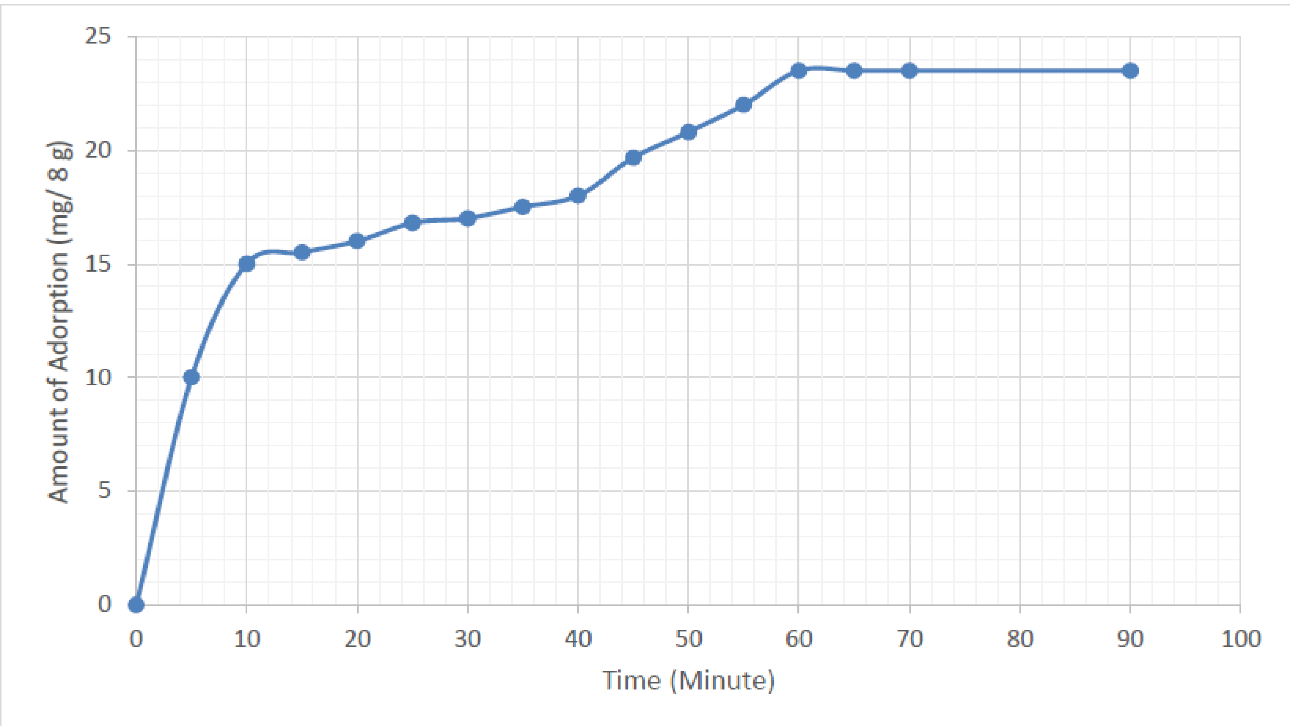
3.4 Effect of adsorbent dose
In both cases, we found that dye adsorption increased with increasing adsorbent dosage. Doses in the range of 1–10 g/L were used in adsorption experiments with an MB concentration of 300 mg/L to investigate the effect of adsorbent amount. The adsorption capacities at a dose of 1 g/L indicate that extremely low adsorption capacities would be observed at doses below 1 g/L. Thus, doses below 1 g/L were not investigated. This phenomena may be explained by the fact that as the quantity of adsorbent rises, a larger number of sorption sites become accessible for adsorption, and therefore the percentage of dye removed increases as the adsorbent dose increases the result shows that maximum removal is obtained at an adsorbent feed of 8 gm/liters. [Salleh *et al*, 2011] [7].



