

APPLICATION OF MELON HUSK ADSORBENT FOR THE REMOVAL OF RHODAMINE 6G DYE FROM AQUEOUS SOLUTIONS : OPTIMIZATION, ISOTHERMAL, KINETICS AND THERMODYNAMIC STUDY

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INTRODUCTION

One of the most important issues confronting humanity today is a lack of pure, high-quality drinking water. The textile industry contributes significantly to the deterioration of water quality through the discharge of partially /untreated effluents [1]. Hence, the need to find ways of treating wastewater. One of the United Nations sustainable development goals is to ensure availability and sustainable management of water and sanitation for all. Hence, this research is a way of contributing to the SDG [2].

AIM

This research aims at investigating the use of a lost cost, environmental friendly adsorbent towards efficient and effective removal of Rhodamine 6G (R6G) from dye containing solutions using melon husk as an adsorbent.

OBJECTIVES:

1. Determination of the wavelength of absorbance of the adsorbate using UV/Visible spectroscopy.
2. Characterization of the adsorbent using Fourier Transform Infrared spectroscopy (FTIR).
3. Optimization of the pH, dosage, concentration of the R6G dye; time and temperature variation from the simulated solutions using batch adsorption experiments.
4. Determination of the mode of adsorption using the Langmuir, Freundlich and Temkin isotherms.
5. Investigation of the adsorption kinetics.

