



EXPLORING THE USE OF BEAN HUSK AN AGRICULTURAL WASTE FOR THE REMOVAL OF DYE MOLECULES FROM AQUEOUS SOLUTIONS

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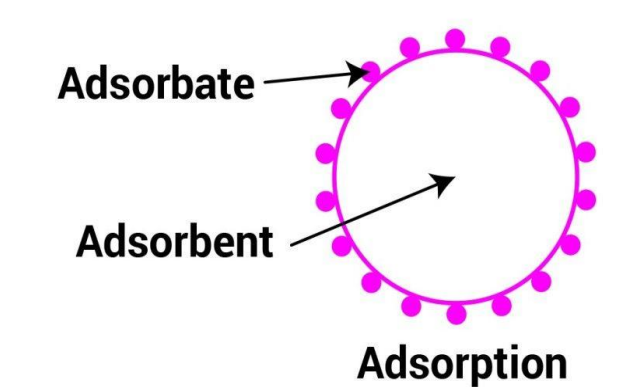
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INTRODUCTION

- The environment serves as natural habitats for all living organisms and foundation for human exploitations in the development of a society.
- Pollution of the environment, particularly the water resources caused by the disposal of untreated industrial effluents has been a growing concern all over the world for decades.
- Dyes are one of the most hazardous chemical compound classes found in industrial effluents and need to be treated due to their toxic effect when exposed to living organisms [1].



AIM: This research aims at investigating the use of a lost cost, environmental friendly adsorbent towards removal of Methylene blue dye from aqueous solutions using melon husk as an adsorbent.

MATERIALS AND METHODS

- The bean husks were obtained in large quantities from a local market in and were washed thoroughly with distilled water and dried. The scales were grounded into a fine powdery form and kept at 4°C until further use.
- A stock solution of 1000 mg/L of MB was prepared and desired concentrations were obtained by appropriate dilution of the stock solution. 0.1 M of HCl and NaOH were prepared to adjust the pH of the dye solution.
- Equipments such as orbital shaker and UV-Visible spectrophotometer were also used in the analysis.
- Batch adsorption experiments which involves initial pH, adsorbent dose, adsorbate concentration, contact time and temperature variation were carried out

