Activated Carbons Produced from Mixtures of Synthetic Polymers by Physical and Chemical Activation: Application on MCPA Removal

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I OBJECTIVES

Production of high porous activated carbons (AC), from a synthetic polymeric mixture, with PET and PAN, by physical or chemical activation, with CO_2 and K_2CO_3.

Comparative study of the influence of textural and chemical parameters of ACs on 4-chloro-2-methylphenoxyacetic acid adsorption from the liquid phase.

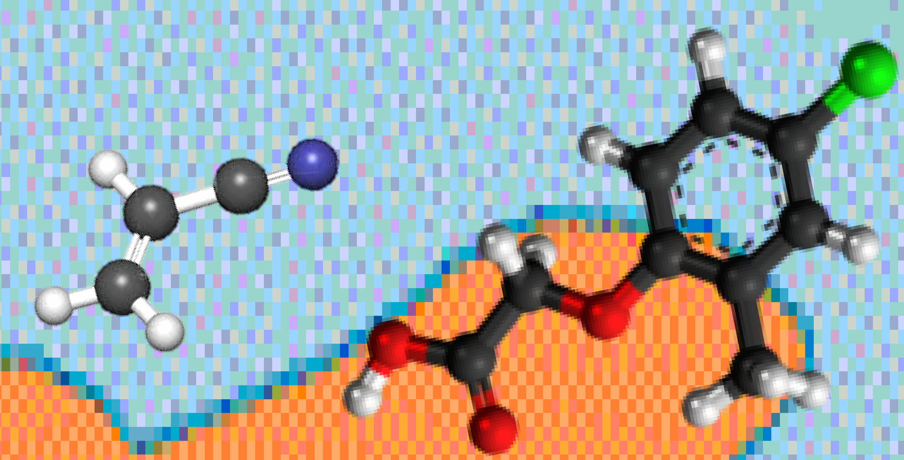
II INTRODUCTION

Pollution of surface and ground waters causes risk to human health because of the potential health hazards of its contents in organic and inorganic compounds [1-2]. Pesticides belongs to this group of hazardous compounds that may pollute water due to their extensive application in agriculture, particularly in developing countries like Timor Lorosa'e. [1]. One of the main adsorbent that famously used to remove the contamination of soils and ground water, from the widespread use of pesticides in modern agriculture, is the activated carbons. Since the presence of herbicides in water can cause serious problems in the environment and to human health, their removal from wastewaters is a crucial issue [2]. For that reasons, the research for cheaper ACs with high adsorption capacity for pesticides removal from the liquid phase still very promising.

III EXPERIMENTAL

● Production of Activated Carbons

- Synthetic polymers, such PET and PAN were used as raw materials to prepare ACs through physical and chemical activation.
- Physical activation was performed in a horizontal tubular furnace with CO_2, at 1073 K.
- Chemical activation was accomplished with K_2CO_3 at 1073 K, with a mass ratio of chemical agents/precursor = 2;

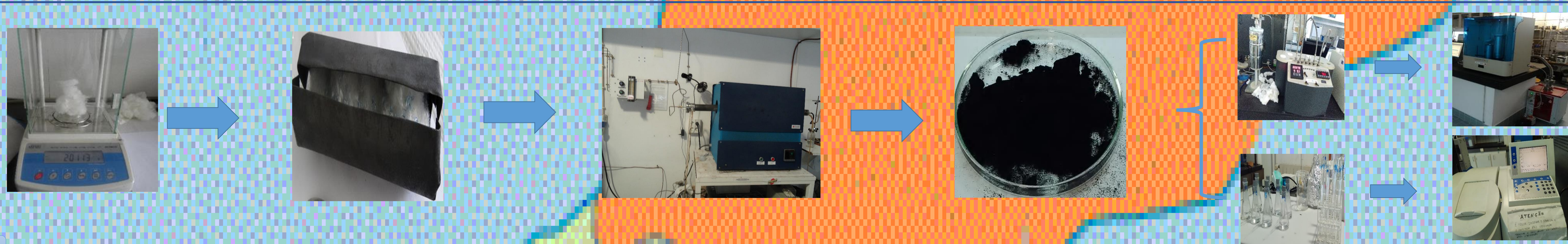


● Physical and Chemical Characterisation

- Nitrogen adsorption at 77 K, elemental analysis, Fourier transform infrared spectroscopy and point of zero charge;

