



10º Encontro Nacional de Cromatografia

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COM O ALTO PATROCÍNIO DE SUA EXCELÊNCIA



O Presidente da República

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10º Encontro de Cromatografia

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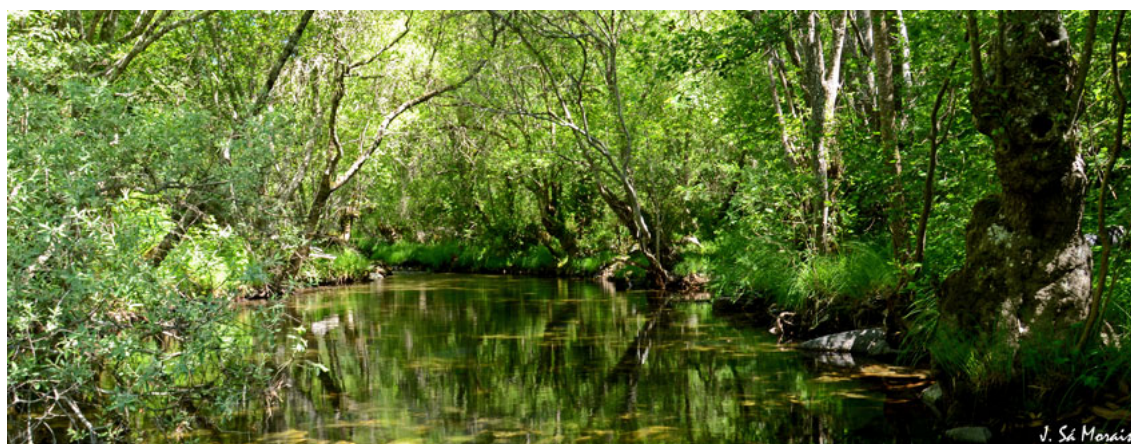
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OC-06 [Chromatographic analysis of biological samples using monolithic columns](#)
Marcela Segundo

Moderator / Moderador - Auditorium B

Marco Gomes da Silva (Universidade Nova de Lisboa)

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Sara Santos
 Engineered polymer particles for the valorization of phenolic compounds present in mixtures obtained through supercritical extraction
- OC-08 [Thermostability studies of oil-soluble cyanidin-3-glucoside dyes](#)
Catarina Gomes
- OC-09 [Adsorption equilibrium and kinetics of CO₂, CH₄ and N₂ on zeolite BETA with different cations and SiO₂/Al₂O₃ ratio](#)
Adriano Henrique
- OC-10 [Seawater degradation studies of gallic acid persulfate, a promising synthetic antifouling agent](#)
Cátia Vilas Boas
- OC-11 [BeerOmics: how can advanced gas chromatography help to understand beer aroma properties?](#)
Cátia Martins

16:30-17:00

- Coffee Break + Poster session

Moderator / Moderador - Auditorium Dionísio Gonçalves

José Manuel F. Nogueira (Universidade de Lisboa)

17:00-17:30

- EC-02 [Nexera UC Online SFE-SFC-MS System](#)
José Manuel Macias
 IZASA Scientific

17:30-18:00

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- OC-13 [Phenolic composition, antioxidant and biological activities of Portuguese vine shoot from *Touriga Nacional* and *Tinta Roriz* varieties](#)
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Adsorption equilibrium and kinetics of CO₂, CH₄ and N₂ on zeolite BETA with different cations and SiO₂/Al₂O₃ ratio

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Biogas is a gas mixture obtained by the anaerobic decomposition of organic matter, being mainly composed by methane, carbon dioxide and other compounds in minor amounts, such as nitrogen, hydrogen sulfide, water vapor and others. Due to the high quantity of methane (higher than 50%), the biogas can be used as a fuel, but, it's necessary to go through a process of purification, to remove CO₂ and transform it in biomethane (around 95%), a fuel similar to natural gas [1,2].

In this way, gas adsorption equilibrium of CO₂, CH₄ and N₂ were investigated in three different types of zeolite BETA materials namely H-BETA-25, Na-BETA-25 and H-BETA-150 at temperatures 313, 373 and 423 K under partial pressures between 0.33 and 4.16 bar. For this experimental analysis a gas chromatographic system was utilized. The isotherm data has been satisfactorily demonstrated with the Langmuir model and the amount adsorbed follows the decreasing order as CO₂ > CH₄ > N₂ for all materials used. Considering experimental temperature, all materials show better absorption at the lowest temperature (313 K) for obvious reason.

First, when we compare two zeolites containing the same SiO₂/Al₂O₃ molar ratio but different compensation cations (H-BEA-25 and Na-BEA-25), interesting results are obtained. It is found that only due to presence of Na⁺ cationic center, zeolite Na-BETA-25 adsorbed quite higher amount of gases than H-BETA-25 (2.84, 1.59 and 0.97 mol/kg, and 2.28, 1.31 and 0.83 mol/kg respectively of CO₂, CH₄ and N₂ gases at 313 K).

In second comparison between two different SiO₂/Al₂O₃ molar ratio (H-BETA-25 and H-BETA-150), zeolite H-BETA-25 adsorbed a little bit higher amount of gases than H-BETA-150 (2.23, 0.98 and 0.58 mol/kg). But when we consider selectivity of gases the zeolite H-BETA-150 (adsorbs lowest amount of gases) showed to be the best over other two materials with decreasing value in pair order CO₂/N₂ > CO₂/CH₄ > CH₄/N₂ (6.65, 3.24 and 2.05 at 313 K). The selectivity order is the same for all three zeolites at mentioned temperatures.

The mass transfer studies were made using the Zero Length Column (ZLC) technique, at 313 K. But it is very difficult to determine the mechanism that controls the diffusion onto three zeolites, as experiments are so fast that ZLC studies were made in equilibrium conditions. Accordingly, it was not possible to obtain kinetic information for the adsorbents. However, it can be said that there are no resistances to the mass transfer in the studied conditions.

References:

- [1] C.A. Grande in *Biofuel's Engineering Process Technology*, Vol. 1 (Eds.: M. A. S. Bernardes), InTech, 2011, pp. 65-84.
- [2] M. Ravina, G. Genon, *J. Clean. Prod.* 2015, 115-126.