



ASSESSMENT OF BATCH EXPERIMENTS ON THE REMOVAL OF METHYLENE BLUE DYE FROM AQUEOUS SOLUTION USING LOW-COST BIOADSORBENT FISH SCALES

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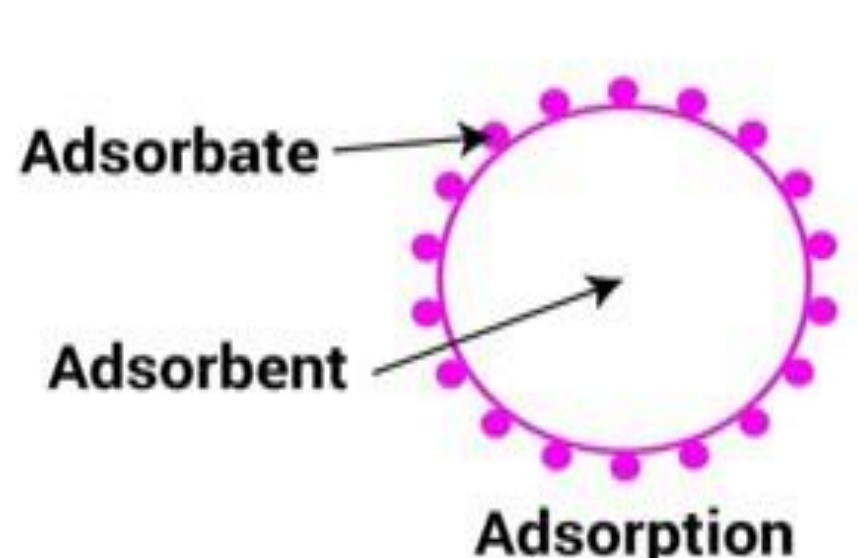
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INTRODUCTION

- 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.
- Fish scales are waste products discarded in abundance from the fish market, fish processing industry etc., this huge waste may cause environmental harzard [1].
- Methylene blue (MB) is a toxic basic blue dye with ($C_{16}H_{18}ClN_3S$) as molecular formula and a molecular weight of 319.85 g/mol [2].
- Adsorption is a surface-based phenomena, where an adsorbate (liquid or gas phase) are attracted to the surface of a solid adsorbent.



AIM AND OBJECTIVES

The aim of this study is to remove methylene blue (MB) dye from aqueous solution by batch adsorption technique using Fish scales as a low-cost biosorbent

The objectives of this study include:

- ✓ Characterize the adsorbent (FS) using the Fourier Transformed Infra-Red spectroscopy (FTIR).
- ✓ Removal of MB using batch adsorption experiments which involves initial pH, adsorbent dosage, adsorbate concentration, contact time and temperature variation.
- ✓ Determine the adsorption isotherms, kinetics and thermodynamic study.

MATERIALS AND METHODS

- The fish scales were obtained in large quantities from a local market and were washed thoroughly with distilled water and dried. The scales were pulverized into a fine powder and kept at 4°C until further use.
- A stock solution of 1000 mg/L of MB were prepared, and desired concentrations were obtained by appropriate dilution of the stock solution. 0.1 M of HCl and 0.1 M 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.
- Experimental parameters; initial pH, adsorbent dose, adsorbate concentration, contact time and temperature variation were carried out using Batch adsorption processes.