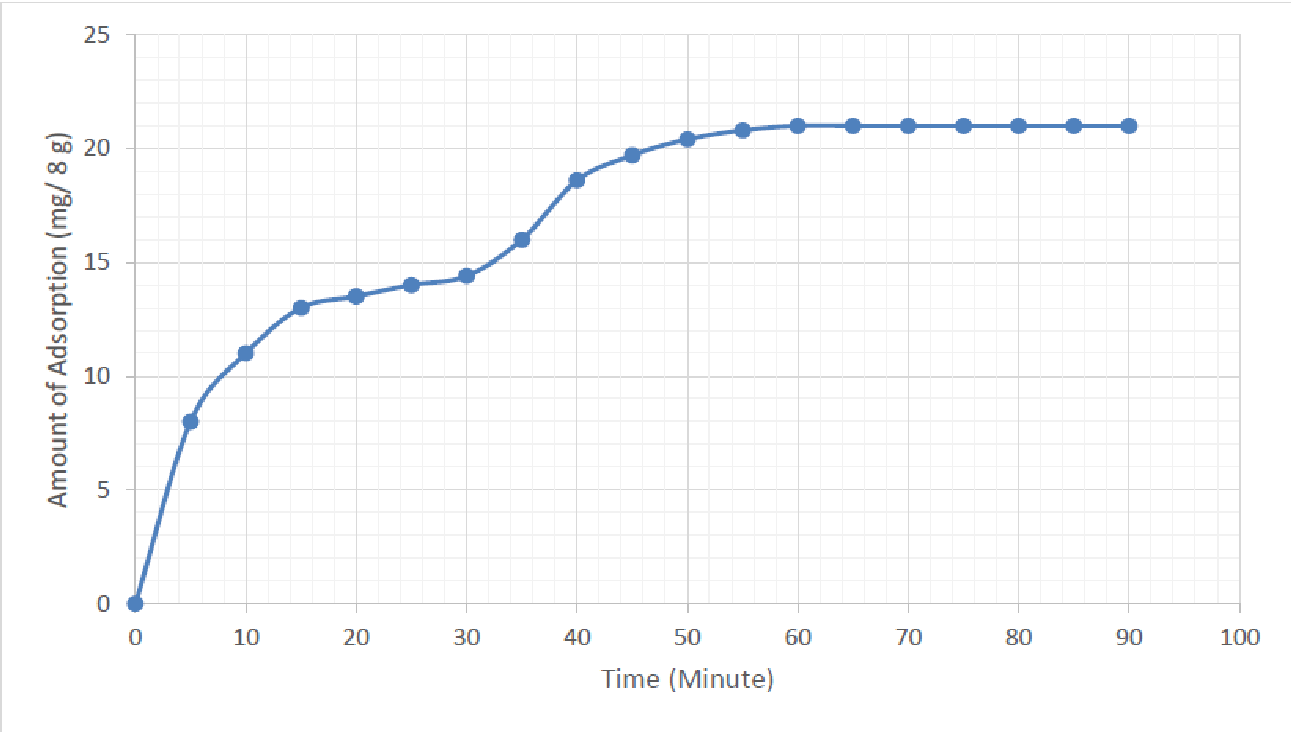
Effect of adsorbent dose

3.5 Effect of contact time

In all cases, an initially high rate of adsorption occurred because the MB concentration provided the driving force for the rapid attachment of MB onto the adsorbent surface. As adsorption proceeded, the ratio of MB molecules to available adsorption sites decreased, which resulted in a decrease in the adsorption rate until equilibrium was reached. This behavior can be seen in, for all adsorbents, and an increase in the initial concentration of MB also resulted in higher initial rates of adsorption. An increase in the initial concentration of MB corresponded to an increase in the ratio of MB molecules to available adsorption sites. This may have subsequently increased the initial driving force for the adsorption of MB by the adsorbent and led to a higher initial rate of adsorption. also shows that, in all cases, the time to equilibrium was completely reached within 60 min [Rahman *et al*., 2013] [8]



Adsorption of methylene blue with time on activated banana feed (25 mg/500 ml solution, 8 g Adsobent)



Adsorption of methylene blue with time on inactivated banana feed (25 mg/500 ml solution, 8 g Adsobent)

4. Conclusion

Our findings show that banana peel is an excellent low-cost adsorbent for removing methylene blue in both inactivated and activated forms. It is best to operate the carbonization at 350 °C for 1 hr. The carbonized adsorbent should be first activated with H_2SO_4 at 85 °C for 1 hr. However chemical activation would not be required if carbonization is done in nitrogen environment.

The removal efficiency of methylene blue was observed to decrease with increasing PH value of the stream. The removal of MB increased with adsorbent dosing with maximum at 8g/L for both activated and inactivated adsorbent. The max. attainable removal of MB was achieved within 60 minutes of contact time for both activated and inactivated adsorbent.

The comparison to other existing bio adsorbents, the adsorption capacity of inactivated banana peels is not particularly high, but activated banana peels are competitive in terms of availability as a waste bio product.

5. References

1. Ibrahim M.B and Sani S. Open Journal of Physical Chemistry 2014;4:139-146.
2. Zendehel M, Barati A, Alikhani H, Hekmat A. Iran journal of Environment Health sciences Engineering, 2010;7(5):423-428.
3. Nasruddin A, Wijanarko G, Ramadhan MA, Budiyanto Sahat O. PGSRET Conf. IEEE Xplore 2017;17:9-15.
4. Guo J, Xu WS, Chen YL, Lua AC. J Colloid Interface Sci 2005;281:285-290.
5. Yuliusman, Nasruddin, Afdhol MK, Haris F, Amiliana RA, Hanafi A *et al*. Advance Science Letter, 2006.
6. Ramuthai S, Nandhakumar V, Thiruchelvi M, Arivoli S, Vijaykumaran V. Electronic Journal of Chemicals 2006;6(S1):S363-S373.
7. Salleh MAM Desalination 2011;280(1):1-13.
8. Rahman FBA, Akter M, Abedin MZ. International Journal of Science and Technology Research 2013;2:47-50.