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# IV Analytical Chemistry Symposium

## “Organic microcontaminants: A challenge for water reuse”

### Book of Abstracts

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## Production and optimization of magnetic waste-based activated carbon for the removal of pharmaceuticals from water

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The growing use of pharmaceuticals and their inefficient removal by conventional wastewater treatments represents a major concern in terms of their potential environmental impact. Therefore, several advanced treatment processes have been adopted, including the adsorptive removal of pharmaceuticals using powdered activated carbon (PAC). In order to widen the potentiality of PAC and to overcome its limitations, the incorporation of magnetic iron oxide nanoparticles have been explored, allowing the use of an external magnetic field, to separate the exhausted PAC from the treated water using [1].

In this work, the in-situ modification of a primary paper mill sludge-based PAC with magnetic iron oxides was studied. The PAC, obtained through KOH activation and pyrolysis of paper mill sludge, was loaded with iron oxides by the co-precipitation method. To optimize the production of the magnetic carbon adsorbent (MCA), a fractional factorial design considering three factors ($Fe^{II}$:$Fe^{III}$ salts molar ratio, PAC:Fe salts mass ratio, temperature) at three levels, and a fourth factor (pH alkaline conditions) at two levels, was applied. Eighteen MCAs were obtained and the statistical analysis of the effect of the variables studied was performed considering the following responses: specific surface area ($S_{BET}$), saturation magnetization ($M_s$) and percentage of removal ($R_e$) of the antiepileptic carbamazepine (CBZ) from water.

The results highlighted the impact of reducing the PAC:Fe salts mass ratio on the decrease of $S_{BET}$ and $R_e$ towards CBZ, as compared to the non-magnetic PAC. Therefore, a compromise between high adsorption capacity and magnetic properties should be established. The described procedure resulted in some materials with fast magnetic separation from the treated water and removal efficiencies ranging between 40 and 77% for CBZ (5 mg/L), with MCA dosages of 35 mg/L. The successful use of an industrial waste as MCA precursor highlighted its potential as an alternative raw material.

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