RESULTS AND DISCUSSION

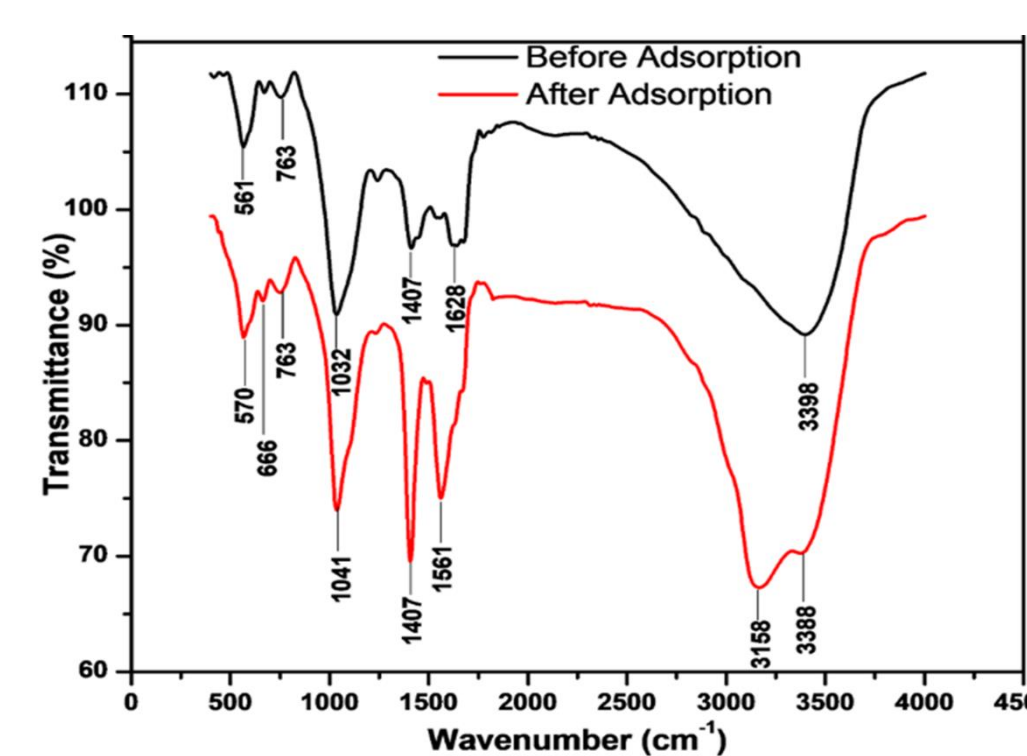


Fig. (a): FTIR of FS

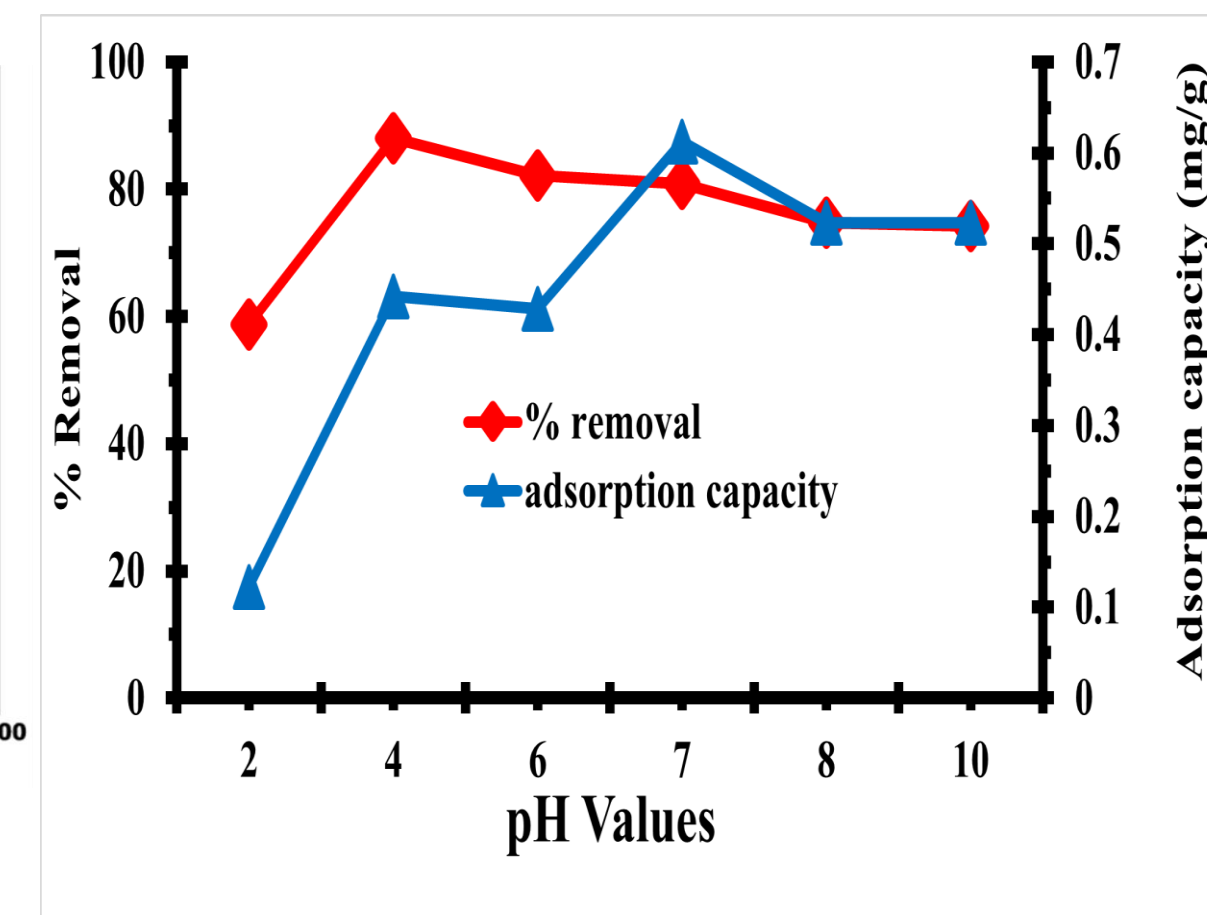


