

REPORT

2nd TwiNSol-CECs Workshop

Advanced Water Treatments in Emerging Contaminants Mitigation with Cutting-Edge Technologies

University of Novi Sad, Faculty of Technology Novi Sad (TFNS)

Novi Sad, Serbia

June 6-7, 2024

The second TwiNSol-CECs Workshop “Advanced Water Treatments in Emerging Contaminants Mitigation with Cutting-Edge Technologies” was organized by TFNS in Novi Sad, Serbia, on June 6-7, 2024, as a part of dissemination activities planned within Work Package no. 6 “Dissemination, communication, and outreach activities” of the TwiNSol-CECs project (GA 101059867).

As a Chair of the Workshop, Prof. Zita Šereš, explained in her introductory words during the opening of the Workshop, the aim of this event was to bring together scientists and experts focused on, but not limited to, the issues on removal of contaminants of emerging concern (CECs) from water by innovative technologies. Since „Cutting-Edge Technologies” in water treatment are part of the focus in TwinSol-CECs project, the 2nd Workshop highlighted three key innovative technologies: membrane processes, advanced oxidation, and biosorption. Each of these technologies offers unique and effective approach for removing micropollutants and CECs from water. These innovative technologies, each with its distinct advantages, represent significant advancements in the quest for clean and safe water. By integrating these methods, more comprehensive and effective strategies for managing water quality and protecting public health can be developed. Beyond these topics, the Workshop also served as a forum for exchanging research ideas, exploration of complementarities and possibilities for collaboration, contributing to the harmonization of research and innovation efforts crucial for the sustainable transition envisioned by the Horizon Europe and Green Deal calls towards a zero-pollution and toxic-free environment.

Thematic areas of the Workshop were:

- ❖ biosorption, membrane, and catalytic-based processes for wastewater treatment;
- ❖ linking sustainable development principles and wastewater treatment processes;
- ❖ analysis of environmental contaminants, including CECs;
- ❖ environmental and human health relevancy of CECs determination.

The Scientific Committee of the Workshop consisted of researchers from 7 countries (in alphabetic order):

Prof. Sandra Budžaki, Josip Juraj Strossmayer University of Osijek, Faculty of Food Technology Osijek, Croatia

Prof. Joao Crespo, NOVA University Lisbon, NOVA School of Science and Technology, Portugal

Dr. Marijana Dragosavac, Loughborough University, Chemical Engineering, UK
Prof. Nataša Đurišić Mladenović, University of Novi Sad, Faculty of Technology Novi Sad, Serbia
Dr. Marinella Farre, IIQAB-CSIC, Department of Environmental Chemistry, Spain
Prof. Ivana Ivančev Tumbas, University of Novi Sad, Faculty of Sciences, Department of Chemistry, Biochemistry and Environmental Protection, Serbia
Prof. Laszlo Zsuzsanna, University of Szeged, Faculty of Engineering, Department of Process Engineering, Hungary
Dr. Nikola Maravić, University of Novi Sad, Faculty of Technology Novi Sad, Serbia
Prof. Barbaros Özer, Harran University, Faculty of Agriculture, Department of Food Engineering, Turkey
Prof. Biljana Pajin, University of Novi Sad, Faculty of Technology Novi Sad, Serbia
Prof. Marina Šćiban, University of Novi Sad, Faculty of Technology Novi Sad, Serbia

The members of the Organizing Committee were (in alphabetic order):

Dr. Igor Antić, University of Novi Sad, Faculty of Technology Novi Sad, Serbia
Dr. Maja Buljovčić, University of Novi Sad, Faculty of Technology Novi Sad, Serbia
Dr. Ivana Lončarević, University of Novi Sad, Faculty of Technology Novi Sad, Serbia
Dr. Dragana Lukić, University of Novi Sad, Faculty of Technology Novi Sad, Serbia
Dr. Nikola Maravić, University of Novi Sad, Faculty of Technology Novi Sad, Serbia
Dr. Ivana Nikolić, University of Novi Sad, Faculty of Technology Novi Sad, Serbia
Dr. Sanja Panić, University of Novi Sad, Faculty of Technology Novi Sad, Serbia
Dr. Mirjana Petronijević, University of Novi Sad, Faculty of Technology Novi Sad, Serbia
Dr. Jovana Petrović, University of Novi Sad, Faculty of Technology Novi Sad, Serbia
Dušan Rakić, MSc, University of Novi Sad, Faculty of Technology Novi Sad, Serbia
Prof. Dragana Šoronja – Simović, University of Novi Sad, Faculty of Technology Novi Sad, Serbia
Jelena Šurlan, MSc, University of Novi Sad, Faculty of Technology Novi Sad, Serbia
Dr. Vesna Vasić, University of Novi Sad, Faculty of Technology Novi Sad, Serbia

The Workshop was organized as a 2-day medium-scale scientific event targeting from the very beginning about 40-50 participants in accordance to the planned venue, the Blue Hall of TFNS. The number of registered participants for the 2nd Workshop was 60 coming from 22 institutions from 9 countries (Portugal, Hungary, Croatia, India, Slovenia, Italia, UK, North Macedonia, and Serbia). The first day of the Workshop started with the opening ceremony, which was also covered by the local media. During the ceremony of the official opening, Prof. Biljana Pajin, Dean of the Faculty of Technology Novi Sad welcomed all the participants, while Prof. Zita Šereš, the Workshop Chair and also a Vice Dean for Science of TFNS, emphasized the importance of the TwiNSol-CECs project, as the largest project in the last ten years at TFNS, and also shared the impressions from the previous, 1st TwiNSol-CECs Workshop organized in 2022.

