DCE 25 6th DOCTORAL CONGRESS IN ENGINEERING

DOCTORAL CONGRESS IN ENGINEERING

# Book of Abstracts

## *Symposium on Chemical and Biological Engineering*

U.PORTO
FEUP FACULDADE DE ENGENHARIA UNIVERSIDADE DO PORTO

DCE 25 6th DOCTORAL CONGRESS IN ENGINEERING

# Book of Abstracts

of the

# Symposium on Chemical and Biological Engineering

**Editors:**
Alexandra Pinto, João Lemos, José Barbosa, Marcelino Fernandes,
Rita Marques, Sahar Abdolbaghi, Sofia Brandão,
Thais Berberich, Vânia Oliveira

Porto
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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 6th Doctoral Congress in Engineering – DCE25, held at the Faculty of Engineering of the University of Porto (FEUP), between June 30th and 1st 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 30th June and 01st 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

# PC 62. Comparative Evaluation of Carbon-Based Catalysts for the Conversion of Cellulose to Ethylene Glycol

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## Abstract

Ethylne glycol (EG) is a valuable chemical intermediate used in the production of high-demand products such as polyester fibres and cosmetics[1]. However, its synthesis relies heavily on fossil fuels. Cellulose, the most abundant biopolymer on Earth, represents a renewable and sustainable feedstock for EG production through catalytic conversion. To improve the environmental and economic viability of this process, biomass-derived carbons have emerged as promising low-cost alternatives to expensive commercial catalysts. Therefore, this study investigates the synthesis and performance of carbon-supported Ni-W catalysts prepared using glucose, glucose/carbon nanotubes (CNT) composites, and fruit peels (banana and orange) as carbon sources.

The carbon supports were synthesised via hydrothermal carbonisation (HTC), followed by either pyrolysis at 700 °C under inert ($N_2$) atmosphere for 3 h or physical activation under $CO_2$ atmosphere at 900 °C for 4 h. Afterwards, Ni and W were introduced onto the supports by incipient wetness impregnation followed by the appropriate reduction treatments.

The catalytic performance was evaluated in the one-pot hydrolytic hydrogenation of cellulose. The reaction was carried out in a 1000 mL stainless steel Parr reactor containing 300 mL of water, 750 mg of ball-milled cellulose, and 300 mg of catalyst. The system was heated under $N_2$ atmosphere to 205 °C, followed by pressurisation with hydrogen (50 bar) to initiate the reaction. The reaction mixture was collected over time and analysed using high performance liquid chromatography (HPLC) and total organic carbon (TOC). The catalyst structure and composition were characterised by several techniques.

All catalysts achieved complete cellulose conversion. Activated glucose-derived carbons yielded a higher EG selectivity (60-62 %)[2, 3] in comparison to the carbonised sample (50 %)[2] and the fruit peel-derived catalyst (45 %)[4]. Despite its lower EG yield, the latter exhibited superior stability, maintaining its performance over four cycles without loss in activity and selectivity, unlike the other samples analysed.

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### References

[1] J. Song et al. (2024). Catalysts, 14(10), 685.
[2] L.S. Ribeiro et al. (2024). Sustain. Energy Fuels, 8, 4588-4601.
[3] R.G. Morais et al. (2024). Molecules, 29(16), 3962.
[4] L.S. Ribeiro et al. (2025). Cellulose. DOI: 10.1007/s10570-025-06464-4