

Removal of Ochratoxin A from water by novel adsorbent; magnetic carbon nanocomposites prepared from sugar beet wastes

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ABSTRACT

In this study, a novel adsorbent, magnetic carbon nanocomposite, was prepared from sugar beet wastes and was used for the in vitro detoxification of ochratoxin A. The prepared adsorbent was characterized by surface area analyzer, scanning electron microscopy, x-ray diffraction, energy dispersive x-ray, thermal gravimetric/differential thermal analysis and fourier transform infrared. Freundlich, Temkin and Langmuir isotherms were used to determine the adsorption parameters of the ochratoxin A adsorption. Pseudo-first and pseudo-second order kinetic models were used to determine the kinetic parameters of the adsorption process. Langmuir isotherm and pseudo-first order kinetic model fitted well the experimental data. The equilibrium time at pH 7 was 235 min. The effect of pH on adsorption of ochratoxin A was also determined. A slight decline in percent adsorption from pH 1 to 13 was observed. The thermodynamic parameters were also determined. The value of ΔS° (85 kJ.mol⁻¹.deg⁻¹) was positive while the values of ΔH° (-21 kJ mol⁻¹) and ΔG° (-2.75, -3.57, -4.39 and -5.21 kJ mol⁻¹ at 30°C, 40°C, 50°C and 60°C, respectively) were negative. The negative value ΔH° indicates the exothermic nature of the process while the increased negative values of ΔG° at high temperature showed the favorable nature of process at high temperature. From the results, it was concluded that this adsorbent could be used as alternative of activated carbon for the detoxification of ochratoxin A both in poultry feed and in gastrointestinal tract of broilers.

Keywords: Ochratoxin A; Sugar beet waste; Nanocomposite

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