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Supplementary Information

Natural biodegradable low-cost Lablab purpureus husk as chromatrap for removal of three hazardous organic cationic dyes from water: Waste to wealth and column elution approach

Sumathi Harohally Paramesh1, Veerendra Shetty Ananthpur1, and Nagaraju Rajendraprasad1*

[1] PG Department of Chemistry, JSS College of Arts, Commerce and Science, A Research Centre Recognized by University of Mysore, Mysuru-570 25, Karnataka, India

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ABSTRACT

Novel results in this study showcase the utilization of sunlight-dried, ground *Lablab purpureus* husk (LLPh), treated with water and alkali, as a highly efficient bio-adsorbent for the removal of cationic dyes from aqueous solutions. Methylene blue (MB), malachite green (MG), and crystal violet (CV) were effectively adsorbed onto NaOH-activated LLPh (NaOH-LLPh) as bio-adsorbent. Employing the Chromatrap method within a column, successfully removed these dyes, while the surface morphology of the bio-adsorbent was elucidated through scanning electron microscopy (SEM) analysis. FTIR spectrometric data revealed valuable insights into the extent of adsorption. The impact of factors including adsorbate concentration, adsorbent dose, pH, contact time, and flow rate on the adsorption process was systematically studied and optimized. Up to 1000 µg/mL of MB and MG and 50 µg/mL of CV were found to be effectively removed by adsorption at pH 4-5, 3, and 2, respectively, at the flow rate of 1 mL/min. The results of kinetic studies and adsorption isotherms of the above-mentioned dyes indicate that all three dyes follow the pseudo-second-order kinetics. The adsorption of MB and MG are well fitted with the Langmuir isotherm model. The other dye CV suits with the Freundlich isotherm model. Based on the results, NaOH-LLPh, as an inexpensive and eco-friendly adsorbent, is suitable for the removal of cationic organic dyes from aqueous samples.

Keywords: *Lablab Purpureus Husk, Chromatrap, Methylene Blue, Malachite Green, Crystal Violet, Scanning Electron Microscope.*

How to cite this article

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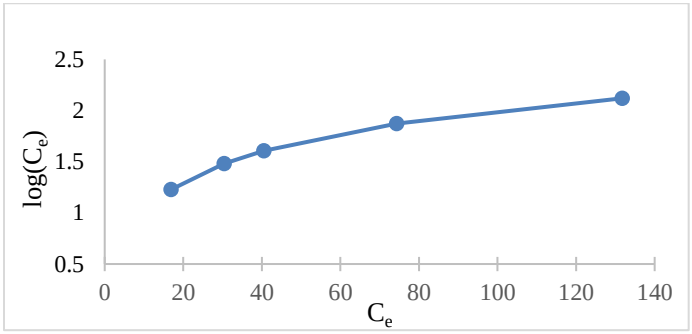

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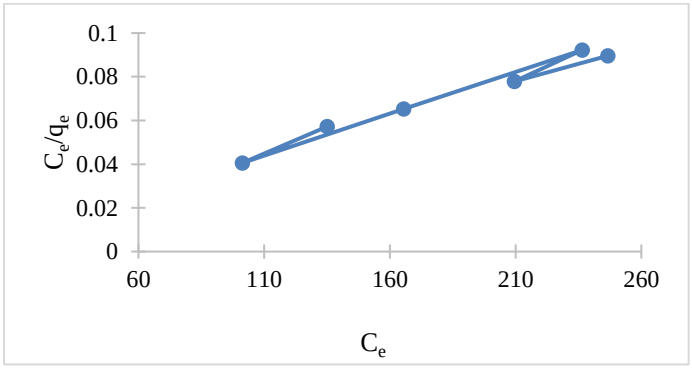

