Modification and Optimization of Activated Carbons for Phenolic Compounds Removal

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1. Introduction – Phenols are generally considered to be one of the important organic pollutants discharged into the environment causing unpleasant taste and odour of drinking water. Development of inexpensive adsorbents from industrial wastes for the treatment of wastewaters is an important area in environmental sciences. For the phenolic compounds removal, it appears that the pH of the solution, the real surface area of the solid, and functional groups play a major role. The objective of this study was to screen various adsorbents for potential application for the removal of phenolic compounds for drinking water concentration range. The adsorbents used in this study were AC prepared from recycled PET and AC prepared from cork submitted to a reduction post treatment.

2. Experimental

2.1. Activated carbon production and modification - The experimental procedure for the activated carbon production, from waste PET, is detailed in a previous paper [1]. With waste cork the procedure was the same. A portion of the samples obtained was subjected to a post-treatment reduction with *sodium hydroxide or urea.* The experimental procedure was detailed in a previous paper [1,2]. The samples resulting from the modification with NaOH were designated below as PET-2-700N and cork-2-700-N. The samples resulting from the modification with urea were designated below as PET-2-700U and cork-2-700-U.

2.2. Physical and chemical characterization - All the AC were characterized structurally via nitrogen adsorption studies at 77 K, the corresponding isotherms being measured on gas adsorption manometric equipment from Quantachrome. Prior to determination of the adsorption isotherms, the samples were outgassed up to 653K over a period of 5 h using a heating rate of 1 K/min.

3. Results and Discussion - Based on previous work and according to published results [1-3], the experiments were made in acidic medium, expecting an increase of the adsorption capacity of AC when the pH solution decreases. In the case of phenol adsorption from aqueous solutions, it has been reported, that there is a decrease in the surface coverage of the AC when their surface acidity increases. For this reason we have submitted the AC to a reduction post treatment to improve the phenolic compounds adsorption. The basic character of the AC was confirmed by their point of zero charge and by the FTIR results.

4. Conclusions – The basic nature of the AC submitted to a reduction post treatment was confirmed by the higher point of zero charge. As expect, and based on the previous results, the AC modification with NaOH or with urea allowed us to increase the phenolic compounds removal.

5. References

[1] Cansado, I.P.P.; Galacho, C.; Nunes, Â.S.; M.M.L.R. Carrott and P.J.M. Carrott "Adsorption Properties of Activated Carbons Prepared from Recycled PET in the Removal of Organic Pollutants from Aqueous Solutions". Adsorption Science and Technology - in Press

[2] Carrott, P.J.M.; Carrott, M.M.L.R.; Mourão, P.A.M., 2006. "Pore size control in activated carbons obtained by pyrolysis under different conditions of chemically impregnated cork", J. Anal. Appl. Pyrolysis 75, 120–127.

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