Fig. (b): Effect of initial pH

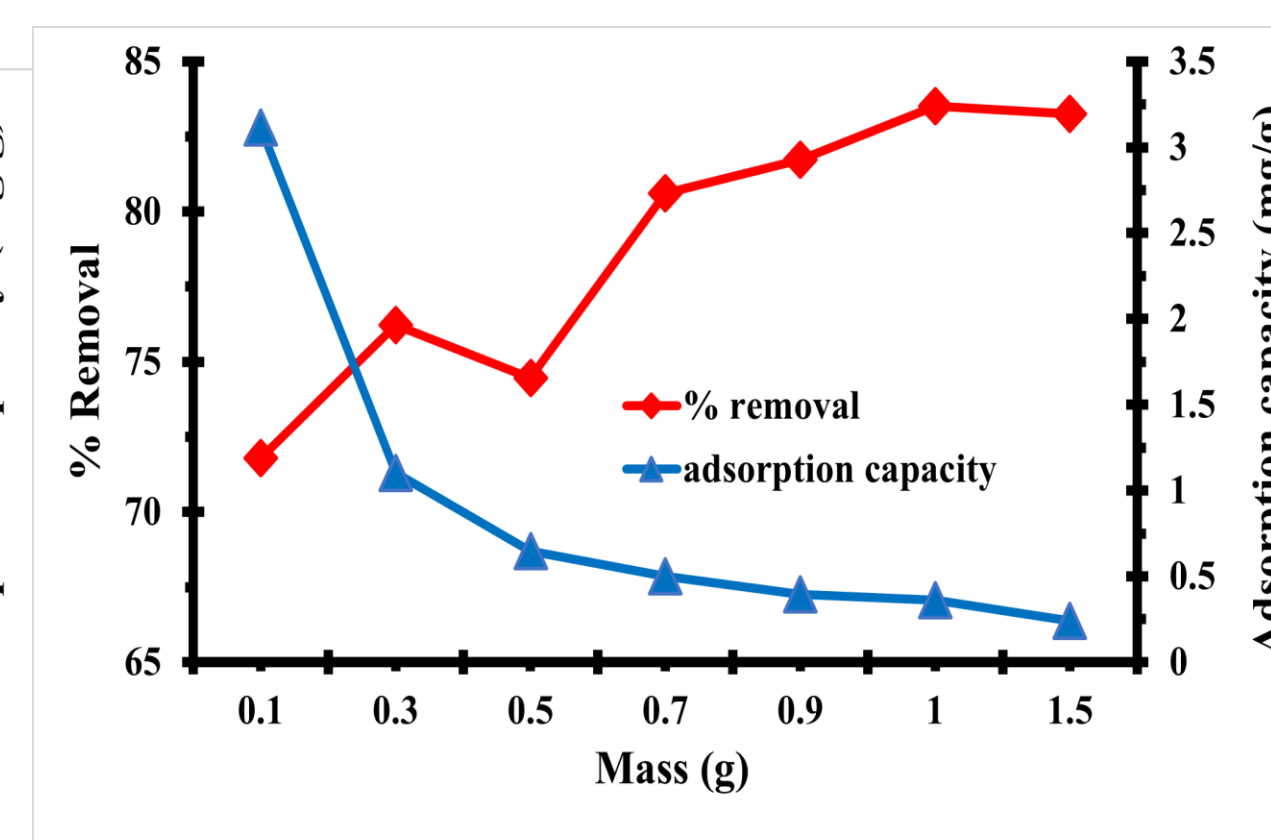


Fig. (c): Effect of adsorbent dose

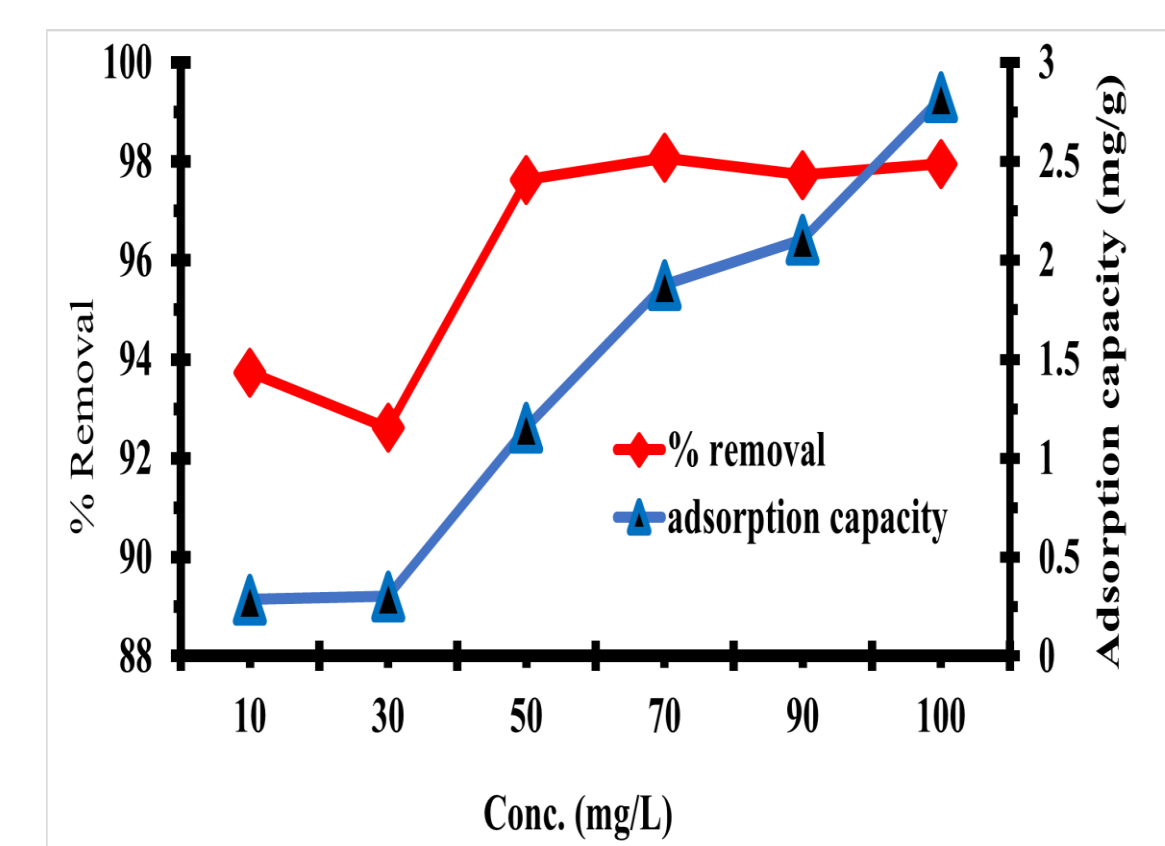


