Effective detoxification of Aflatoxin B1 and Ochratoxin A using magnetic graphene oxide nanocomposite: isotherm and kinetic study

ABSTRACT

One of the approaches for reducing exposure to mycotoxins is to lessen their bioavailability by applying nanocomposite adsorbents. Magnetic graphene oxide (MGO) is a new class of nanostructured multifunctional nanocomposite materials, which play a vital role as an adsorbent. The primary aim of this study is to apply response surface methodology (RSM) to optimize the influence of pH within the range of 3 to 7, time (3–7 h), and temperature (30–50 °C), on the simultaneous detoxification of aflatoxin B1 (AFB1) and ochratoxin A (OTA) by using MGO. The optimal condition was obtained at pH 5, 5 h, and 40 °C. Further investigation of the adsorption evaluation was carried out by studying different parameters, such as the influence of contact time, initial mycotoxins concentration, and temperature. According to the experimental data, it can be concluded that the pseudo-second-order kinetic model and the Freundlich isotherm fitted well. The capability of adsorption for the Freundlich model was calculated as 153 and 95 ng/g for AFB1 and OTA, respectively. The thermodynamic study showed that the sorption studies act spontaneously as an exothermic process. These findings suggest that the application of MGO as a nanocomposite is of great significance for the detoxification of mycotoxins.

Keyword: Nanocomposite adsorbent; Detoxification of mycotoxin; Adsorption; Kinetic study; Thermodynamic