ADSORPTION OF PHARMACEUTICALS FROM DILUTE AQUEOUS SOLUTIONS INTO SYNTHETIC BETA ZEOLITE

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Domestic and commercial wastewaters contain a variety of organic wastewater contaminants such as pharmaceuticals and personal care products. These compounds undergo incomplete removal in wastewater treatment plants and they are found in the surface waters receiving the effluents of these plants. The aim of this work is to investigate the capability of beta zeolite in removing three test molecules Hydrochlorothyazide (HTZ) Ketoprofene (HTP) and Diclofenac (DCF), respectively. All of these drugs are ubiquitous contaminants in the sewage waters, in particular HTZ is nor effectively removed by conventional activated sludge treatment and membrane bioreactors (MBRs) [1]. Three beta zeolites with different silica alumina ratio (360 36 and 25 respectively) were purchased in their protonated forms (Tosoh Corporation), in order to investigate the role of hydrophobicity on the retention. Kinetics and adsorption isotherm batch data obtained via HPLC-DAD prove that beta zeolite with SAR equal to 36 has a higher adsorbent capacity than that with SAR equal to 360 when both KTP and HTZ are considered. Thermogravimetric analysis (TGA) revealed that the amount of pharmaceuticals embedded in the beta framework is strongly related to the SAR value, thus confirming an higher adsorption of HTZ on low SAR beta. Finally, a comparison of the X-ray diffraction patterns of untreated and exhausted samples shows relevant differences both in the intensity and position of the diffraction peaks, indicating that the beta crystal structure was markedly modified by the pharmaceuticals adsorption experiment. In conclusion, the experimental results demonstrated that SAR play an important role in determining the adsorption capacity of zeolites employed as adsorbent materials. The high adsorption properties were attributed to the large hydrophobic surface area and the regularshaped, open and interconnected threedimensional pore structure of the zeolite. For these reasons, the Beta zeolites are efficient in removing drugs from wastewater and in particular polar drugs.

[1] Radjenovic´, J.; Petrovic´, M.; Barceló, D. Water Research (Oxford) 2009 Vol. 43 No. 3 pp. 831-841

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