Fig. (d): Effect of adsorbate concentration

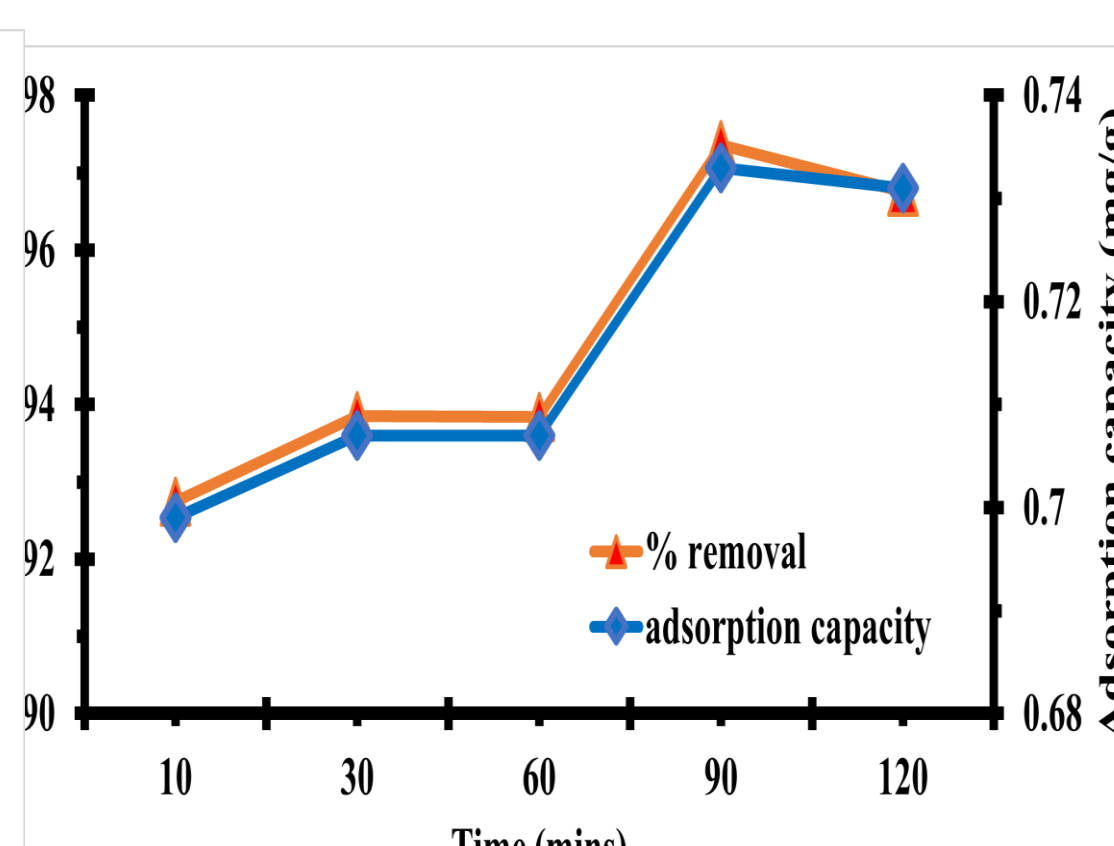


Fig. (e): Effect of contact time