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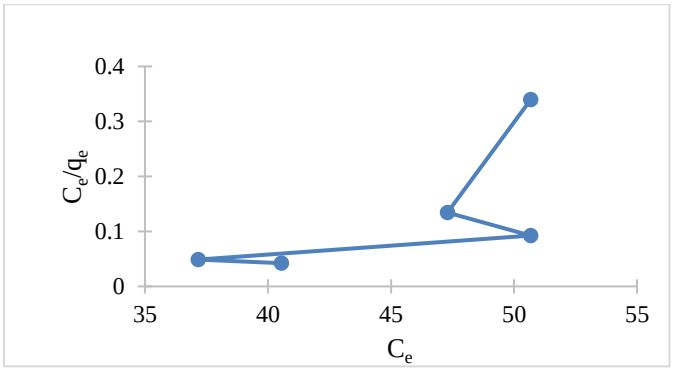
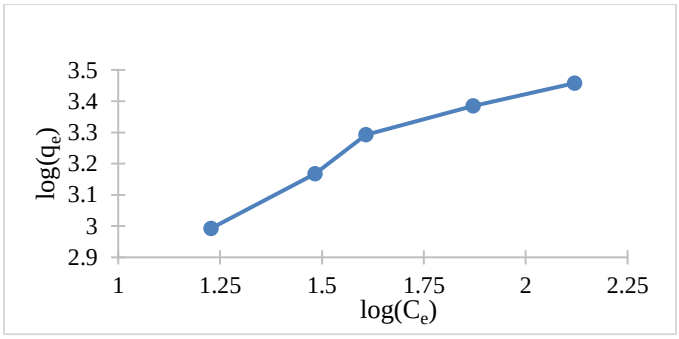
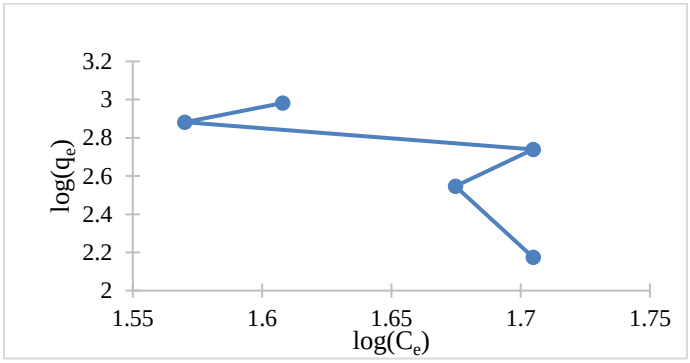


(c)

Fig. 8. Langmuir Adsorption isotherm plots at constant adsorbent dose 0.25g at room temperature for adsorption of (a) MB, (b) MG, and (c) CV at the operating pH of 2, 4.5, and 3, respectively



(a)



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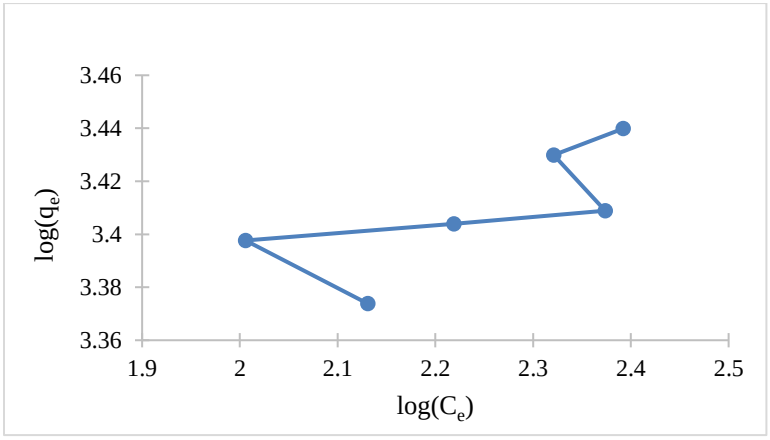
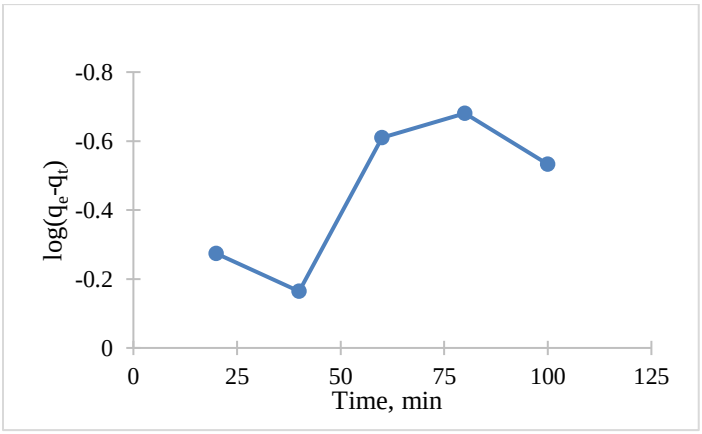
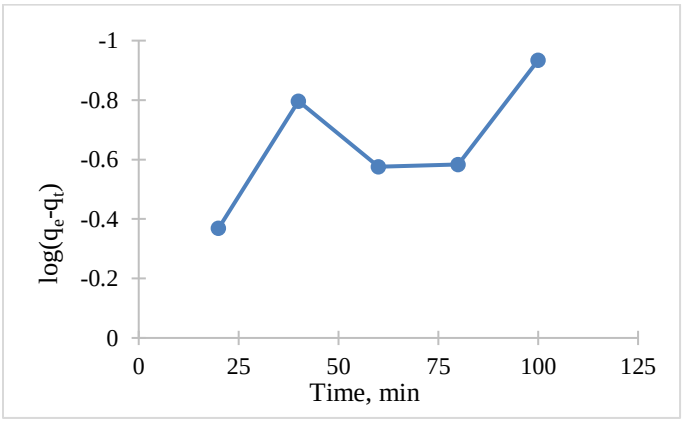


