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METAL-FREE CATALYSTS DERIVED FROM LIGNIN FOR EFFICIENT WET PEROXIDE OXIDATION

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In this work, a wheat and hemp lignin (Sarkanda, Granit S.A.) has been used as raw material for the development of metal-free activated carbons. These materials were tested in the catalytic wet peroxide oxidation (CWPO) of 4-nitrophenol (4-NP; 5 g L⁻¹) during 24 h experiments conducted at relatively mild operating conditions ($p = 1$ atm, $t = 50$ °C, pH = 3, catalyst load = 2.5 g L⁻¹ and $[H_2O_2]_0 = 17.8$ g L⁻¹).

First, the lignin was carbonized under N₂ atmosphere followed by the activation of the obtained non-porous carbon (LG) under air atmosphere at different temperatures (150 to 350 °C), leading to the generation of significant porosity. All materials present high concentration of basic groups at their surface, pointing them as appropriate for CWPO processes [1], even though the ratio basicity/acidity decreases when increasing the activation temperature. The materials activated at higher temperatures (300 and 350 °C) promoted an efficient H₂O₂ decomposition into HO• radicals, removing *ca.* 70 % of 4-NP (Figure 1). The H₂O₂ yields of homolysis ($\eta_{H_2O_2}$) observed in the elimination of the pollutant were close to 100 % in both cases. On the contrary, the materials prepared at the lower activation temperatures (150 and 200 °C) promoted a faster but inefficient H₂O₂ decomposition, conducting to a 4-NP removal lower than 25 % after 24 h. This low efficiency is mainly attributed to the formation of non-reactive species due to the recombination of the HO• radicals, and to the poor adsorption capacity of these materials, which do not favour the approximation of 4-NP to the active sites where HO• radicals are generated.

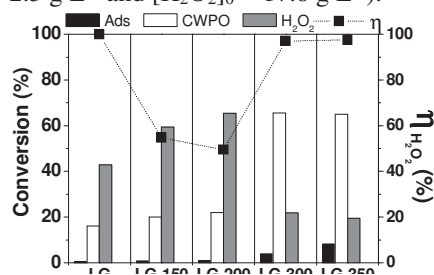


Figure 1. Removal of 4-NP by adsorption and CWPO; H₂O₂ decomposition and efficiency.

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[1] R.S. Ribeiro, A.M.T. Silva, J.L. Figueiredo, J.L. Faria, H.T. Gomes, Carbon 62 (2013) 97-108.