MATERIALS AND METHODS



Fig. 1: Melon Husk

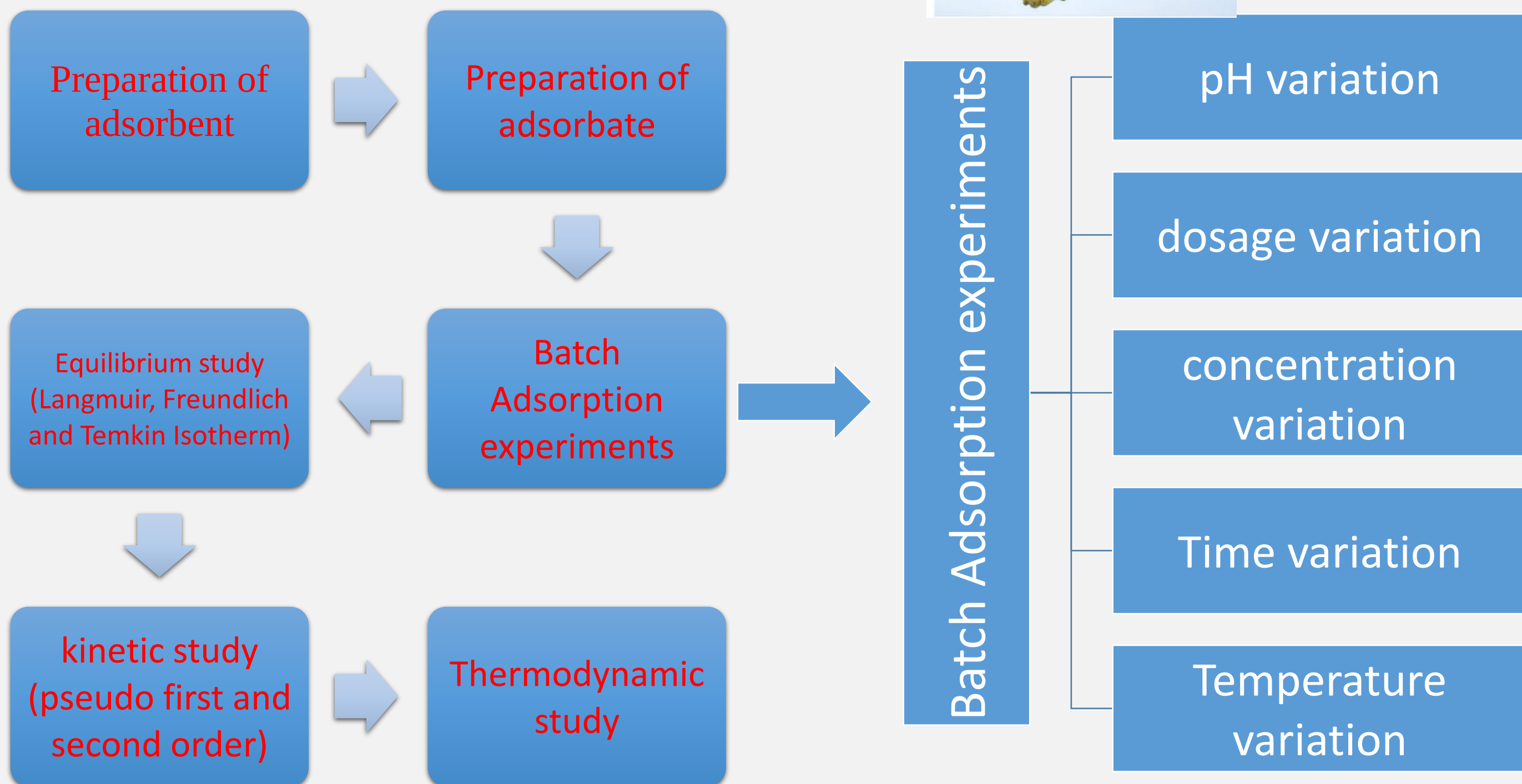


Fig.2: Flowchart showing the experimental procedures

RESULTS

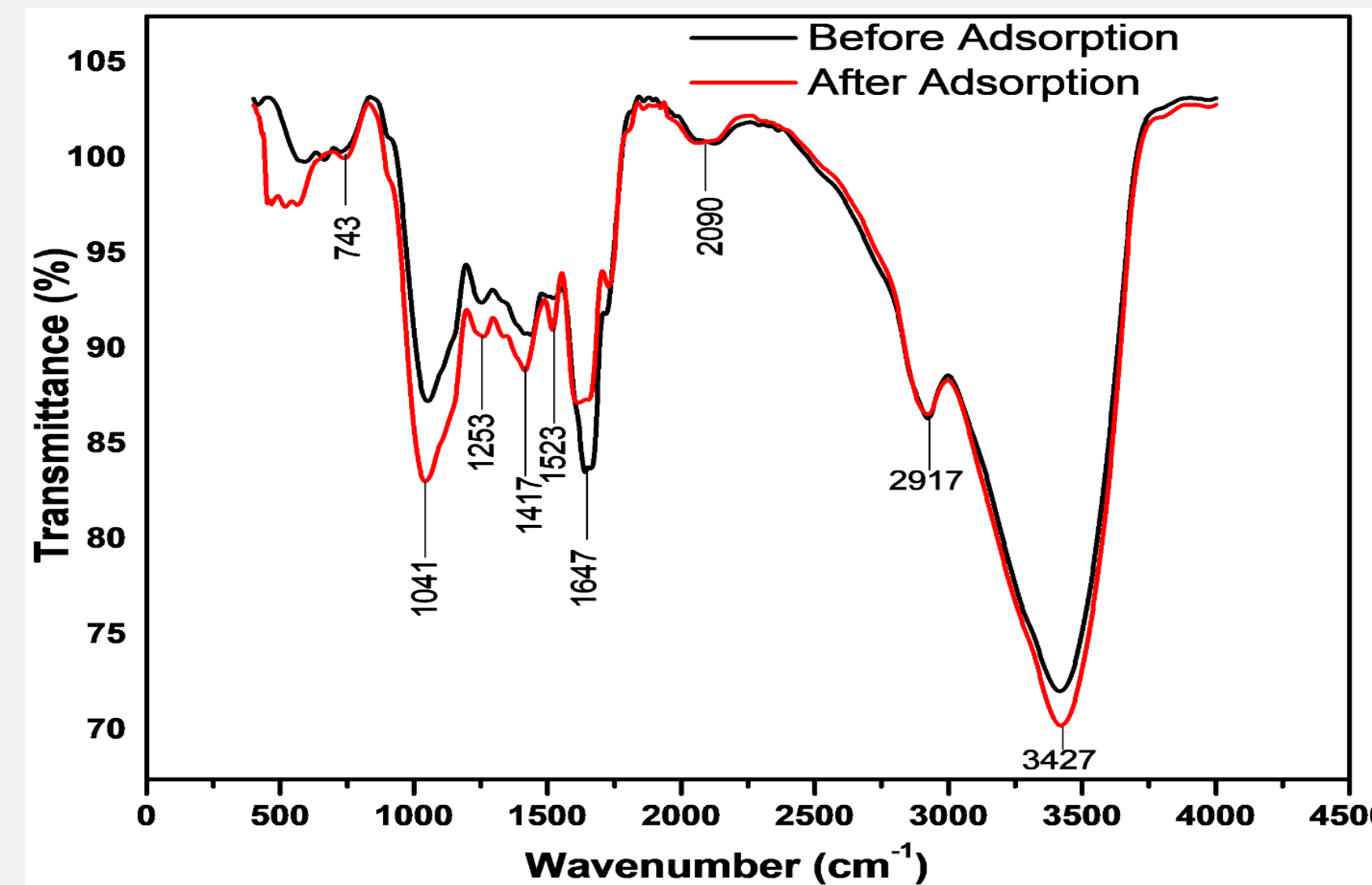


Fig. 3 : FTIR spectra of melon husk

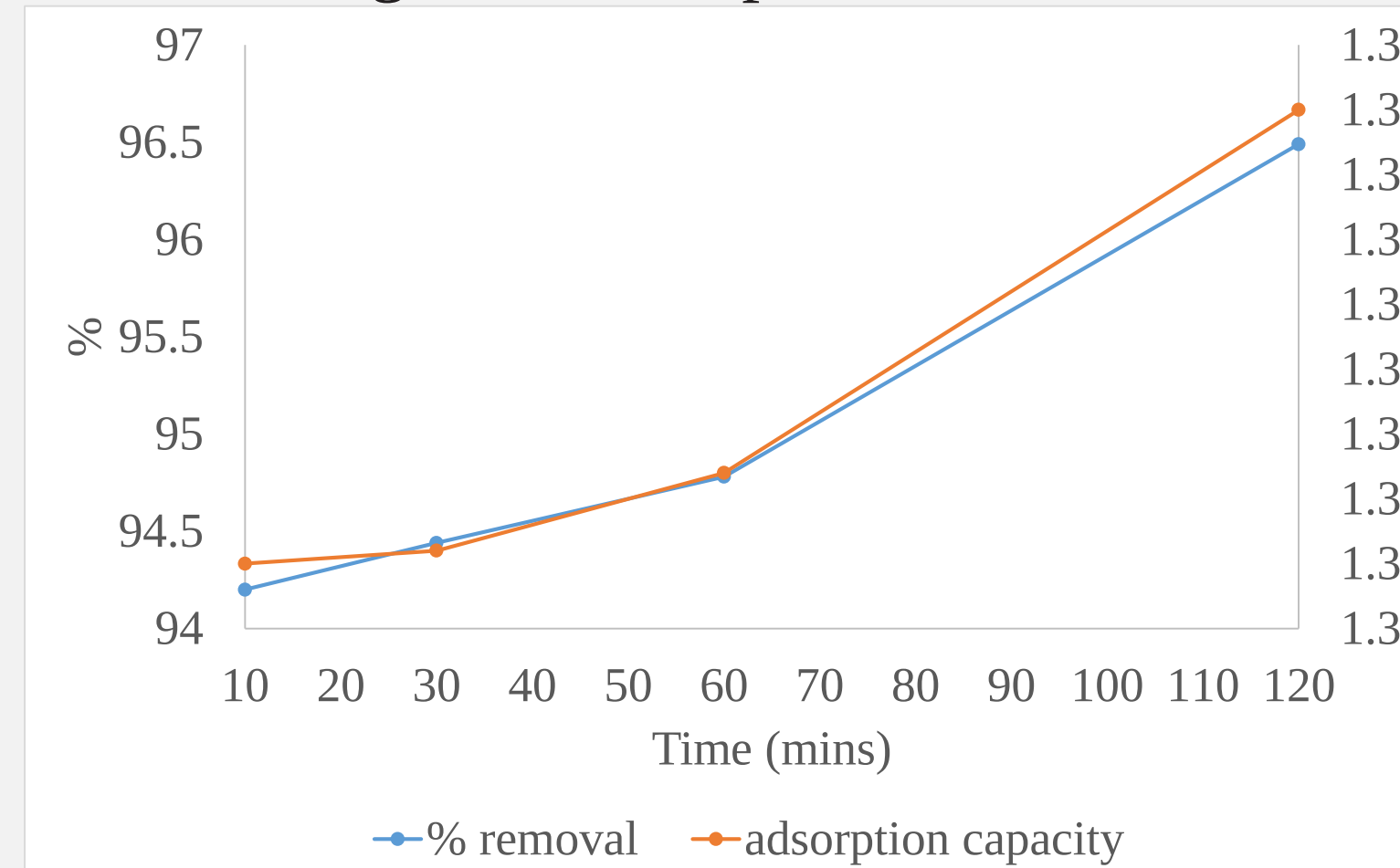


Fig. 7: Effect of contact time on R6G adsorption

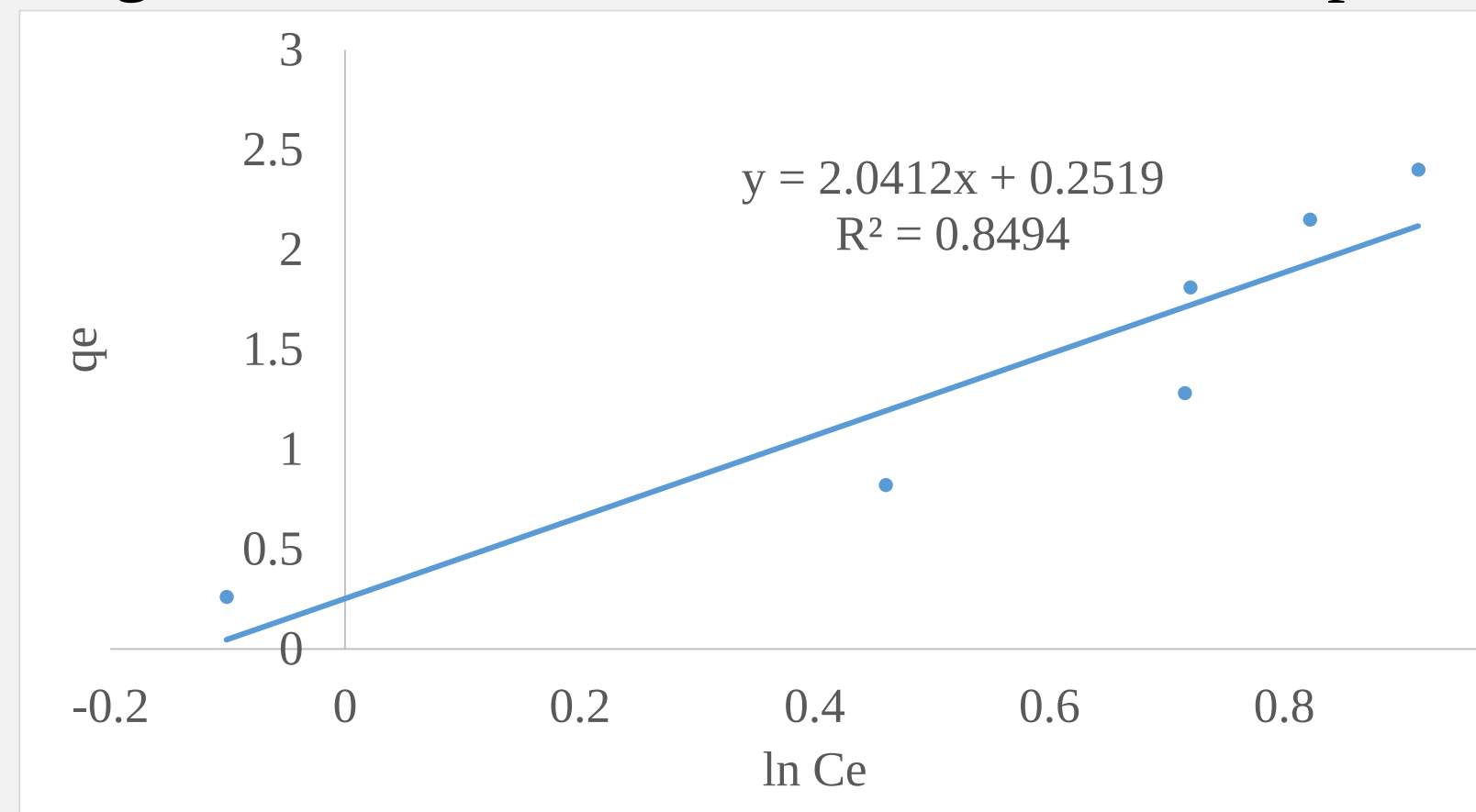


