Novel Environmental Catalysts prepared with Residual Metals on Bioactive Nanomaterials

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Volatile organic compounds (VOCs), which are emitted from many industrial processes and transport activities, constitute an important concern for the scientific community due to their role in atmospheric pollution and subsequent impact on human health. Among the various methods that can be applied to efficiently control VOCs emissions, catalytic oxidation over solid catalysts seems to be the most efficient and cost-effective technology. Catalysts used for the treatment of gas streams contaminated with VOCs are mostly based on noble metals. Using low cost transition metals such as chromium to replace the noble metal in the catalysts is quite desirable in terms of economical and practical consideration.

The catalytic oxidation of 1,2-dichlorobenzene was investigated over NaY and NaX zeolites, loaded with chromium through the action of a robust biosorption system consisting of a bacterial biofilm supported on the zeolites. The results of biosorption showed that the maximum metal removal efficiency was 20%, in both systems based on NaYor NaX, starting from solutions with chromium(VI) concentrations ranging from 50 to 250 mgCr/L [1]. The bacterial biofilm, *Arthrobacter viscosus*, supported on the zeolite reduces Cr(VI) to Cr(III). The Cr(III) is retained in the zeolite by ion exchange. The new catalysts were characterized by spectroscopic methods (FTIR and ICP-AES), surface analysis (XRD) and thermal analysis (TGA). These catalysts, Cr/FAU, prepared through this new procedure present good activity and selectivity for 1,2-dichlorobenzene oxidation in wet air at 350^{o}C. The study was extended to the oxidation of ethyl acetate and to the oxidation of ethanol [2].

[1] B. Silva, H. Figueiredo, C. Quintelas, I.C. Neves, T. Tavares, “Zeolites as supports for the biorecovery of hexavalent and trivalent chromium”, *Microporous and Mesoporous Materials*, 116 (2008), 555-560.

[2] H. Figueiredo, I.C. Neves, C. Quintelas, T. Tavares, M. Taralunga, J. Mijoin, P. Magnoux, Oxidation catalysts prepared from biosorbents supported on zeolites, *Applied Catalysis B: Environmental*, 66 (2006), 273-279.