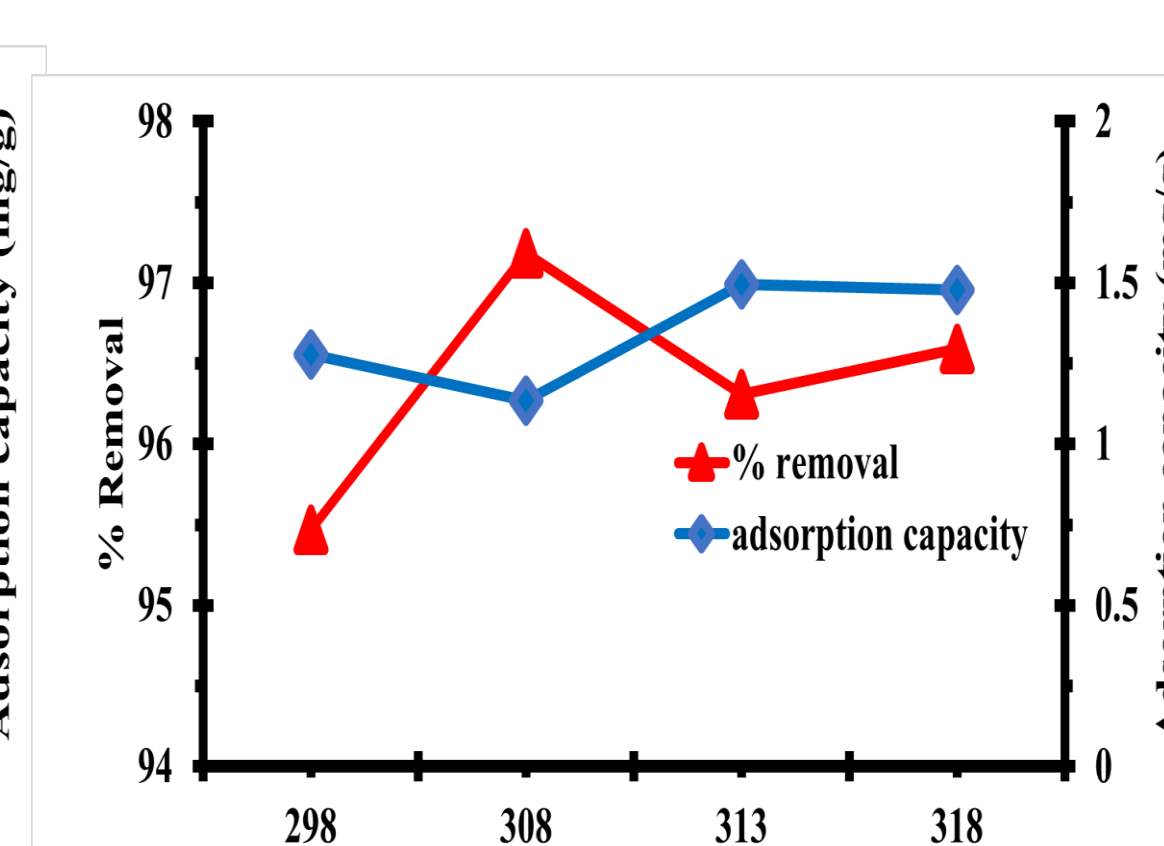


Fig. (f): Effect of temperature

ADSORPTION ISOTHERM, KINETIC AND THERMODYNAMIC STUDY