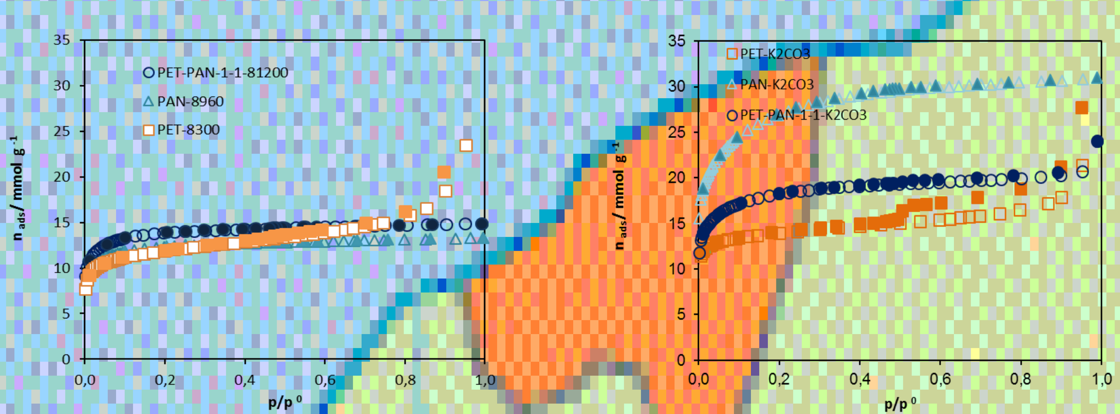
● Adsorption of pesticide, MCPA, from liquid phase

- A fixed amount of adsorbent was added to a flask containing the same volume of aqueous solutions with different initial known concentrations of MCPA. The tests were completed in a thermostated shaker bath, at 298 K, pH medium controlled and an equilibrium time of 2 days; Residual concentrations of pesticides were determined by UV-Vis;



IV RESULTS / DISCUSSIONS

● Characterisation Structural



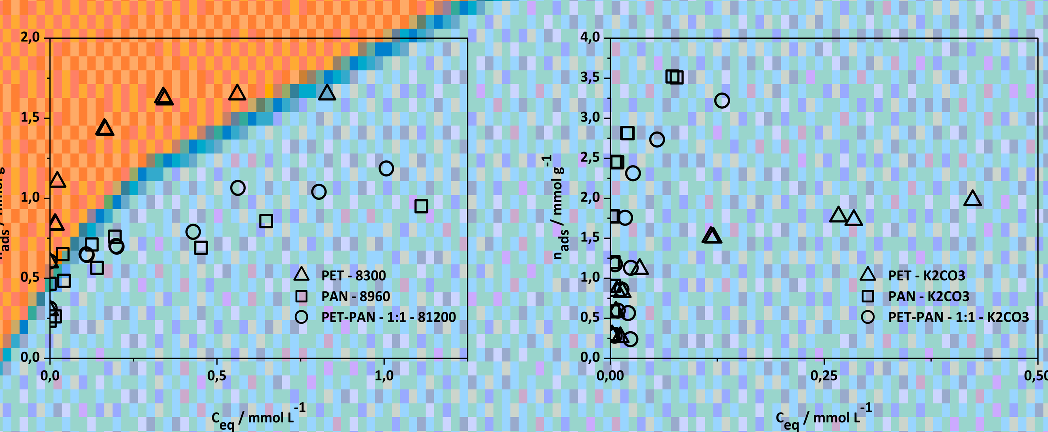
❖ **Physical activation: Type I Isotherms ⇒ microporous materials**

Micropore volume: 0.11 - 0.56 cm^3g^{-1} ; mean pore size »0.82 nm

❖ **Chemical activation: Type I Isotherms ⇒ microporous materials**

Micropore volume: 0.27-1.02 cm^3g^{-1} ; mean pore size »0.92 nm

● Adsorption of MCPA from liquid phase



Point of zero charge (pHpzc)

PET-8120 = 8.8

PET-PAN-720 = 10.8

Elemental analysis

Carbon - PAN-8240 – 61.7%
- PET-PAN-720 - 88.1%

❖ **MCPA adsorption capacity from the liquid phase**

❖ **AC physical activated**

❖ MCPA adsorption: from 1.0 mmol g^{-1} on PET-PAN-1-1-81200 to 1.65 mmol g^{-1} on PET-8300

❖ **AC chemical activated**

❖ MCPA adsorption: from 1.9 mmol g^{-1} on PET-K_2CO_3 and to 3.5 mmol g^{-1} on PAN-K_2CO_3

V CONCLUSIONS

- Using different experimental conditions, with physical activation, the three precursor allows to achieve a high microporous AC, reaching 0.56 cm^3 g^{-1}
- The chemical activation with K_2CO_3 presents a yield ranging from 21.6 to 24.5 wt% and achieved a higher porous volume reaching 1.02 cm^3 g^{-1}
- The ACs were successfully applied on the MCPA removals from the liquid phase, it must be highlighted that chemical activated carbon presented an excellent performance

VI BIBLIOGRAPHY

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Acknowledgments

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