15th - 19th September 2019
Florence Italy

BOOK of ABSTRACTS

12th European Congress of Chemical Engineering
ECCE 12

5th European Congress of Applied Biotechnology
ECAB 5

BRIDGING SCIENCE WITH TECHNOLOGY

A Renaissance in Chemical Engineering

www.ecce12-ecab5.org

Venue:
Florence, Italy
Fortezza da Basso
Piazza Adua, 1, 50123 Firenze (Italy)

Date:
From September 15 to September 19, 2019

Organized by:
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CONTENT

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PREFACE

The Event is organized by AIDIC, the Italian Association of Chemical Engineering, under the auspices of the European Federation of Chemical Engineering (EFCE), as well as of the European Society of Biochemical Engineering Science (ESBES).

EFCE scientific congresses and symposia are the heart of its activities. The first EFCE European Congress was held in 1997 in Florence, organized also at that time by AIDIC; and it marked the start of a grand journey of growth. The European Congress of Chemical Engineering has now become a biennial and world-famous event, attended by scientists, researchers, teachers, students, industry professionals, owners, contractors and suppliers from all the continents, who can interact, share, debate, collaborate and inspire one another, bringing chemical engineering expertise on an unprecedented scale to a single location.

A few years ago ESBES joined EFCE for the organization of the European Congress, thereby widening their scope and their field of application. ESBES contribution to the topics of the Florence 2019 Congress is particularly relevant, due to the importance that biotechnology is taking and will take in research, society and industry.

The joint Congresses ECCE12 (the 12th European Congress of Chemical Engineering) and ECAB 5 (the 5th European Congress of Applied Biotechnology) and the associated events stand under the common theme of

Bridging Science with Technology : a Renaissance in Science

The scientific content of both the congresses ECCE12 and ECAB 5 is set under the governance of EFCE and ESBES Working Parties and Sections.
The conferences cover a wide range of research themes under the umbrella of Chemical Engineering and Applied Biotechnology. The topics treated by WPs and Sections are all those ones typical of Chemical Engineering and Applied Biotechnologies, from the classical ones, like process simulation and reactor design, to the most current ones, like nanotechnologies, bio-fuels, bio-catalysts, food and water, that represent the challenges of the future and are of interest to everybody.

MAIN TOPICS

ECCE12

1 SUSTAINABLE PROCESSES
2 PARTICLE TECHNOLOGY
3 PRODUCTION , PROPERTIES AND TECHNOLOGY OF NEW MATERIALS
4 NANOTECHNOLOGY
5 SEPARATION TECHNOLOGY AND HEAT & MASS TRANSFER
6 THERMODYNAMICS AND INTERFACIAL PHENOMENA
7 FLUID MECHANICS AND TRANSPORT PHENOMENA
8 MULTIPHASE SYSTEMS
9 MEMBRANE ENGINEERING : Energy from salinity gradients, Hybrid artificial organs
10 INDUSTRIAL ELECTROCHEMISTRY
11 PROCESS SYSTEM ENGINEERING
12 CHEMICAL REACTION ENGINEERING
13 BIOMASS
14 FOOD ENGINEERING
15 ENERGY AND CHEMICAL ENGINEERING
16 ENVIRONMENT, SAFETY & QUALITY
17 QUALITY ASSURANCE, CONTROL & MANAGEMENT SYSTEMS
18 KNOWLEDGE, EDUCATION & TRAINING

ECAB5

ADVANCED AND INNOVATIVE TECHNOLOGY IN INDUSTRIAL
19 BIO-PRODUCTION, BIO-SEPARATION, AND BIO-DETECTION (BIOSENSORS)
BIOENERGY, BIOFUELS&RENEWABLES, BIORESOURCES,
20 BIOREFINERY AND BIOMATERIALS (BIO-ACTIVE COMPOUNDS, BIOFUELS, FINE CHEMICALS)
21 BIOCATALYSIS (FUTURE MICROBES AND ENZYMES)
22 NOVEL PROCESSING (E.G. MICROBIAL FUEL CELLS), DOWNSTREAM PROCESSING
23 FROM SMALL TO LARGE (NANO-BIOTECHNOLOGY, SCALE-UP/SCALE DOWN, LARGE-SCALE PRODUCTION)
24 SYSTEMS BIOTECHNOLOGY AND METABOLIC ENGINEERING
25 PROTEIN AND ENZYME STABILITY
26 ENVIRONMENTAL BIOTECHNOLOGY
27 BIOFILMS IN INDUSTRY AND BIOMEDICINE
28 CHEMICAL PRODUCT DESIGN AND BIOPRODUCTS
29 BIOECONOMY
30 BIOREACTOR PERFORMANCE
31 DOWNSTREAM PROCESSING
32 FOOD BIOPROCESSES
33 MICROALGAE BIOENGENEERING
34 MODELLING, MONITORING, MEASUREMENT & CONTROL
35 REGENERATIVE MEDICINE MANUFACTURING

The scientific programme of ECCE12-ECAB5 features more than 1200 Lecture and Poster presentations, including 6 plenary lectures and 8 keynote lectures by outstanding Researchers.
This Book of Abstracts consists of a summary of the topics treated and listed in the Congresses.

The Organizers

ECCE12
The 12th EUROPEAN CONGRESS OF CHEMICAL ENGINEERING
Florence 15-19 September 2019

Fixed Bed Adsorption and Breakthrough Modelling of Activated Porous Carbon Derived from Compost for Post-Combustion CO_2 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 CO_2 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 CO_2 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 H_2SO_4 before and after the carbonization at 800 ºC (CMSW-S-800 and CMSW-800-S, respectively). Then, breakthrough measurements of CO_2 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 (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 ºC.

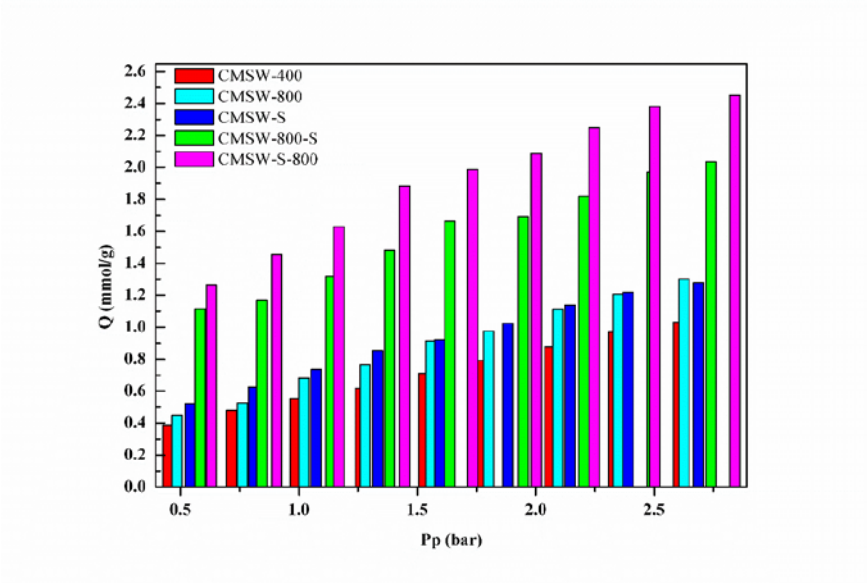

Figure 1. A comparison between CO_2 uptake capacity (mmol/g) of investigated adsorbents at 40 ^{0}C.

4. Conclusions

In this study, the potential of municipal solid wastes as a source of adsorbents for CO_2 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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