(c)

Fig. 9. Freundlich adsorption isotherm models at constant adsorbent dose 0.25g at room temperature for adsorption of (a) MB, (b) MG, and (c) CV at the operating pH of 2, 4.5, and 3, respectively, under the room temperature



(a)



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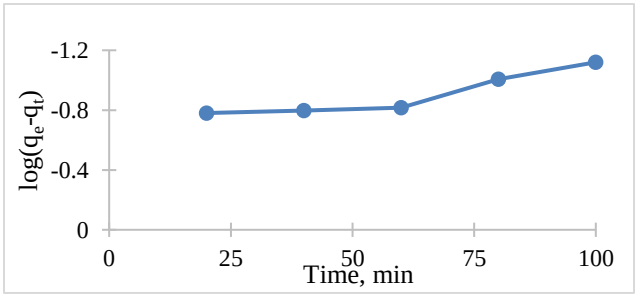
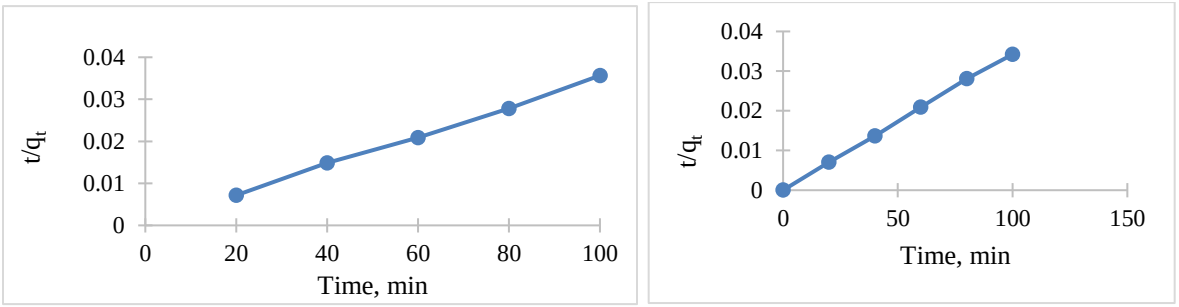


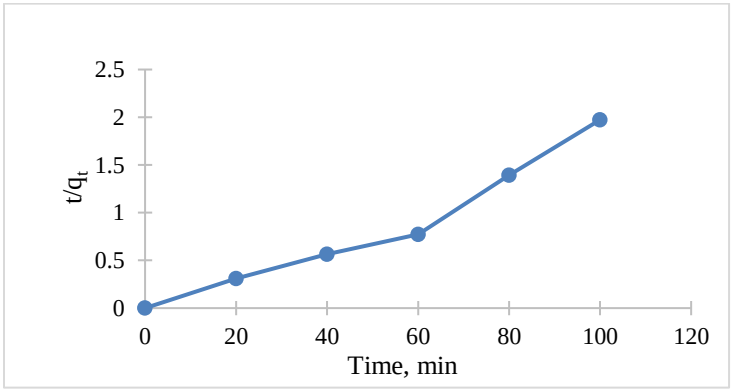
(c)

Fig. 10. Plots in the study of pseudo first order model for adsorption of (a) MB, (b) MG, and (c) CV dyes on proposed activated *Lablab purpureus* husk as adsorbent at the operating pH of 2, 4.5, and 3, respectively, under the room temperature



(a)

(b)



(c)

Fig. 11. Plots for reflecting the pseudo-second-order model for adsorption of (a) MB, (b) MG, and (c) CV on the activated *Lablab purpureus* husk adsorbent