RESULTS AND DISCUSSION

1. ADSORBENT CHARACTERISATION

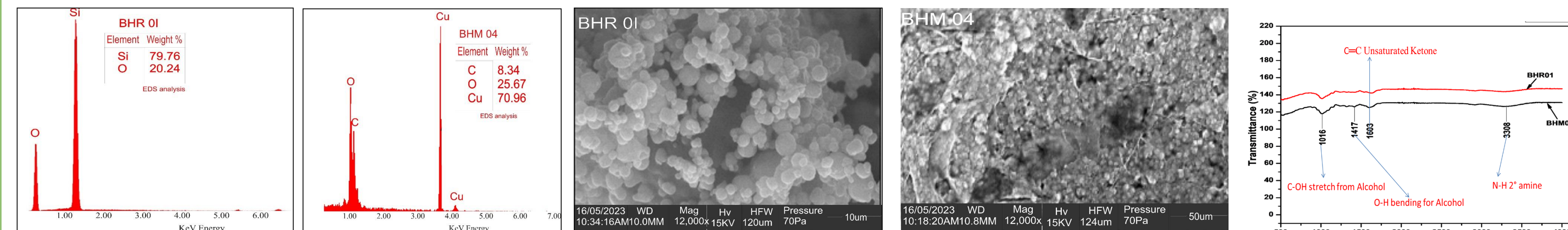


Fig 1 a image of raw beans husk before adsorption EDX analysis

Fig 1 b image of raw beans husk after adsorption EDX analysis

Fig.1 c image of raw beans husk before adsorption x 12,000 zoom

Fig.1 d image of raw beans husk after adsorption x 12,000 zoom

Fig.1e FTIR RESULT

2. OPTIMIZATION STUDY

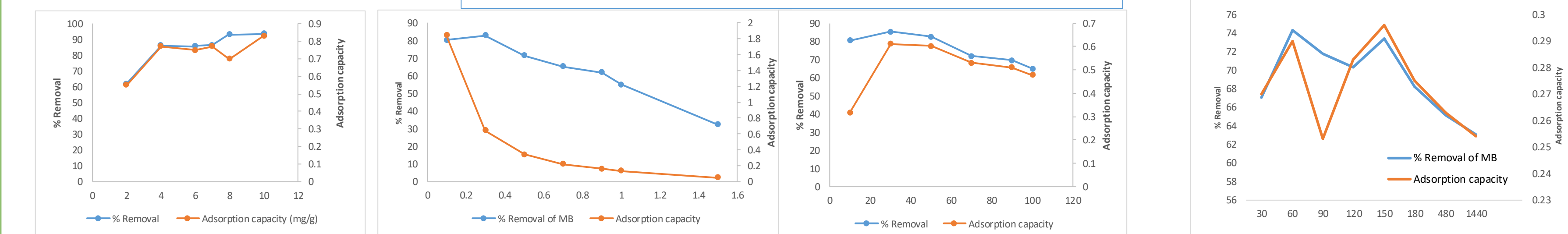


Fig. (2a): Effect of initial pH

Fig. (2b): Effect of adsorbent dose

Fig. (2c): Effect of adsorbate concentration

Fig. (2d): Effect of contact time

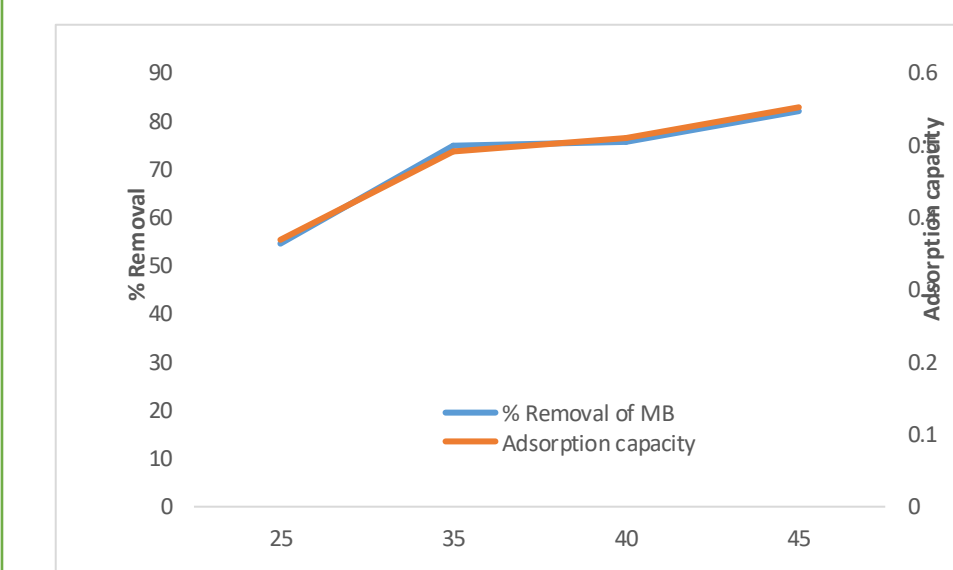


Fig. (2e): Effect of temperature

3. ISOTHERM STUDY

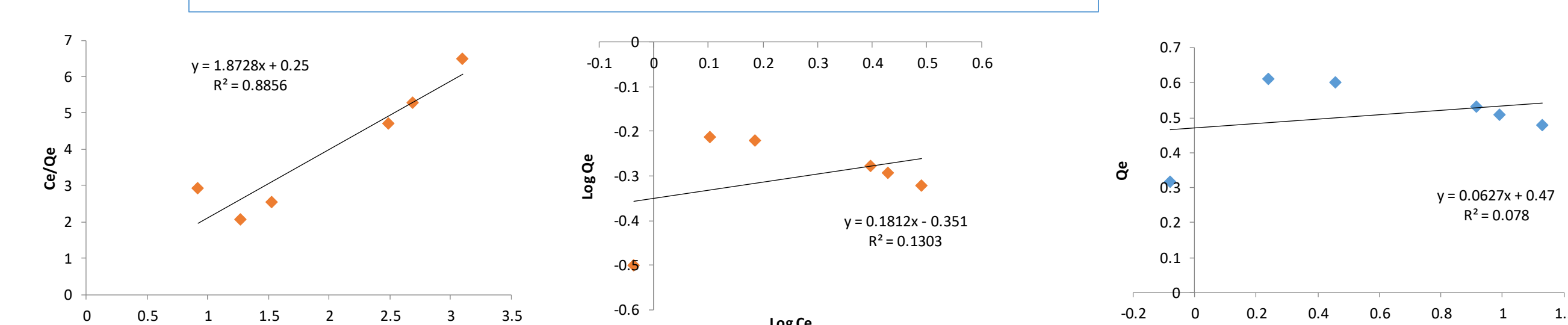


Fig 3a:Langmuir isotherm model

Fig 3b:Freundlich isotherm model

Fig 3c: Temkin Isotherm Model

The graphs above shows the % removal and dye adsorption efficiency of the batch experiments, **Fig. (2a)** shows a range of 61.96 to 93.8% and 0.55 to 0.83 mg/g repectively with an optimal pH 10. In **Fig. (2b)** the optimum dye removal was 82.95% attained for adsorbent dose of 0.3 g and adsorption capacity at 0.64 mg/g, as there is an observed decrease beyond 0.3g. The **Fig. (2c)** shows the adsorbent concentration had an optimal concentration of 30 mg/L with 85.26% and 0.612 mg/g as the % removal and adsorption capacity respectively. In **Fig. (2d)** the % removal and adsorption efficiency increased and decreased as the contact time increases, they both were in a range of 58.09 to 74.28% and 0.238 to 0.290 mg/g respectively with 120 min as the optimum time. As seen in **Fig. (2e)** the temperature was ideal at 45°C with dye percentage removal at 81.75% and adsorption capacity at 0.551 mg/g.

