**Fixed Bed Adsorption and Breakthrough Modelling of Activated Porous Carbon Derived from Compost for Post-Combustion CO2 Capture**

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**Highlights**

* Novel adsorbents were synthesized from derived compost in mechanical biological treatment.
* 5-samples were activated chemically and thermally in different procedures.
* Breakthrough experiments were performed in a fixed bed column.

**1. 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, the obtained compost by mechanical biological treatment plant from municipal solid waste has been considered as a source of adsorbents for CO2 capture.

**2. Methods**

The compost used was obtained in mechanical biological treatment plants for municipal solid waste, supplied by the company “Resíduos do Nordeste, EIM”. In order to homogenize 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 (CMSW-400) and 800 ºC (CMSW-800). In addition, two materials were prepared with H2SO4 before and after the carbonization at 800 ºC (CMSW-S-800 and CMSW-800-S, respectively). Then, breakthrough measurements of CO2 were carried at post combustion conditions (40ºC and 1-5 bar).

**3. Results and discussion**

Figure 1 shows the uptake capacity of proposed samples at 40 ºC. 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. Frist, better textural properties of proposed sample, including: higher external surface area (), microporous surface area () and external surface area (). It can be also ascribed for desorption of weak superficial groups as consequence of the thermal treatment at 800 ºC.



**Figure 1.** A comparison between CO2 uptake capacity (mmol/g) of investigated adsorbents at 40 0C.

**4. 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 sulfuric and thermal calcination is the best one and its uptake capacity is comparable with commercial carbon materials. The results proved the proposed strategy can be a green route for integrated management of environment.

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