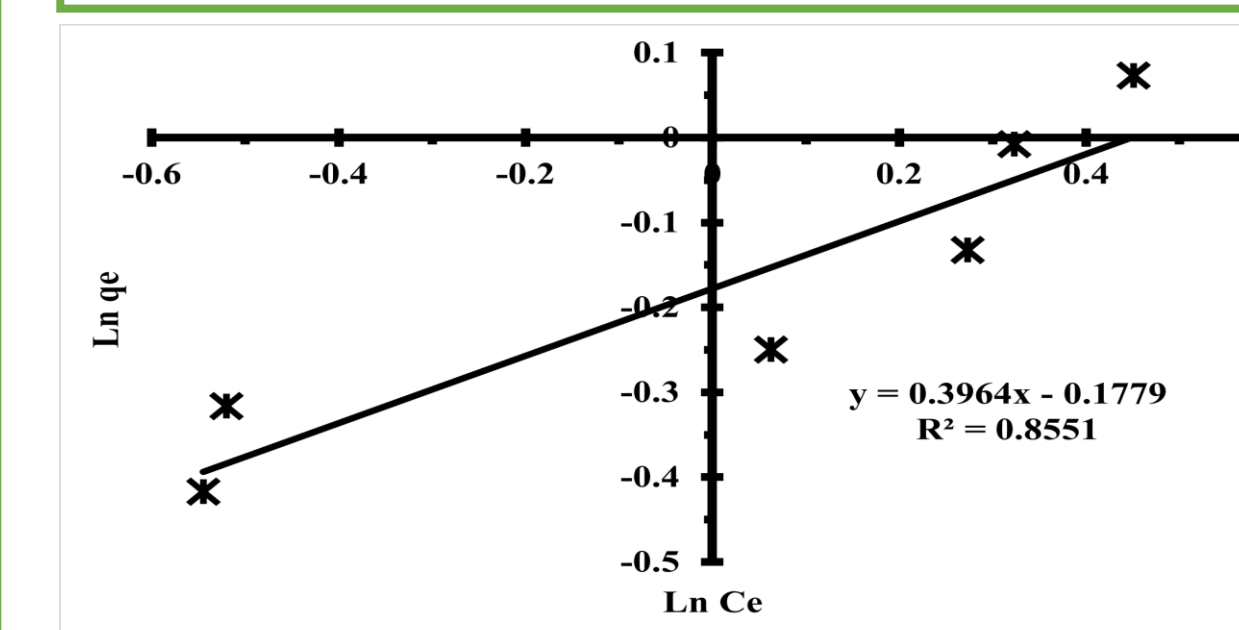


Fig (g): Freundlich adsorption isotherm plot for adsorption of MB onto fish scales