The morning session of the Workshop started with the plenary lectures of the outstanding researchers:

- Prof. João G. Crespo from *LAQV-Requimte, Department of Chemistry, FCT - NOVA University of Lisbon*, who gave a lecture on "Ion-Exchange Membrane Processes: Perspectives in Water Treatment and Desalination", and
- Prof. Olívia Salomé G. P. Soares from *Faculty of Engineering, University of Porto*, presented "Catalytic advanced oxidation processes for pollutants degradation".

After the plenary lectures, the participants had the opportunity to get to know each other better through networking during the coffee break.

The morning session continued with 3 invited lectures (Program of the Workshop is attached to this Report, Annex I). After the lunch break, the participants had the opportunity for further discussion during the poster session which included 22 poster presentations (listed in the Program attached to the Report).

The afternoon session of the first day of the Workshop included a series of invited (2) and oral (4) presentations of registered participants on research topics of interest for the project in accordance to the Workshop Agenda (in Annex I of the Report).

The morning session of the second day of the Workshop started with the plenary lecture given by:

- Dr. Vanessa Pereira from the *iBET, Instituto de Biologia Experimental e Tecnológica, Oeiras, Portugal*, entitled "Mitigating Anticancer Drug Pollution: Nanofiltration for Control of Emerging Contaminants in Wastewater Effluents".

Afterwards, 5 invited and 2 oral presentations were given according to the Workshop Agenda (Annex I), followed by the lunch break. The afternoon session of the second day of the Workshop included 2 invited and 2 oral presentations of registered participants.

Before signing the attendance list, all participants were informed that by signing the list they would also granted the permission and consent to TwiNSol-CECs team for the use of the any photograph(s) or electronic media images taken/made at the 2nd TwiNSol-CECs Workshop for presentation under any legal use.

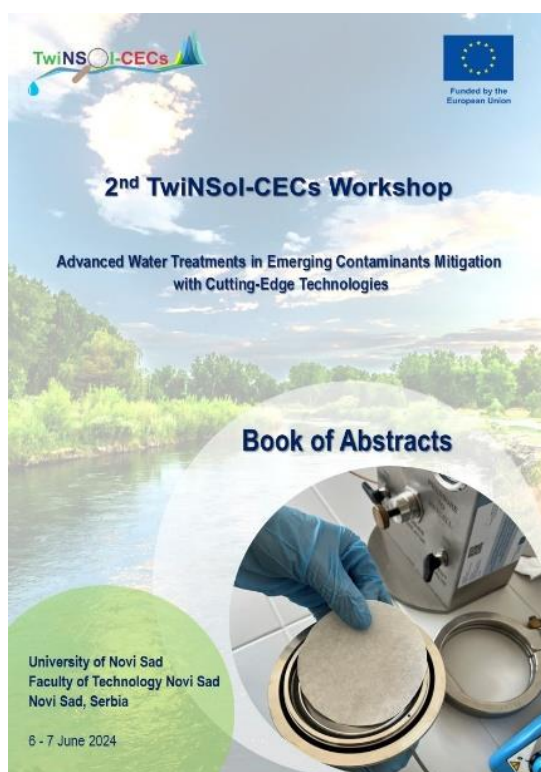
During the registration, all participants were provided with the registration pack free of charge, containing the prepared project promotional material (the project newsletter no. 1, pencil, and a notebook, all with obligatory visual elements for identifying the funding source and the project itself), packed in the bag decorated with the project and EU logo together with the printed agenda of the Workshop.

An electronic version of the Book of Abstracts was published with ISBN and catalogization data obtained in accordance to the official procedure for Cataloguing in Publication (CIP) by the Matica Srpska Library. The electronic version of the Book of Abstracts of the 2nd TwiNSol-CECs Workshop is available on the internet page of TwiNSol-CECs project (https://twinsol-cecs.com/images/documents/news_and_events/book_of_abstracts-2nd_twinsol-cecs_workshop.pdf). It has been also uploaded to the open repository Zenodo:

<https://zenodo.org/records/11485380>

In order to promote the "seeding" effect of TwiNSol-CECs, the promotional materials of recent national projects (started in 2024) and dedicated to various aspects of environmental micropollutants, in which also TFNS members of TwiNSol-CECs have been involved, were displayed to the Workshop participants. Valuable experience of TFNS researchers gained from the TwiNSol-CECs proposal preparation to the execution of different tasks in close collaboration with the eminent researchers from the EU partners inevitably have had positive impact on further research within domain of environmental pollution and mitigation, which can be also measured through successful evaluation of the following research proposals/projects as those funded by the Science Fund of Serbia.

