



AP-18: Investigation of the Adsorption of Methylene Blue from aqueous solution by untreated pine tree bark: Kinetics and Equilibrium Analysis

SAADALLAH Kelthoum^{1*}, Ad Chifaa¹, DJEDID Mebrouk¹, BENALIA, Mokhtar¹

¹ dept. process engineering, Laboratory of process engineering, Laghouat University, Laghouat, Algeria

*Email**: k.saadallah@lagh-univ.dz

Subject description: The accumulation of synthetic dyes in the industrial effluent of several industrial sectors poses significant risks to both human health and the environment. Methylene blue (MB), a commonly employed dye, has been identified as one of the chemicals implicated in this context. The utilization of adsorption as a method for water treatment has proven to be highly efficient. However, due to the cost of the adsorbent material, there has been an increasing focus on investigating economically feasible and environmentally friendly sorbents. This necessitates the exploration of locally accessible alternative resources, including organic materials and agricultural wastes.

Objectives: This study aims to explore the potential of untreated pine tree bark (UPTB), an abundant agricultural waste in Algeria, as an adsorbent for removing methylene blue (MB) from aqueous solutions commonly used in various industries. The study seeks to investigate the adsorption kinetics and isotherm models to understand the mechanism of adsorption, and to evaluate the feasibility of utilizing untreated pine tree bark as a cost-effective and sustainable adsorbent for methylene blue removal.

Methods: The effects of initial dye concentration, contact time, adsorbent dosage, pH and temperature were investigated and optimized for maximum dye recovery during the batch mode experiment. A variety of MB concentrations were studied at initial values of 15-150 mg/L. Various pH values were evaluated, the adsorption temperatures of the adsorbent used were changed at 25-55 °C to assess the efficiency of MB removal by the agricultural waste. The investigation focused on the reaction kinetics of the process and the examination of Langmuir and Freundlich adsorption isotherms.

Results and discussion: The results indicate that approximately 60 minutes of contact time is sufficient for the adsorption of MB to reach equilibrium. The highest percentage of MB removal achieved was 99%. The experimental data fitted well with the pseudo-second-order kinetic model. The MB adsorption onto UPTB fit well with the Freundlich isotherm model. The maximum MB uptake capacity of the UPTB adsorbent was 35.36 mg/g.

Conclusion: The findings of this study suggest that utilizing untreated pine bark tree could be a promising, effective, and cost-efficient approach for removing methylene blue from aqueous solutions. This highlights the potential of agricultural waste materials in developing sustainable solutions for treating industrial waste, with the aim of protecting the environment and promoting efficiency.

Keywords: untreated pine tree bark 1, methylene blue 2, adsorption 3, kinetic 4, isotherm 5.