TITLE: ANTIFUNGAL AND ANTIMYCOTOXIN PROPERTIES OF 4A ZEOLITE AND ITS NEW ION-EXCHANGED DERIVATIVES

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ABSTRACT:
Aspergillus flavus is a problematic fungus that produces aflatoxins, especially in the food industry due to their potential to persist pre- and post-harvest as a pathogen and saprophyte in the food supply. Among the aflatoxins, the aflatoxin B_1 (AFB_1) is the most frequent and potentially mutagenic, teratogenic and hepatocarcinogenic. It is already known that synthetic 4A zeolite slowly releases its parent ions and acts as inorganic bactericide and disinfectant, which is excellent in terms of safety and thermal stability when compared to organic ones. Zeolites are microporous crystalline hydrated aluminosilicates consisting of three-dimensional frameworks of $[SiO4]^{4-}$ and $[AlO4]^{5-}$ which can be exchangeable by other ions contributing to their different properties as antimicrobial use, as well as feed additives. This study aims to evaluate the effect of 4A zeolite and some ion-exchanged zeolites with Cu^{2+}, Li^{+}, Co^{2+} and Zn^{2+} against *A. flavus*. In addition, we evaluate the antimycotoxin activity and AFB_1 adsorption capacity of these compounds as well their toxic potential using assays with *Artemia* sp. The ion-exchanged zeolites were duly synthetized and characterized by X-Ray Fluorescence, Atomic Absorption Spectrophotometry, Scanning Electron Microscope (SEM), Fourier Transform Infrared spectroscopy and X-Ray Diffraction. Antifungal activity was performed by the agar diffusion and dilution method, optical microscopy and SEM. Antimycotoxin assays and AFB_1 adsorption by the high-performance liquid chromatography device. The ion-exchanged zeolites with Li^{+} and Cu^{2+} showed the best antifungal activity against *A. flavus*, including significant effects on conidia germination and hyphae morphological alterations. Regarding to antimycotoxin activity, all zeolites efficiently inhibited the AFB_1 production by *A. flavus*. However, the ion-exchanged zeolites exhibited better results than the 4A zeolite. On the other hand, the AFB_1 adsorption capacity was only observed by the 4A zeolite and zeolite-Li^{+}. Lastly, our data showed that all zeolites samples used at effective concentrations for antifungal and antimycotoxin assays (2 mg/mL) showed no toxic effects towards *Artemia* sp. Taking into account its advantages regarding to low cost, easily accessible and antifungal and antimycotoxin properties, these modified zeolites can be used as new control agents to effective constraint of *A. flavus* growth and AFB_1 production, especially the zeolite-Li^{+} which met the best results.

Keywords: antifungal, *Aspergillus flavus*, aflatoxin B_1, zeolite, toxic effects

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