ADSORPTION AND DEGRADATION OF SULFACHLOROPYRIDAZINE SULFONAMIDE ANTIBIOTIC INTO A HIGH SILICA MORDENITE

ANNALISA MARTUCCI[1], MAURO ANDREA CREMONINI[2], SONIA BLASIOLI[3], GIORGIO GATTI[4], LARA GIGLI[5], ILARIA BRASCHI[6]*

[1]*Dipartimento di Scienze della Terra, Università di Ferrara , Ferrara, 1 – 44100, Italy*
[2]*Dipartimento di Scienze degli Alimenti, Università di Bologna, Bologna, 44 – 40127, Italy*
[3]*Dipartimento di Scienze e Tecnologie Agroambientali, Università di Bologna, Bologna, 44 – 40127, Italy*
[4]*Dipartimento di Scienze e Tecnologie Avanzate, Centro Interdisciplinare Nano-SiSTeMI, Università del Piemonte Orientale "Amedeo Avogadro", Alessandria, 11 – 15121, Italy*
[5]*Dipartimento di Scienze e Tecnologie Agroambientali, Università di Bologna, Bologna, 44 – 40127, Italy*
[6]*Dipartimento di Scienze e Tecnologie Agroambientali, Università di Bologna , Bologna, 44 – 40127, Italy*
ilaria.braschi@unibo.it

Despite their well-know ability to induce high level of bacterial resistance, persistent sulfonamide antibiotics have been using in veterinary medicine without paying attention in handling and confining contaminated manure and sewage disposal. Owing to their acidic nature, sulfonamides concentrate in anionic form in water bodies where they can remain unchanged for long periods of time. In this study the removal of sulfachloropyridazine sulphonamide (SC) from water by adsorption in a high silica mordenite zeolite (MOR) with channel window dimension comparable to that of the antibiotic was investigated. The adsorption of sulfachloropyridazine by mordenite was completed within 4 h with the maximal amount of adsorbed antibiotic of 18% zeolite dry weight. The adsorption kinetics performed at room temperature and 65°C highlighted an unfavourable temperature effect. The desorption trials conducted on exhausted mordenite elucidated the irreversibility of the adsorption process. Diffractometric data allowed us to obtain clear evidences of the embedding of sulfachloropyridazine into mordenite channels as well as to exactly localize the organic species in the structure. The relevant incorporation of SC in MOR structure is confirmed by a variations of unit cell parameters as well as a remarkable deformation in the dimensions of the channel systems, when compared with the parent zeolite. The most evident effect was the lowering of Cmcm real symmetry of the parent MOR to Cmc21 after adsorption of SC. On the whole, Rietveld refinement revealed the incorporation of 2.0 sulfonamide molecules within the MOR framework, in very good agreement the saturation capacity determined by the adsorption isotherm. Upon adsorption on silanol sites of mordenite, sulfachloropyridazine was degraded to a new product identified as 4-amino-N-(6-hydroxyl-3-pyridazinyl)benzene sulfonamide. The byproduct was not formed in the absence of mordenite.

Keywords: sulfachloropyridazine, adsorption, degradation