Abstract

In this work, an activated carbon sample with a high adsorptive performance for the herbicide 2,4-dichlorophenoxyacetic acid (2,4-D) was prepared from queen palm endocarp (Syagrus romanzoffiana) by pyrolysis process. The activated carbon presented an XRD pattern related to carbon graphite and functional groups such as C–H, C=O, O–H. The material particles presented a highly-porous structure, being beneficial to the adsorption process. The activated carbon showed a remarkable specific surface area of 782 m² g⁻¹ and pore volume of 0.441 cm³ g⁻¹. The solution pH presented a strong influence on the adsorption process, with ideal pH = 2, being the best adsorbent dosage, 0.5 g L⁻¹. The correspondent removal percentage was 95.4%. The pseudo-second-order model represented kinetic data, presenting R² > 0.992 and MSR < 19.62 (mg g⁻¹)². The Langmuir model was the most suitable for describing the equilibrium data with the highest R² (> 0.997) and lowest values of MSR (< 92.04 (mg g⁻¹)²), indicating a maximum capacity of 367.77 mg g⁻¹. The thermodynamic study indicated a spontaneous operation, with ΔG° ranging from −23.2 to −32.6 kJ mol⁻¹ and endothermic process (ΔH° = 67.30 kJ mol⁻¹), involving physical interactions in the adsorbent/adsorbate system. The adsorbent could be regenerated by NaOH and used 7 times with the same adsorption capacity. Hence, overall, the activated carbon prepared from the Jerivá endocarp corresponds to a promising adsorbent in removing 2,4-D herbicide in wastewater.
Keywords
Activated carbón; Syagrus romanzoffiana; Queen palm; 2,4-D, adsorption