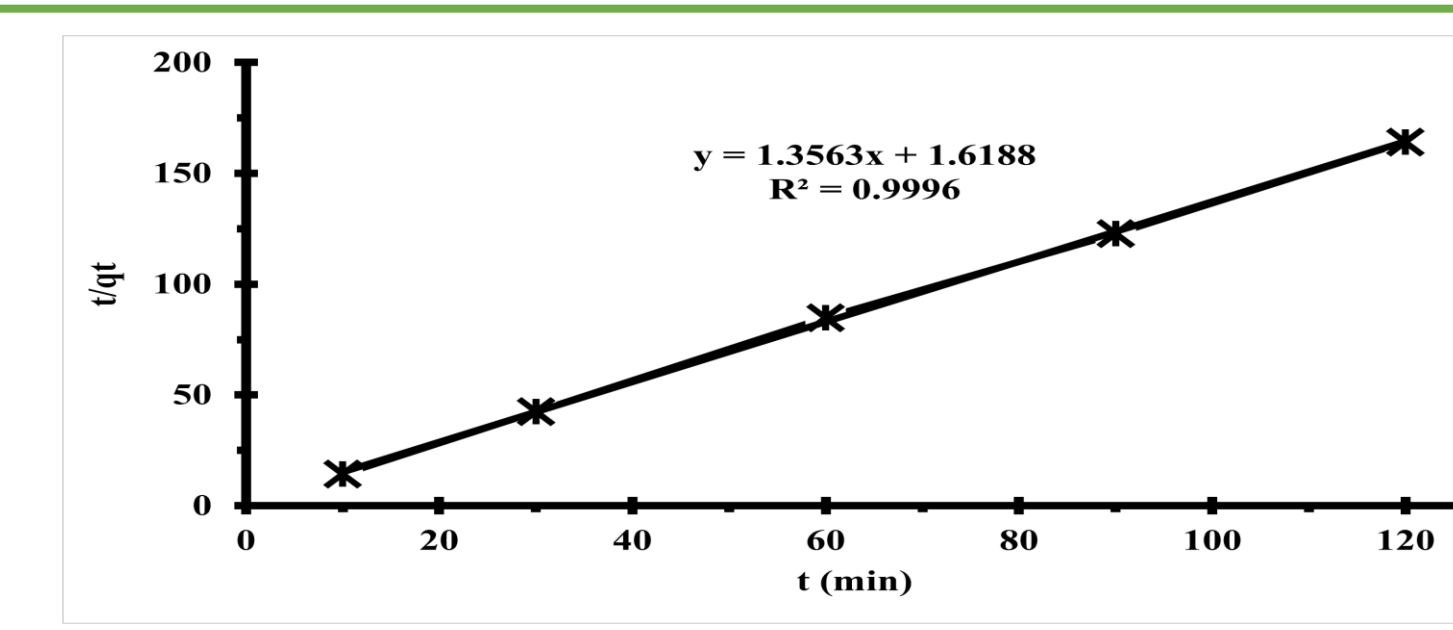


Fig (h): Pseudo-second order plot for adsorption of MB onto Fish scales.

Table 1. Thermodynamic parameter for adsorption of Methylene blue dye onto fish scales

Temperature(K)	ΔG° (KJmol ⁻¹)	ΔH° (KJmol ⁻¹)	ΔS° (Jmol ⁻¹ K ⁻¹)
298	-7.95	8.78	56.10
308	-8.50		
313	-8.79		
318	-9.07		

CONCLUSION

The adsorbent was characterized using the Fourier Transformed Infra-Red Spectrophotometer, it revealed the amines, hydroxyl groups, aromatic rings and alkyl halide to be the functional groups present. The batch experiments shows that the removal of methylene blue from aqueous solution using fish scales was highly efficient. The experimental data showed a good fit with Freundlich isotherm model, pseudo-second order model and the thermodynamic parameters indicated that the adsorption was favorable, endothermic and spontaneous. In conclusion, fish scales may be used as a low-cost, effective, and eco-friendly adsorbent for the removal of Methylene dye from effluents.

REFERENCES

- [1] 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.
- [2] EL Alouani M., Alehyen S., EL Achouri M., and M. Taibi M. (2018). Removal of Cationic Dye – Methylene Blue- from Aqueous Solution by Adsorption on Fly Ash-based Geopolymer. Journal of Materials and Environmental Sciences. 9(1): pp 32-46