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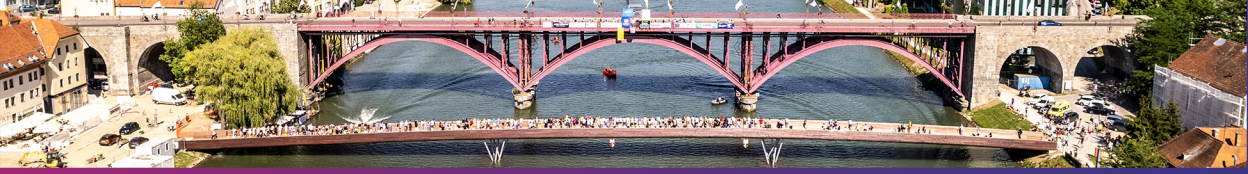
# 20<sup>th</sup> European Meeting on

# Supercritical Fluids

Book of Abstracts



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# 20<sup>th</sup> European Meeting on Supercritical Fluids

Book of Abstracts

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**Željko Knez**

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# Foreword

ŽELJKO KNEZ

Dear attendees.

On behalf of all organizers, I am pleased to welcome you to the **20<sup>th</sup> European Meeting on Supercritical Fluids** (EMSF 2024). This year, **EMSF 2024** is a joint meeting of the International Society for the Advancement of Supercritical Fluids (**ISASF**) and the European Federation of Chemical Engineering (**EFCE**) Working Party on High Pressure Technology (**WP HPT**) Event No. 807.

The conference will encompass various subjects, from **fundamental studies** to **practical applications**, offering insight into the state-of-the-art work being carried out by researchers from around the world.

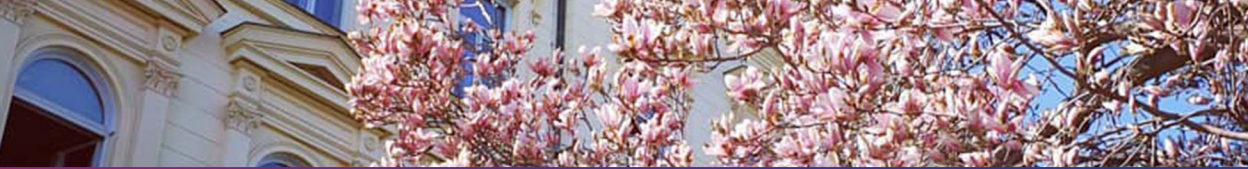
The conference program pages present a selected collection of topics highlighting the latest research and advances in supercritical fluids and high-pressure engineering. We invite you to explore the diverse topics covered in this conference program and the exciting possibilities offered by supercritical fluids. Whether you are an experienced practitioner or a newcomer to the field, we hope that both the lectures

and the posters will inspire you and stimulate new ideas for future research and collaboration.

I would like to thank all the participants for sharing their insights with us, the Organizing and Scientific Committees members, the reviewers, the donors and sponsors, and the volunteers whose work made EMSF 2024 possible.

Sincerely,

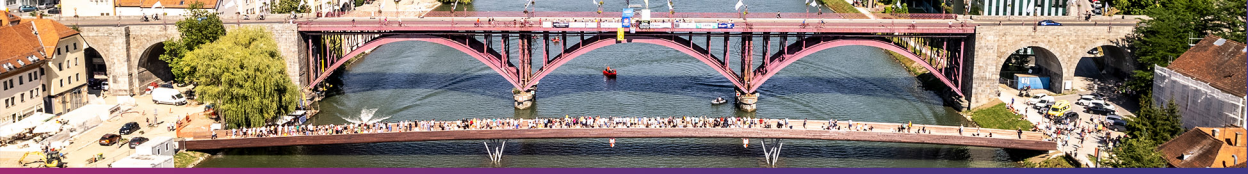




ORAL  
**ABSTRACTS**



**20<sup>th</sup> European Meeting on  
Supercritical Fluids**  
Maribor, Slovenia, May 26 - 29, 2024





# Syngas production from organic fraction of municipal solid waste by supercritical water gasification

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Rapid population growth increases waste generation and energy consumption. According to the World Bank Report, global waste generation is estimated at 2,200 million tons annually by 2025, and energy demand is expected to increase sixfold following the current trend [1]. Nowadays, the Organic Fraction of Municipal Solid Waste (OFMSW) are either disposed in landfills or, at most, used for anaerobic digestion or composting, although, considering that food wastes consist mainly of carbohydrates, lignin, proteins, lipids, and organic acids, there is potential to valorize their organic content within a circular economy framework. In this context, sustainable waste management becomes crucial for generating revenue through the conversion of waste into energy, material recovery, valuable substances, and recycling methods. Various technologies have been devised to transform biomass and other waste into environmentally friendly energy sources, encompassing fuel, heat, electricity, and organic fertilizer [2,3].