Fig. 11: Temkin isotherm of adsorption R6G onto melon husk

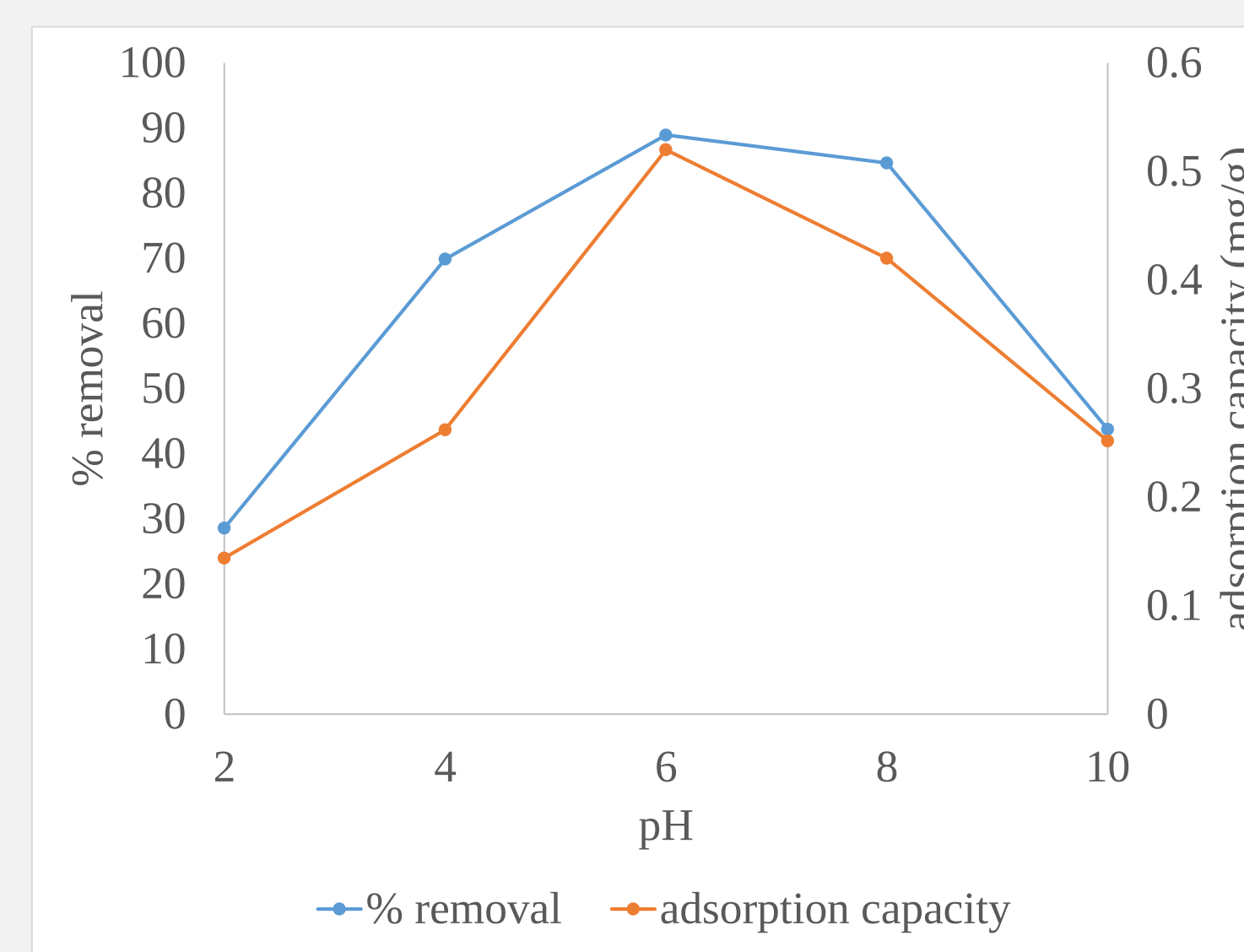


Fig. 4: Effect of initial pH on R6G adsorption

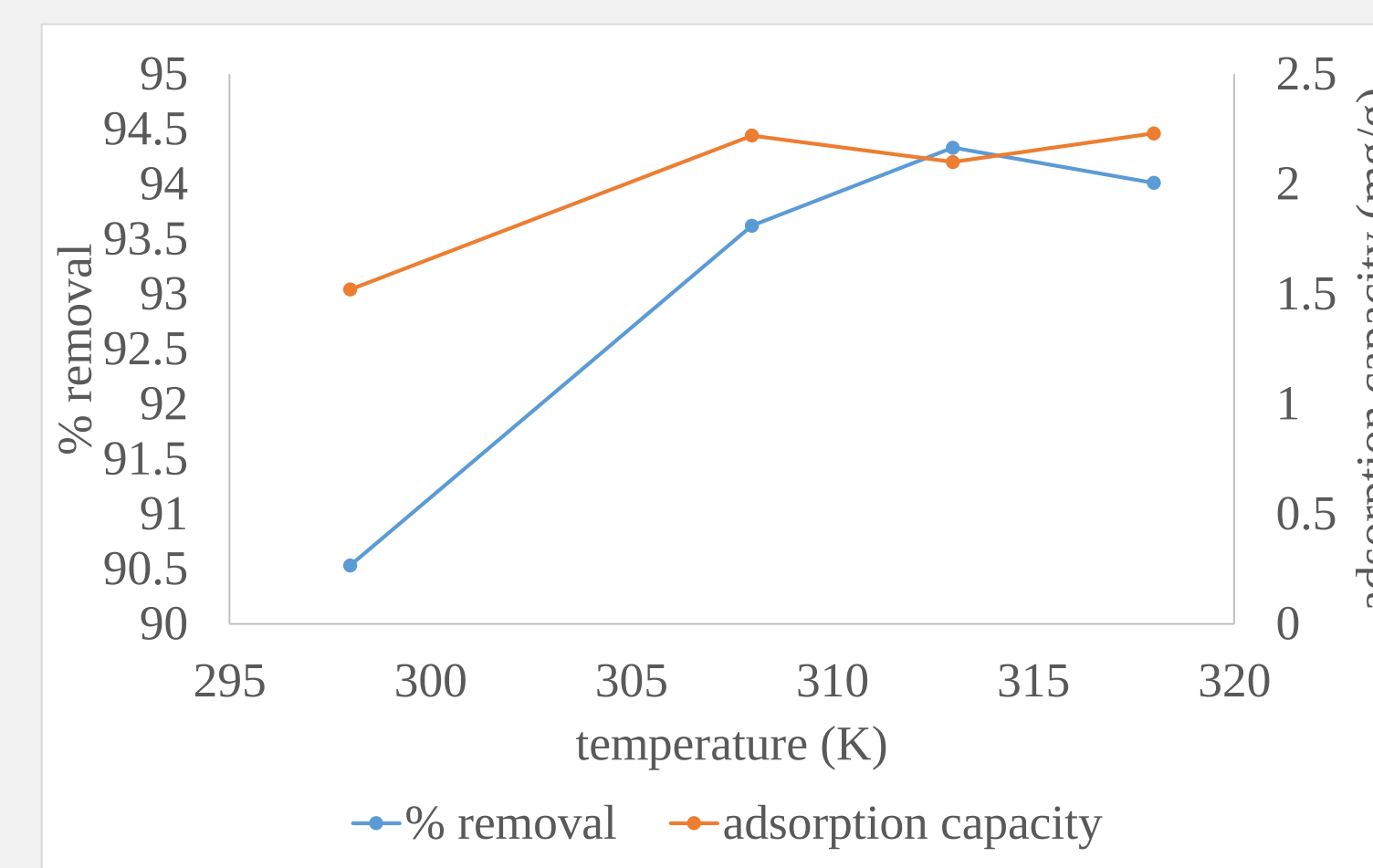


Fig. 8: Effect of temperature on R6G adsorption

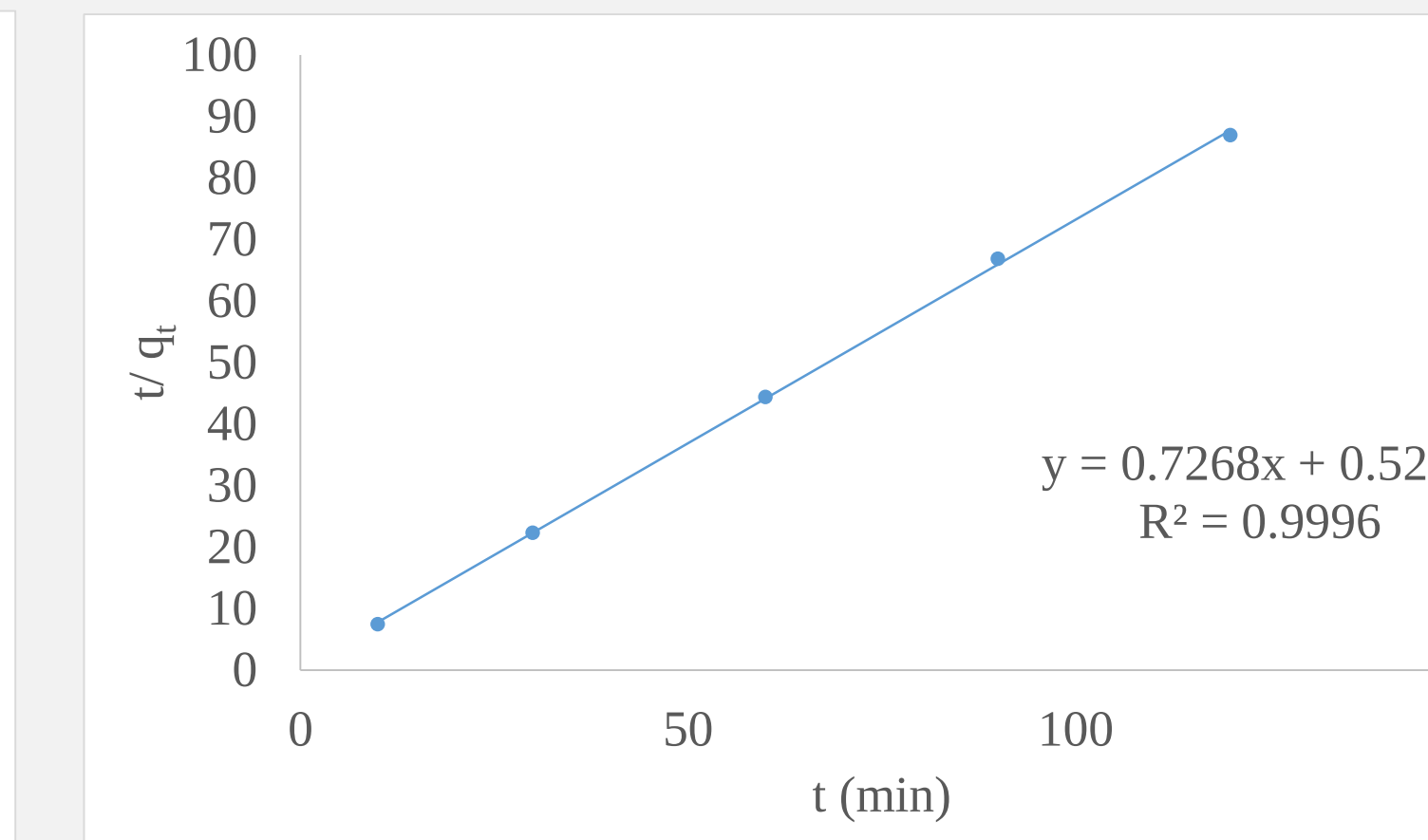


Fig. 12: Pseudo-second-order model of adsorption R6G onto melon husk

