

# 4PYCHEM



## 4<sup>TH</sup> PORTUGUESE YOUNG CHEMISTS MEETING

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UNIVERSITY OF COIMBRA  
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## P31 - Catalytic wet peroxide oxidation of highly concentrated 4-nitrophenol solutions using metal-free graphene-based materials

Rui S. Ribeiro<sup>1,\*</sup>, Adrián M.T. Silva<sup>2</sup>, Luisa M. Pastrana-Martínez<sup>2</sup>, José L. Figueiredo<sup>2</sup>, Joaquim L. Faria<sup>2</sup>, Helder T. Gomes<sup>1</sup>

LCM - Laboratory of Catalysis and Materials - Associate Laboratory LSRE/LCM

<sup>1</sup>Department of Chemical and Biological Technology, School of Technology and Management, Polytechnic Institute of Bragança, Campus de Santa Apolónia, 5300-857 Bragança, Portugal.

<sup>2</sup>Departamento de Engenharia Química, Faculdade de Engenharia, Universidade do Porto, Rua Dr. Roberto Frias, 4200-465 Porto, Portugal.

\*rui.ribeiro@ipb.pt

Graphene and its derivatives possess unique electronic, optical, thermal and mechanical properties that fascinated the scientific community in the last few years [1, 2]. At the same time, different carbon materials have been reported as metal-free catalysts for the catalytic wet peroxide oxidation (CWPO) of toxic and bio-recalcitrant organic pollutants, even when operating at high pollutant loads ( $5 \text{ g L}^{-1}$ ) [3]. In the present work, aiming to explore the structural and electronic transfer properties of graphene-based materials, exfoliated graphene oxide (GO) was prepared by the modified Hummers method [4, 5] using natural graphite as primary precursor, followed by chemical reduction processes using glucose (rGOG), hydrazine (rGOH) and vitamin C (rGOV). These rGO samples were subsequently tested as catalysts in the CWPO process, considering 4-nitrophenol (4-NP) as model pollutant, fed to the process in high concentration ( $5 \text{ g L}^{-1}$ ). In Figure 1 are the different conversion results measured for the produced rGO materials. They are all effective catalysts for the CWPO of  $5 \text{ g L}^{-1}$  4-NP solutions. The measured performances depend on their surface chemistry (better for less acidic materials) and on the amount of structural defects. Therefore, the results obtained may open a window of opportunity for the treatment of wastewaters with high pollutant concentrations by CWPO, which would be potentially more attractive for industrial applications than the typical conditions employed in CWPO, which consider pollutant concentrations in the range  $0.01\text{-}0.1 \text{ g L}^{-1}$ , and in few cases up to  $1 \text{ g L}^{-1}$ .

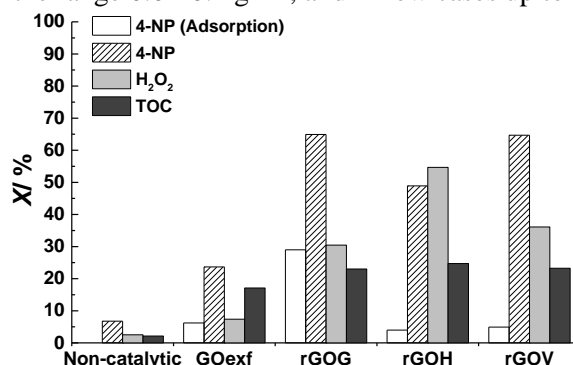


Figure 1 - 4-NP, TOC and H<sub>2</sub>O<sub>2</sub> conversion, obtained in CWPO runs performed during 24 h ( $T = 50 \text{ }^\circ\text{C}$ ,  $\text{pH } 3$ ,  $[\text{H}_2\text{O}_2] = 17.8 \text{ g L}^{-1}$  and catalyst loading =  $2.5 \text{ g L}^{-1}$ ). 4-NP adsorption removal is also shown for comparison.

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