

# REMOVAL OF THE ANTIBIOTIC SULFAMETHOXAZOLE BY “GREEN” CLAY SORBENTS

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Contamination of water resources with pharmaceuticals has been one of the top concerns of environmental sciences in the latest years [1, 2], the matter having received very significant media coverage recently [2, 3]. Antibiotics in particular have been gathering considerable attention and are amongst the most serious worries due to the development of antibiotic resistant bacteria as result of prolonged exposure [1, 2, 3]. In particular, antimicrobials and their metabolites are being detected in significant amounts in water supplies, and although no evidence exists that human health is affected by minute doses of antibiotics over long periods of time, changes have been observed in ecosystem functions [3,4]. In addition to antimicrobial resistance, other effects have been observed such as a delay in cell growth of bacteria, limited denitrification, and shifts in community composition [5]. Sulfamethoxazole (SMX), a broad-spectrum biostatic sulfanilamide, has become a point of interest because of its prevalence in contaminated wastewaters at concentrations correlated to bacterial resistance and genetic mutations in organisms [3,4,5]. Taking into account the widespread use of sulfonamides and their potential environmental effects, there is importance in developing new technologies for removing SMX and similar compounds from points of discharge. In fact, most wastewater treatment plants are inefficient for the removal of most micropollutants, especially hardly biodegradable organic xenobiotics which are present in wastewaters at low concentrations, as these conventional systems were only designed for removing bulk pollutants. Several advanced technologies have been evaluated as options to treat these contaminants, e.g. advanced oxidative processes or membrane filtration, but despite the sometimes high removal efficiencies attained, these technologies are too expensive to be considered as viable solutions on a large scale. Adsorption, alone or as part of a more complex water or wastewater treatment process, has been seen as playing a very important role in the removal of many organic xenobiotic pollutants [6, 7]. In this regard, the choice of adsorbent materials is crucial. However, pollutants removal efficiency is not the sole selection criterion, as the cost of the materials may provide or preclude economic viability of the water/wastewater treatment system. Therefore, the quest for efficient adsorbents that are widely available, and do not require expensive processing in order to be used (thereby allowing lower production costs) is a very important aspect of research aimed to manage this environmental problem. In this work we present the study of sorption properties of clay materials (LECA and vermiculite) for the removal of SMX from water. The dependence

of removal efficiencies on the antibiotic initial concentrations, contact time with the adsorbents and other system/environment conditions was assessed. The two clay materials were compared in terms of their more balanced performance towards the removal of the pharmaceutical tested and the materials are suggested as a useful component of a water or wastewater treatment system designed for the removal of this contaminant (and others of similar type). Vermiculite was shown to be more efficient than LECA in the adsorption of the pharmaceutical and the one with faster kinetics. In order to gain a deeper insight into the characteristics that favor the removal of this compound by mineral surfaces, quantum chemical theoretical calculations were performed to illustrate the type of interactions that are responsible for the preferable adsorption of the compound to the vermiculite surface.

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