Heavy metal ions adsorption from dairy industrial wastewater using activated carbon from milk bush kernel shell


Activated carbons (MBK400 and MBK600), produced from milk bush kernel shells, were carbonized at 400 and 600°C, respectively, activated with H₃PO₄, and subsequently, employed to remove heavy metals (cadmium, lead, nickel, zinc, iron, and copper) in dairy industrial wastewater (DIWW). Effects of doses (1.0–3.0 g/L) and contact time (5–25 min) at constant agitation (120 rpm) on removal efficiencies and adsorption capacities of the agricultural precursors were investigated. Four types of Langmuir isotherm model were used to fit the adsorption of the heavy metals. The pH of the treated DIWW increased from 6.1 to a range of 6.7–6.9 and 6.8–6.9 with MBK400 and MBK600, respectively, while, there were slight increase in the conductivity of the treated DIWW, except with 3.0 g of MBK400, which reduced the conductivity from 377 to 345 µS/cm. The maximum percentage of cadmium, iron, copper, lead, zinc and nickel removal were 90, 80, 91.7, 91.6, 87.18, and 73.62% with 2.0 g/L MBK400, 1.0 g/L MBK400, 3.0 g/L MBK600, 2.0 g/L MBK600, 3.0 g/L MBK600 and 1.0 g/L MBK600, respectively. The removal of lead ranked the highest, consistently, for all the doses of MBK400 and MBK600 used. The Langmuir Type-1 was the most suitable linearized Langmuir isotherm that described the adsorption of the heavy metals in the DIWW, based on coefficient of determination (R²). The adsorbents developed are suitable for the removal heavy metals, particularly lead, in a typical DIWW.

Keywords: Activated carbon; Adsorption; Dairy wastewater; Heavy metals; Milk bush kernel shell

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