Preparation of activated carbon from inexpensive and magnetized materials with Fe_3O_4 nanoparticles to remove hexavalent chromium from aqueous solutions; Study of isotherms and kinetics

ABSTRACT

Background & objective: Heavy metals such as chromium are among the most common pollutants commonly found in high concentrations in industrial wastewater, causing damage to aquatic environments and endangering the health of living organisms, especially humans. The aim of this study is determination of the optimal removal of hexavalent chromium by magnetized activated carbon (AC / Fe_3O_4) from aqueous solutions.

Methods: The structure and properties of AC/Fe_3O_4 were investigated by FESEM, FTIR, BET and VSM techniques. The effect of solution pH parameter (3-11), initial concentration of hexavalent chromium (10-50) mg/L and adsorbent dose (0.5-2) g/L on hexavalent chromium removal efficiency along with isotherm and kinetics studies was investigated. The concentration of hexavalent chromium was determined by direct reading at 540 nm with a spectrophotometer.

Results: The optimal conditions for maximum removal of hexavalent chromium at pH 3, contact time of 60 minutes, adsorbent dose of 1.5 g/L were obtained with an initial concentration of hexavalent chromium of 30 mg/L. The isotherm and kinetics study showed that the experimental data followed the Langmuir and pseudo-second-order kinetics.

Conclusion: Under desirable conditions, the maximum capacity of AC/Fe_3O_4 adsorption increased to 21.14 mg/g. The present study illustrated that AC/Fe_3O_4 can be used as an adsorbent to remove chromium from aqueous solutions.

***Keywords*:** Adsorption; Activated carbon; worn tire; Magnetic nanoparticles; Hexavalent chromium