

# Book of Abstracts



## *Symposium on Chemical and Biological Engineering*



# Book of Abstracts

of the

## Symposium on Chemical and Biological Engineering

**Editors:**

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## Advancing Science & Technology for a Sustainable World

Symposium on Chemical and Biological Engineering

This volume contains the peer-reviewed and accepted abstracts presented at the Symposium on Chemical and Biological Engineering, of the 6<sup>th</sup> Doctoral Congress in Engineering – DCE25, held at the Faculty of Engineering of the University of Porto (FEUP), between June 30<sup>th</sup> and 1<sup>st</sup> July, 2025.

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# WELCOME

## Message from the Symposium Organizing Committee

We welcome all participants to the Symposium on Chemical and Biological Engineering, held in the scope of the 6th Doctoral Congress in Engineering (DCE25), hosted at the Faculty of Engineering of the University of Porto (FEUP), Portugal, on the 30<sup>th</sup> June and 01<sup>st</sup> July 2025.

This Symposium is organised by PhD students of the Doctoral Program in Chemical and Biological Engineering (PDEQB) at FEUP, with the support of the Associate Laboratory ALiCE, which brings together the R&D units CEFT, LEPABE, and LSRE-LCM.



The Symposium covers a wide range of fields of Chemical and Biological Engineering, aligned with the UN Sustainable Development Goals. The programme includes both oral and poster presentations, mainly focused on the following topics:

- Biological Engineering and Biotechnology
- Reaction and Separation Processes
- Energy and Environment
- Product Engineering
- Catalysis and Carbon Materials
- Analytical Chemistry
- Transport Phenomena
- Biorefinery and Sustainability
- Innovative Materials and Applications
- Modelling, Synthesis and Integration of Chemical Processes

We would like to thank the invited speakers for their kind participation and for sharing their insights and expertise, which significantly enriched the scientific quality of the event.

The Symposium received 115 submissions, which were reviewed with the support of the Scientific Committee, resulting in 44 oral presentations and 71 poster presentations.

We would like to extend our thanks to all the authors for their valuable contributions, the Scientific Committee for their dedication and assistance during the review process, the DCE Organising Committee for their commitment and hard work, and the Associate Laboratory ALiCE for their support.

We hope this Symposium will inspire productive discussions, new ideas, and future collaborations.

Porto, June 2025

The Symposium Organizing Committee

## OC 10. Hybrid CNT-Zeolite catalysts: a new approach to convert lipid sources into sustainable aviation fuel (SAF)

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### Abstract

The aviation industry faces increasing pressure to cut down greenhouse gas emissions, making sustainable aviation fuel (SAF) production from lipid sources a promising solution. However, some challenges still remain, including the full deoxygenation of triglycerides and subsequent cracking and isomerization reactions to achieve the target C<sub>8</sub>–C<sub>16</sub> hydrocarbons [1]. Developing a tandem catalytic system is therefore essential. In this context, carbon nanotubes (CNT) offer excellent textural properties, while zeolites provide the acidity needed for cracking, isomerization and aromatization, making them excellent supports for the reactions mentioned. Thus, this work aimed to develop a new methodology for synthesizing catalysts by combining CNT and H-ZSM-5 via ball-milling. Hybrid supports were prepared using different CNT:H-ZSM-5 ratios (1:1, 1:2, 2:1, 4:1), milled at 10 s<sup>-1</sup> for 60 min. Co and Mo (2.5% and 10.5%, respectively) were then impregnated, followed by drying at 110 °C overnight. The catalysts were treated at 600 °C under N<sub>2</sub> and H<sub>2</sub> flows (3 h in each gas) and named CoMo/xCNyHZ (x = CNT content; y = H-ZSM-5 content). Moreover, the materials were characterized by N<sub>2</sub> adsorption at 196 °C and Raman spectroscopy. The catalytic tests were assessed in a batch reactor, loaded with 100 mg of catalyst and 500 mg of palmitic acid (lipid model compound) in 50 mL of n-decane. The reactions were performed at 325 °C, with 20 bar of initial H<sub>2</sub> pressure for 3 h. The liquid products were analysed by GC-MS. The supports showed predominantly mesoporosity, favorable for the reactions. Raman spectroscopy showed a shift toward higher wavenumbers in the CNT/H-ZSM-5 materials compared to the ball-milled and original CNT, demonstrating the interaction between the zeolite and CNT. Analyzing the catalytic results, CoMo/1CN2HZ promoted excessive cracking, producing preferentially C<sub>1</sub>–C<sub>6</sub> hydrocarbons. On the other hand, CoMo/1CN1HZ showed a more balanced SAF-range distribution. Higher CNT content favored alkane and isomer production. CoMo/2CN1HZ showed a promising result, with 22 % of C<sub>8</sub>–C<sub>16</sub> iso-alkanes, 12 % of C<sub>8</sub>–C<sub>16</sub> alkanes and 6 % of aromatics.

### Acknowledgments

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### References

[1] R. Arundhathi et al. (2024). Catal. Today 442, 114895.