

Adsorption of the mycotoxin zearalenone by clinoptilolite and phillipsite zeolites treated with cetylpyridinium surfactant

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Colloids and Surfaces B: Biointerfaces

Volume 151, 1 March 2017, Pages 324-332

Abstract

In this study, organozeolites were prepared by treatment of the natural zeolites (clinoptilolite and phillipsite) with cetylpyridinium chloride (CP) equivalent to 50 and 100% of their external cation exchange capacities (ECEC). Organoclinoptilolites (ZCPs) and organophillipsites (PCPs) were characterized by FTIR spectroscopy, thermal analysis, determination of the point of zero charge and zeta potential. Adsorption of zearalenone (ZEN) by ZCPs and PCPs at pH 3 and 7 was investigated. Results showed that adsorption of ZEN increases with increasing amounts of CP at the zeolitic surfaces for both ZCPs and PCPs but the adsorption mechanism was different. Adsorption of ZEN by ZCPs followed a linear type of isotherm at pH 3 and 7 while ZEN adsorption by PCPs showed non linear (Langmuir and Freundlich) type of isotherm at both pH values. Different interactions between the ZEN molecule (or ion) and ZCPs and PCPs occurred: partition (linear isotherms) and adsorption in addition to partition (non linear isotherms), respectively. For the highest level of organic phase at the zeolitic surfaces, the maximum adsorbed amount of ZEN was 5.73 mg/g for organoclinoptilolite and 6.86 mg/g for organophillipsite at pH 3. Slightly higher adsorption: 6.98 mg/g for organoclinoptilolite and 7.54 mg/g for organophillipsite was achieved at pH 7. The results confirmed that CP ions at both zeolitic surfaces are responsible for ZEN adsorption and that organophillipsites are as effective in ZEN adsorption as organoclinoptilolites.