Seawater-based mesoporous geopolymer as a sorbent for the removal and recovery of methylene blue from wastewater

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**Abstract**

Seawater-based geopolymer (SGP) made from coal fly ash was experimented as a sorbent for the removal of methylene blue using batch sorption process from wastewater. Elemental composition and surface profile of SGP was characterized by different analytical methods such as scanning electron microscopy with energy-dispersive X-ray spectroscopy, Fourier-transform infrared spectroscopy, Brunauer–Emmet–Teller, X-ray fluorescence, and X-ray diffraction analysis. The effect of variables such as solution pH (2–12), the point of zero charge, the contact time, initial dye concentrations (10, 20, and 30 mg/L), SGP dosage (0.01–0.1 g/L), and the temperature (30°C, 40°C and 50°C) was considered to establish optimal experimental conditions. Isotherm experimental result concludes that the Langmuir isotherm suits well than Freundlich isotherm. Results showed that the system forms homogeneous, monolayer with adsorption capacity (59.52 mg/g) by SGP. The kinetic results confirm that the pseudo-second-order sorption well-suited model. The negative values of enthalpy, Gibb’s free energy, and entropy reveal that the sorption is exothermic, favorable, and spontaneous with ordered arrangement on the SGP surface. SGP adsorbent was successfully reused up to four cycles and can be considered efficient.

**Keywords:** Seawater-based geopolymer (SGP); Methylene blue (MB); Reusability; Kinetics; Isotherms.