4. KINETIC AND THERMODYNAMIC STUDY

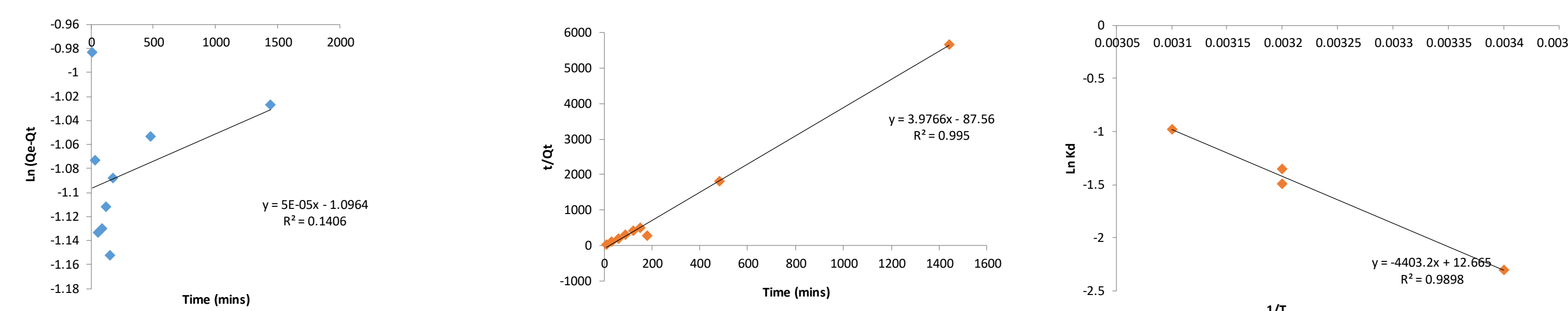


Fig (4a): Pseudo-first order plot for adsorption of MB onto Bean Husk

Fig (4b): Pseudo-second order plot for adsorption of MB onto Bean Husk.

Fig (4c): Adsorption thermodynamics (Van Hoff's plot)

TABLE 1: ADSORPTION THERMODYNAMICS (VANT HOFF'S PLOT)

Temperature (K)	ΔG (KJ/ mol)	ΔH (KJ/mol)	ΔS (J/mol/K)
298	5778.12		
308	3875.98	37039.72	106.538
313	3575.55		
318	2629.54		

CONCLUSION

The adsorbent was characterized using the Fourier Transformed Infra-Red Spectrophotometer, it revealed alcohol, amine and ketone to be some of the functional groups present. The batch experiments shows that the removal of methylene blue from aqueous solution using Bean husk was highly efficient. The experimental data showed a good fit with Langmuir isotherm model, pseudo-second order model and the thermodynamic parameters indicated that the adsorption was favorable, endothermic and spontaneous. As a result, Bean husk may be used as a low-cost, effective, and eco-friendly adsorbent for the removal of Methylene dye from effluents.

REFERENCES

- [1] Edris, B., Ferdos, K. M. and Mohammad, A. Z. (2012). Methylene blue (cationic dye) adsorption into Salvadora persica stems ash. African Journal of Biotechnology, 11 (101), 16661-16668.
- [2] Merina, P. D., Renuka, M., Vijaylakshmi, J. V., Suguna, P. R. and Karpuramprasad. (2018). Removal of Methylene Blue by Adsorption Using Fish Scale Chitin. Nature Environment and Pollution Technology, 17 (3), 993-998.