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# Wet peroxide oxidation of paracetamol using natural clay-based materials as catalysts

**Adriano S. Silva[1,2,3], Jose L. Diaz de Tuesta[1,2,*], Juliana G. Sgorlon[3], Marzhan S. Kalmakhanova[4], Helder T. Gomes[1,2]**

[1]Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal

[2]Laboratory of Separation and Reaction Engineering–Laboratory of Catalysis and Materials (LSRE-LCM), Faculdade de Engenharia, Universidade do Porto, Rua Dr. Roberto Frias, 4200-465 Porto, Portugal

[3]Universidade Tecnológica Federal do Paraná, R. Marcílio Dias, 635 - Jardim Paraiso, Apucarana - PR, 86812-460, Brasil

[4]M.KH. Dulati Taraz State University, Taraz. Department of Chemistry and Chemical Engineering, Tole bi 63, Taraz, Kazakhstan

**jl.diazdetuesta@ipb.pt*

In recent years, many pharmaceutical compounds have been identified worldwide at trace levels (in the order from ng·$L^{-1}$ to mg·$L^{-1}$) in the aquatic environment [1]. The presence of pharmaceutical contaminants in water, even at low concentrations, could bring harmful toxicological consequences to human beings and animals that ingested the contaminated water [2]. This work deals with the treatment of water containing paracetamol (PCM) by catalytic wet peroxide oxidation (CWPO) using clay-based materials as catalysts. PCM was considered as a model pharmaceutical emergent pollutant. For the preparation of the catalysts, natural clays from four different regions of Kazakhstan were used Akzhar, Asa, Karatau, and Kokshetau. From the clay obtained in kokshetau deposit, three catalysts were prepared: 1) natural one (KON), 2) calcined clay at 600 ºC for 5 h (KOC), and 3) a pillarized clay (KOP) with a pillaring solution containing 0.25 M $CoCl_2$, 0.5 M $FeCl_3$ and 0.5 M NaOH, resulting in OH/(Fe+Co) = 2:1. Additionally, three clays were prepared by the same procedure of pillarization from the Akzhar, Asa and Karatau natural clays, resulting in AKP, ASP, and KAP, respectively. The concentration of PCM, $H_2O_2$ and total organic carbon (TOC) were followed during the CWPO experiments (Fig. 1). All materials revealed high catalytic activity, the non-pillared samples allowing to remove more than 33.4% of PCM after 24 h of reaction time under the following operating conditions: 80 °C, initial pH 3.5, $C_{catalyst}$ = 2.5 g $L^{-1}$, $C_{PCM}$ = 100 mg $L^{-1}$ and $C_{H_2O_2}$ = 472 mg $L^{-1}$. The CWPO runs done with the pillared clay catalysts resulted in more than 90% of removal of the pollutant after 24 h of reaction. The best catalyst was KOP since it leads to the complete removal of the pollutant after 8 h of reaction time and to the highest abatement of TOC (>60%) under the same operational conditions.

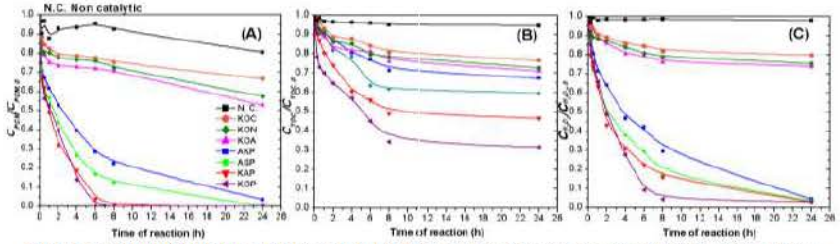


**Fig.1** Concentration of A) PCM, B) TOC and C) $H_2O_2$ against time of reaction.

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