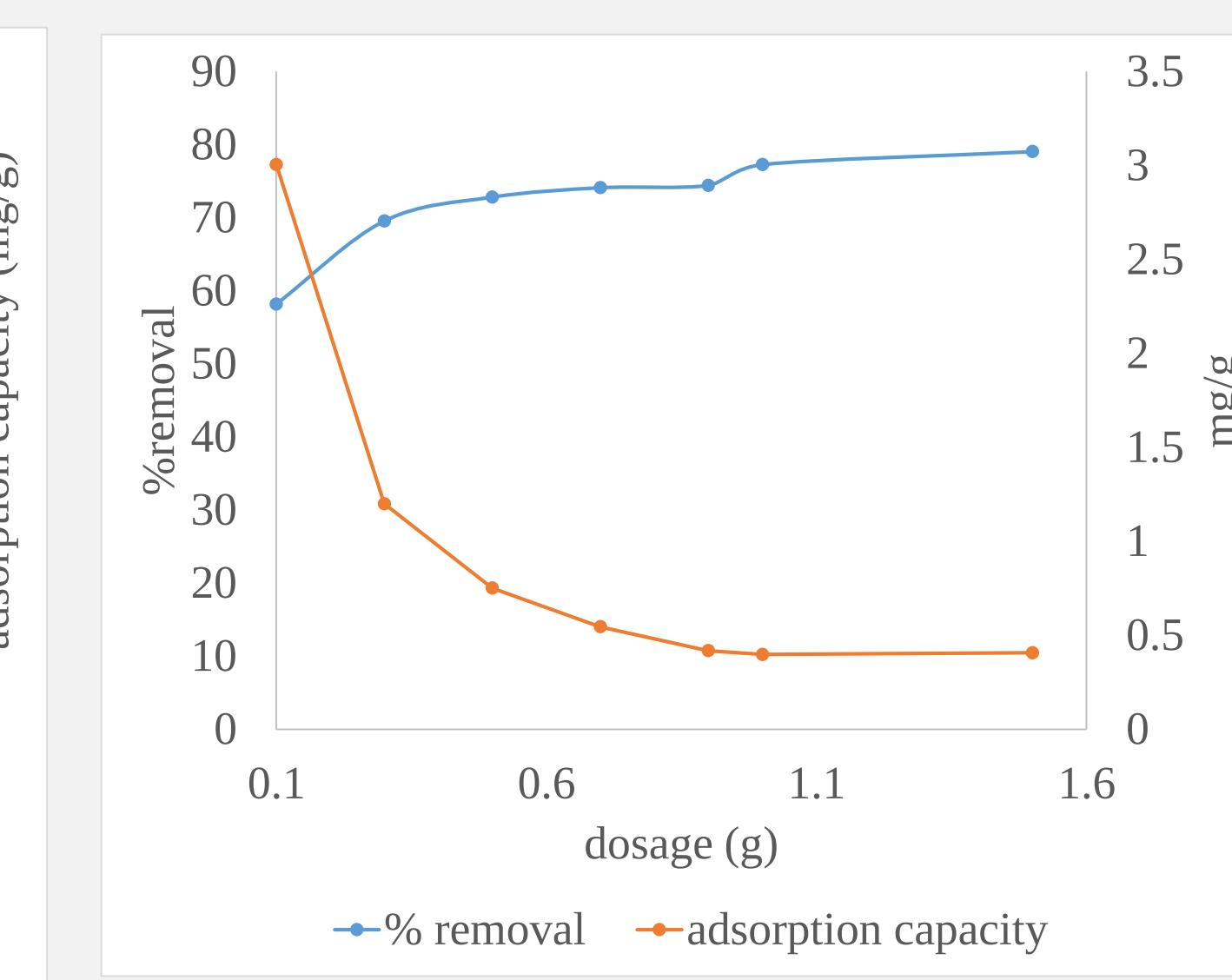


Fig. 5: Effect of adsorbent dosage on R6G adsorption

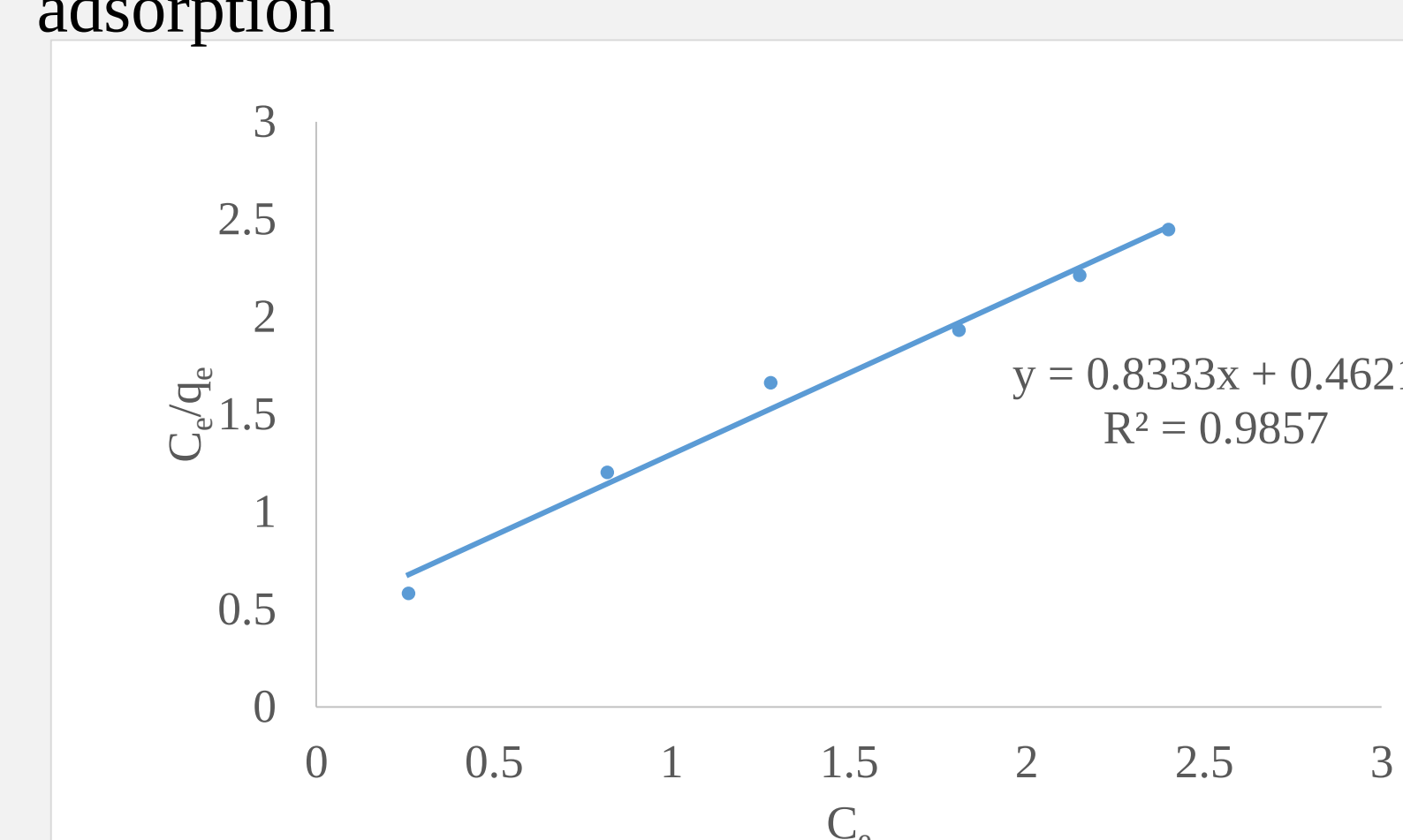


Fig. 9: Langmuir isotherm of adsorption R6G onto melon husk

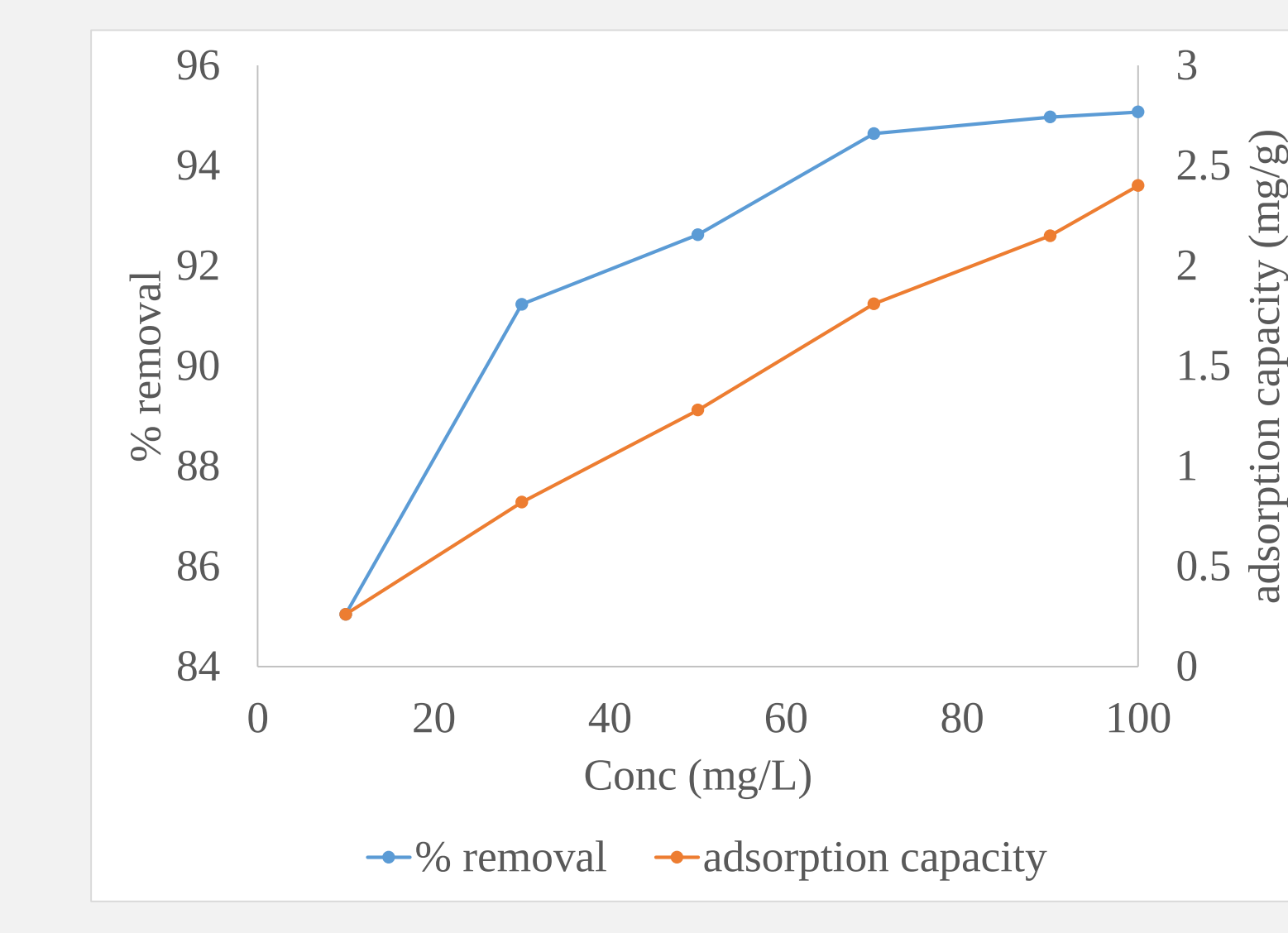


Fig. 6: Effect of initial concentration on R6G adsorption

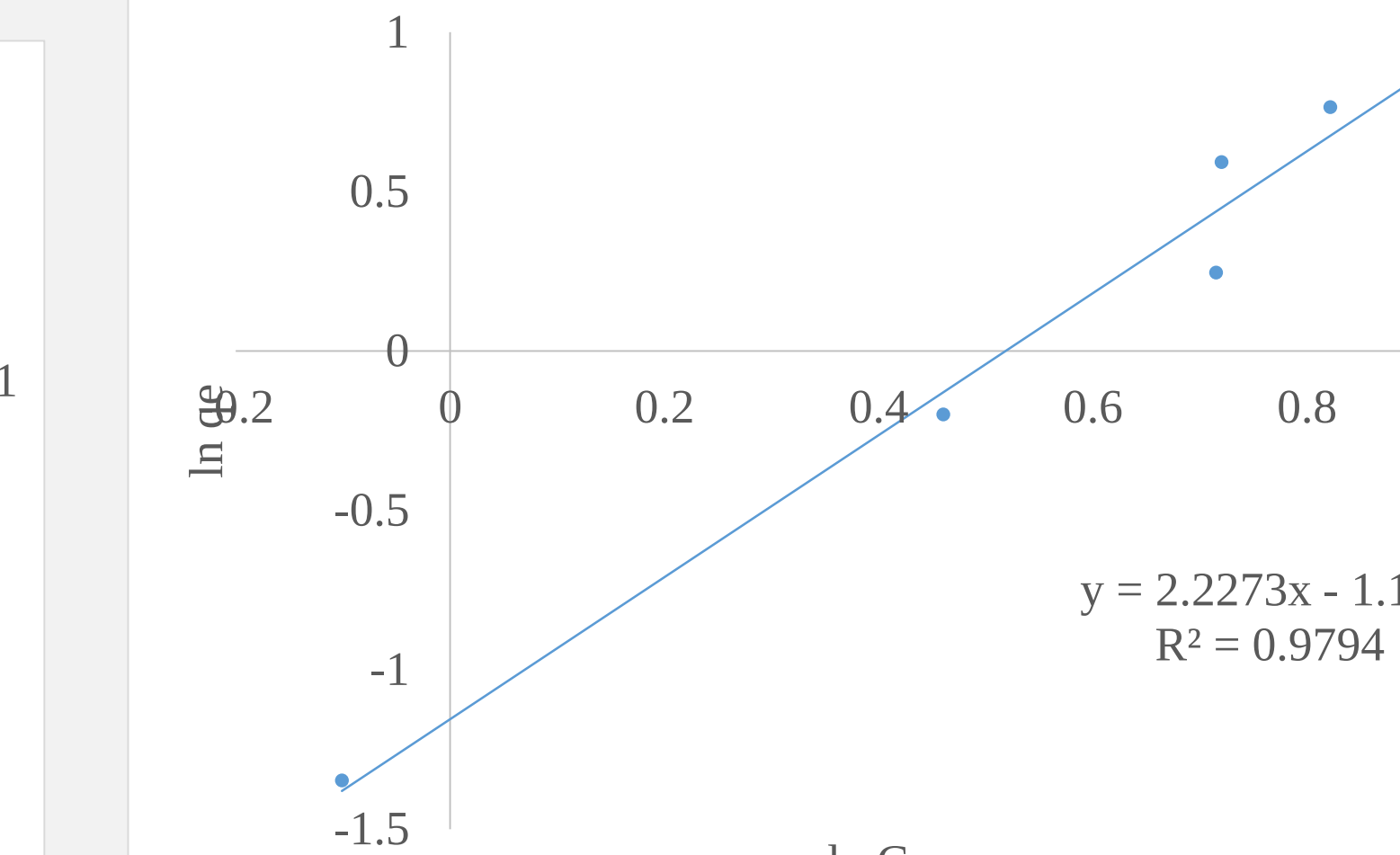