The supercritical water gasification (SCWG) process involves the conversion of organic compounds to gaseous products in an aqueous system, under conditions above its critical point (i.e., 374 °C and 22.1 MPa) [4]. Beyond the critical point, both

the density and viscosity decrease, enhancing the diffusivity and reducing transport limitations. Moreover, the reaction kinetics increase, because of the high temperatures, favoring cracking of heavy organic compounds to light ones [5]. A high-quality syngas is obtained as a result of the gasification of OFMSW. To minimize the cost-effectiveness of SCWG, diverse heat sources can be employed, including renewable sources. Among them, solar thermal energy appears the most suitable. In the context of this study, the heat necessary for promoting SCWG is supplied by Fresnell solar thermal collectors modified and adapted for high-pressure fluids and stored in an innovative heat-storing system. In this way, the exploitation of two different renewable sources, as the solar thermal energy and the solid wastes, can reduce the operational costs significantly, encouraging the application of this technology at an industrial scale.

In the present study, a 500 mL lab-scale reactor was used to investigate the gasification of OFMSW with supercritical water. A real organic waste was preliminarily minced, homogenized, and, finally, diluted with water. The gasification tests were carried out at 400°C and 25 MPa. At the end of the test, the products were analyzed, to determine the composition of the produced syngas and liquid/solid residues. The effects were investigated of the reaction time and of the water/waste weight ratio on the final product. The results showed the production of a good-quality syngas with a high hydrogen percentage (up to 30% mol/mol) and with an H<sub>2</sub>/CO ratio around 4, demonstrating that the SCWG of OFMSW could represent a feasible method for syngas production.

The present work was carried out within the framework of the "SUNGAS" project, Action 1.1.5 of the P.O. F.E.S.R. Sicily 2014-2020.

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# 20<sup>TH</sup> EUROPEAN MEETING ON SUPERCRITICAL FLUIDS (EMSF 2024): BOOK OF ABSTRACTS

ŽELJKO KNEZ, MILICA PANTIĆ,  
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The 20th European Meeting on Supercritical Fluids (EMSF 2024) was hosted by the Faculty of Chemistry and Chemical Engineering of the University of Maribor from 26 May to 29 May 2024 in Maribor, Slovenia. The EMSF 2024 was a joint event of the International Society for the Advancement of Supercritical Fluids (ISASF) and the European Federation of Chemical Engineering (EFCE) Working Party on High Pressure Technology (WP HPT) Event No. 807. This symposium provided an excellent opportunity for engineers, chemists, physicists, food technologists, and biologists to meet and discuss new ideas, review ongoing challenges, present potential solutions, and identify future issues related to high pressure technologies and supercritical fluids. The aim of the meeting was to deepen connections between researchers, establish new contacts, and promote synergies and partnerships between researchers. The symposium presented the latest advances in high-pressure process technologies that can contribute to the further development of the field.

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**Ključne besede:**  
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# 20<sup>TH</sup> EUROPEAN MEETING ON SUPERCRITICAL FLUIDS (EMSF 2024): KNJIGA POVZETKOV

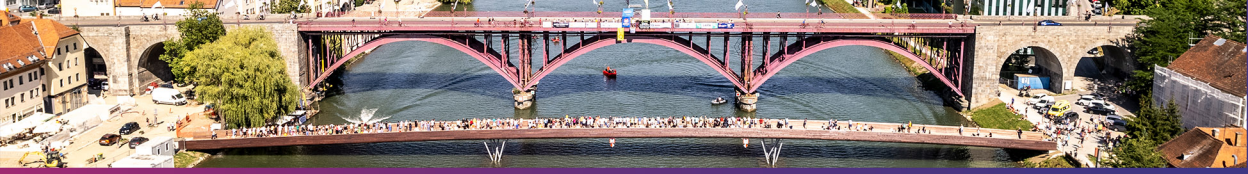
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Fakulteta za kemijo in kemijsko tehnologijo Univerze v Mariboru je gostila 20. Evropsko srečanje o nadkritičnih tekočinah (EMSF 2024), ki je potekalo od 26. do 29. maja 2024 v Mariboru, Slovenija. EMSF 2024 je skupno srečanje Mednarodnega združenja za napredek madkritičnih tekočin (ISASF) in Evropske zveze za kemijsko inženirstvo (EFCE) za visokotlačno tehnologijo (WP HPT), dogodek št. 807. Ta simpozij je bil odlična priložnost, da se inženirji, kemiki, fiziki, živilski tehnologi in biologi srečajo in razpravljajo o novih idejah, pregledajo trenutne izzive, predstavijo možne rešitve in opredelijo prihodnja vprašanja, povezana z visokotlačnimi tehnologijami in nadkritičnimi tekočinami. Cilj srečanja je bil poglobiti povezave med raziskovalci, vzpostaviti nove stike ter spodbujati sinergije in partnerstva med raziskovalci. Na simpoziju so bili predstavljeni najnovejši dosežki na področju visokotlačnih procesnih tehnologij, ki lahko prispevajo k nadaljnjemu razvoju področja.



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