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This volume contains the extended abstracts presented at the 13th International Chemical and Biological Engineering Conference (CHEMPOR 2018), held in Aveiro - Portugal, from the 2nd to the 4th of October, 2018.

University of Aveiro & Ordem dos Engenheiros

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Engineering Conference
(CHEMPOR 2018)**

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Edited by:

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Inês Portugal

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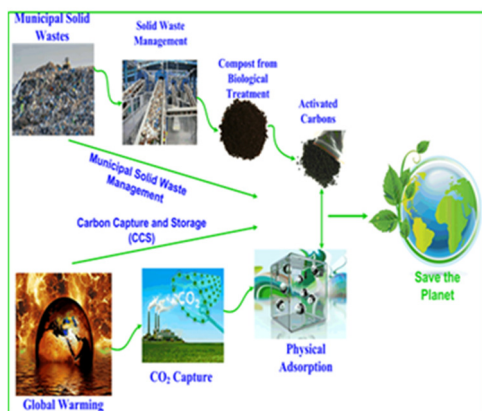
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Thermally and chemically activated biochar obtained in mechanical biological treatment plants for carbon dioxide adsorption

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In this study, based on the scopes of CCS strategy and municipal solid waste management, a novel Integrated Environment Management (IEM) strategy has been proposed. In this way, the obtained compost in the mechanical biological treatment from municipal solid wastes has been considered as a source of adsorbents for CO₂ capture. In this way, the matured compost waste was modified by liquid phase treatment with sulfuric acid and thermal treatment at 800 °C. Then, the prevalent operational conditions of post-combustion processes have been considered to find the best prepared samples for CO₂ capture.

Introduction

In the recent years, synthesis, preparation and development of valuable carbon materials have received much interest in the view of energy efficiency and sustainability for various applications in CO₂ capture, wastewater treatment and gas storage studies [1, 2]. On the other hand, based on European legislation to management of solid wastes and limiting the utilization of fertilizers from waste as well as finding approaches to manage these materials, novel approaches are required [3]. In this study, obtained compost by mechanical biological treatment plant from municipal solid waste has been considered as a source of activated carbons. Then, by using sulfuric acid (H₂SO₄) and treating at 800 °C, chemically and thermally activations, respectively, were implemented on the prepared samples.

Objectives

In this work, based on the scopes of CCS technique and municipal solid waste management a novel strategy has been proposed. In this way, the obtained compost in the mechanical biological treatment from municipal solid wastes has been considered as a source of adsorbents for CO₂ capture.

Experimental

The employed compost was obtained in mechanical biological treatment plants for municipal solid waste, supplied by the company "Resíduos do Nordeste, EIM". In order to homogenise and remove the soluble compounds and suspended solids, the compost was first mixed with water and washed. Then, two different materials were prepared by carbonization at 400 (C-400) and 800 °C (C-800). In addition, following the procedure previously described [4], two materials were prepared with H₂SO₄ before and after the carbonization at 800 °C (C-S-800 and C-800-S, respectively). Then, breakthrough measurements of CO₂ carried by He were conducted at post-combustion conditions (1 bar and 40-100 °C).

Results and Discussion

The equilibrium data for CO₂ adsorption were collected using breakthrough method in a fixed bed reactor at the post-combustion operational conditions. Figure 1 shows the uptake

capacity of prepared samples at 40 °C. The results show the prepared sample by the subsequent treatments with acid sulfuric and thermal calcination has the higher uptake capacity than other ones and literature reports; which it can derived from several factors. First, better textural properties of proposed sample, including: higher external surface area (S_{ext}), microporous surface area (S_{microp}) and external surface area (S_{ext}). It can be also ascribed for desorption of weak superficial groups as consequence of the thermal treatment at 800 °C.

Conclusions

In this study, the potential of municipal solid wastes as a source of adsorbents for CO₂ capture were investigated at the post-combustion operational conditions. Then, the breakthrough measurements in the fixed bed adsorption column were performed. The equilibrium adsorption capacity of the considered samples revealed that the adsorption capacity of the sample which has been treated with the subsequent treatments with acid sulphuric and thermal calcination is the best one. Finally, the results proved the proposed strategy is a proper tactic for two of main current challenges of mankind, including: CO₂ capture to reduce the global warming also to control the accumulation of waste on landfills.

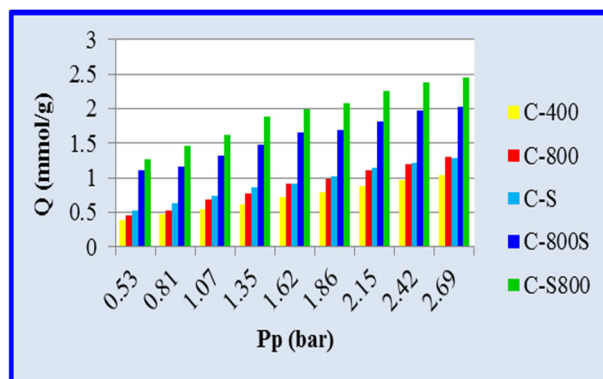


Figure 1: Uptake capacity of prepared sample at 40 °C and different pressures.

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