Fig. 10: Freundlich isotherm of adsorption R6G onto melon husk

Table 1: Thermodynamic parameters of the adsorption process

Temp (°K)	ΔG° (kJ mole ⁻¹)	ΔH (kJ mole ⁻¹)	ΔS (J K ⁻¹ mole ⁻¹)
298	-1.91	-22.88	-70.92
308	-0.81		
313	-0.41		
318	-0.66		

CONCLUSION

The FTIR indicates that the melon husk consist of functional groups such as, C=C (alkene), C-OH (hydroxyl), C=O (amide) and C-X (alkylhalide) stretch; Optimum biosorption was achieved at an initial pH, dosage, initial R6G concentration and contact time of 6.0, 20 g/L, 50 mg/L, and 10 min respectively. The most applicable isotherm is the Langmuir isotherm; The kinetic data can be best described by pseudo-second-order kinetic model. The process was spontaneous, feasible and exothermic.; Raw melon husk is able to adsorb Rhodamine 6G dye onto it's surface and proved to be a good biosorbent. For future studies, the usability of melon husk for dyes removal from real wastewater should be studied.

REFERENCES

1. Rania, A., Sameh, S. A., Fanghua, L., Kamal, M. O., Yehia, A. G. M., Tamer, E., Haixin, J., Yinyi, F. and Jianzhong, S. (2022). A critical review on the treatment of dye-containing wastewater: Ecotoxicological and health concerns of textile dyes and possible remediation approaches for environmental safety, **231**, 151-176
2. UN (2015). United Nations, Sustainable Development Goals, 1st edition, New York.