CARBOCATVIII

8TH INTERNATIONAL SYMPOSIUM ON CARBON FOR CATALYSIS

PORTO, PORTUGAL

JUNE 26 – 29, 2018

Book**of**Abstracts

CARBOCATVIII

26-29 JUNE 2018

VIII International Symposium on
Carbon for Catalysis

Porto - Portugal

VIII INTERNATIONAL SYMPOSIUM ON CARBON FOR CATALYSIS
ALMEIDA GARRETT MUNICIPAL LIBRARY, PORTO (PORTUGAL)

ISBN
978-989-8124-22-7 (Digital edition)

Editors
José L. Figueiredo
Joaquim L. Faria
Bruno F. Machado
Adrián M.T. Silva
Cláudia G. Silva
Manuel F. Pereira
Raquel Rocha
Salomé Soares

Edition

Sociedade Portuguesa de Química

Design

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This book of abstracts was produced from the works submitted directly by the authors. Only minor editing changes were introduced, which in no way altered the scientific content. The final online version was established for the VIII International Symposium on Carbon for Catalysis according to the published template. The authors are responsible for the scientific content of their abstracts.

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CATALYTIC ACTIVITY OF CARBON BASED MATERIALS DEVELOPED FROM COMPOST DERIVED FROM MUNICIPAL SOLID WASTE

Jose L. Diaz de Tuesta[1,2], Caroline M. Masso[1,3], Juliana M.T. de A. Pietrobelli[3], Paulo Praça[4], Adrián M.T. Silva[2], Joaquim L. Faria[2], Helder T. Gomes[1,2,*]

[1] *Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, 5300-253 Bragança, Portugal.*
[2] *Laboratory of Separation and Reaction Engineering - Laboratory of Catalysis and Materials (LSRE-LCM), Faculdade de Engenharia, Universidade do Porto, 4200-465 Porto, Portugal.*
[3] *Universidade Tecnológica Federal do Paraná, Campus Ponta Grossa. Av. Monteiro Lobato, S/N. Km 04. Jardim Carvalho 84016-210 - Ponta Grossa, PR – Brasil.*
[4] *Resíduos do Nordeste, EIM, S.A. Empresa Intermunicipal, Mirandela, 5370-340, Portugal.*
**htgomes@ipb.pt*

In waste processing facilities equipped with mechanical biological treatment (MTB) systems, the municipal solid waste (MSW) is typically separated in organic residues, recyclable waste and rejects. The organic fraction is then treated by anaerobic digestion, obtaining biogas and a compost that can be used in agriculture. However, the current waste management legislation in Europe and the expected developments regarding the coming directives on the application of the "End-of-waste" criteria, are leading to barriers on the use of fertilizers resulting from waste [1]. Within this context, the current work proposes an alternative strategy to the valorisation of compost, through the production of high-added value materials to be used in catalytic processes. To this aim, a compost obtained from a MTB plant for MSW was considered in the formulation of carbonaceous materials prepared from glycerol, a low-cost by-product obtained in biodiesel production [2]. The composition of the compost used is summarized in Table 1. As can be observed, the content in organic matter is roughly 50%.

Table 1. Indicative composition of compost

Species	Mass composition
Moisture	29.6%
Organic matter	48.8%
Alkaline	7.1%
Iron	*ca.* 1%

In a first step, the compost was mixed with water (1 litter of water per 100 g of compost) and washed at room temperature, in order to homogenize the material and remove suspended solids. Then, carbon materials were prepared by partial carbonization of a mixture of carbon precursors (glycerol and compost), adapting the experimental procedure described elsewhere [2]. Mixtures of glycerol (99 wt.%) and compost (3:1, 1:1, 1:3) were contacted with H_2SO_4 (96-98 wt.%) in the ratio 80 g per 20 g of carbon precursors, at 180 ºC for 20 min. The resulting materials were calcined under nitrogen flow (100 $cm^3\ min^{-1}$) at 120, 400 and 600 ºC during 60 min at each temperature, and then at 800 ºC for 240 min, obtaining the G3C1, G1C1 and G1C3 samples according with the glycerol:compost mass ratio considered. In addition, another sample was prepared using only compost as precursor, following the same procedure, resulting in the C1 sample. The synthesized materials were assessed as catalysts in the decomposition of H_2O_2 (17.8 g/L) at room temperature by using a catalyst load of 2.5 g/L in aqueous phase (initial pH = 3).

The burn-off of the samples was found to be in the range 70.2-76.3% (measured as weight loss from the sum of compost and glycerol masses). The conversion of H_2O_2 obtained in the H_2O_2 decomposition experiments, using the carbon-based materials as catalysts, are depicted in Figure 1.

As can be observed, the materials prepared are catalytically active for H_2O_2 decomposition. When compared to the non-catalytic run, a visible increase in the conversion of H_2O_2 is seen. In addition, this conversion is increased when using simultaneously compost and glycerol precursors in the synthesis of the materials, when compared to the synthesis with only compost (Figure 1) or only glycerol [2], as precursors.

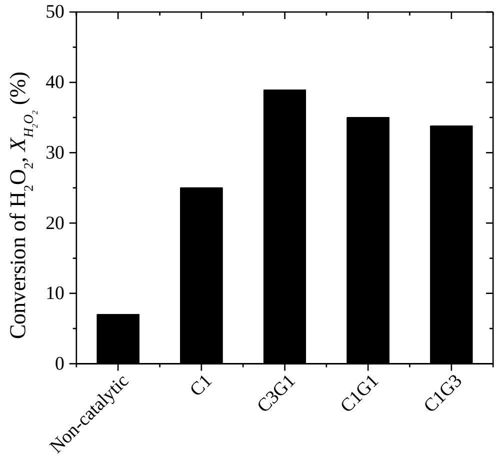

Figure 1. Hydrogen peroxide conversions at 24 h under the following conditions: room temperature, $pH_0 = 3$, $[H_2O_2]_0 = 17.8$ g/L and [catalyst] = 2.5 g/L.

Acknowledgements. This work is a result of projects: VALORCOMP, funded by FEDER through Programme INTERREG V A Spain - Portugal (POCTEP) 2014–2020; "AIProcMat@N2020 - Advanced Industrial Processes and Materials for a Sustainable Northern Region of Portugal 2020", with the reference NORTE-01-0145-FEDER-000006, supported by NORTE 2020, under the Portugal 2020 Partnership Agreement, through FEDER; and POCI-01-0145-FEDER-006984 – Associate Laboratory LSRE-LCM funded by FEDER through COMPETE2020 - POCI – and by national funds through FCT.

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