Selected photos took during the Workshop sessions are available in Annex II of the Report.



Cover page of the 2nd TwiNSol-CECs Workshop Book of Abstracts available at
https://twinsol-cecs.com/images/documents/news_and_events/book_of_abstracts-2nd_twinsol-cecs_workshop.pdf

and

<https://zenodo.org/records/11485380>

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Annex I Agenda

Thursday – 6 June 2024

Morning session, Faculty of Technology Novi Sad, Blue Hall

- 9:00 – 10:00 Registration
- 10:00 – 10:15 Official opening, Biljana Pajin, Dean of the Faculty of Technology Novi Sad, and Zita Šereš, Chair of the Workshop
- Plenary lectures (30 min per lecture + 5 min for Q&A after each lecture):*
- 10:15 – 10:50 João G. Crespo, Sylwin Pawlowski, Svetlozar Velizarov – **Ion-Exchange Membrane Processes: Perspectives in Water Treatment and Desalination**
- 10:50 – 11:25 Olívia Salomé G. P. Soares – **Catalytic advanced oxidation processes for pollutants degradation**
- 11:25 – 11:55 *Coffee break*
- Invited lectures (15 min per lecture + 5 min for Q&A after each lecture):*
- 11:55 – 12:15 Sanja Panić, Mirjana Petronijević, Igor Antić, Jelena Živančev, Maja Buljovčić, Nataša Đurišić-Mladenović – **Heteroatom-doped pyrochar for efficient metal-free catalytic oxidation of contaminants of emerging concern**
- 12:15 – 12:35 Minja M. Boğunović, Ivana I. Ivančev-Tumbas – **Hybrid adsorption/membrane filtration in water treatment for the removal of organic micropollutants**
- 12:35 – 12:55 Nandor Nemestothy, Merve Visnyei, Veronika Kalauz-Simon, Peter Bakonyi – **Gaseous Byproducts in Wastewater Treatment: Challenges and Opportunities with Membrane Technology**
- 13:00 – 14:00 *Lunch*
- 14:00 – 14:30 *Poster session with Coffee*

Afternoon session, Faculty of Technology Blue Hall

- Invited lectures (15 min per lecture + 5 min for Q&A after each lecture):*
- 14:30 – 14:50 Snežana Maletić, Jelena Beljin, Irina Jevrosimov, Tamara Apostolović, Srđan Rončević, Marijana Kragulj Isakovski – **The contribution of inoculated biochar to pesticide adsorption and biosorption**
- 14:50 – 15:10 Djordja V. Kerkez, Milena R. Bečelić-Tomin, Anita S. Leovac Mačerak, Dragana D. Tomašević Piliipović, Dejan Krčmar, Nataša S. Slijepčević, Vesna Z. Pešić – **Sludge application on land: Opportunities and challenge**

Oral presentations (10 min per lecture + 5 min for Q&A after each lecture):

- 15:10 – 15:25 Szabolcs Kertész, Imre Vajk Fazekas, Martin Trancsik, Aws N. Al-Tayawi, József Richárd Lennert, Sándor Beszédes, József Csanádi, Tamás Szabó, Cecilia Hodúr, Gábor Veréb, Zsuzsanna László – **Enhancing the efficiency of low-pressure membrane separations using 3d printed spacers**
- 15:25 – 15:40 Aws N. Al-Tayawi, Hajnalka Csott, Nikolett Sz. Gulyás, József Richárd Lennert, Zsuzsanna Horváth Hovorka, Zsuzsanna László, Cecilia Hodúr, Szabolcs Kertész – **Evaluation of flow dynamics utilizing integrated 3d printed turbulence promoters for mitigation of membrane fouling**
- 15:40 – 15:55 Jelena Molnar Jazić, Tajana Simetić, Marijana Kragulj Isakovski, Aleksandra Tubić, Jasmina Agbaba – **Advanced oxidation processes for natural organic matter and emerging contaminants abatement in water treatment**
- 15:55 – 16:10 Jasmina Nikić, Malcolm A. Watson, Maja Vujić, Jovana Pešić, Jovana Jokić–Govedarica, Srđan Rončević, Jasmina Agbaba – **Addressing arsenic contamination: a polymer-based nanocomposite for water treatment**

Friday – 7 June 2024

Morning session, Faculty of Technology Blue Hall

9:00 – 10:00 Registration

Plenary lectures (30 min per lecture + 5 min for Q&A after each lecture):

10:00 – 10:30 Maria B. Cristóvão, Jorge Bernardo, Andreia Bento-Silva, Maria R. Bronze, João G. Crespo, Vanessa J. Pereira – **Mitigating Anticancer Drug Pollution: Nanofiltration for Control of Emerging Contaminants in Wastewater Effluents**

Invited lectures (15 min per lecture + 5 min for Q&A after each lecture):

10:30 – 10:50 Nikola Maravić, Zita Šereš, Jelena Šurlan, Nataša Đurišić-Mladenović, Igor Antić, Jelena Živančev, Carla Brazinha, Claudia F. Galinha, João G. Crespo – **Removal of acetaminophen and clarithromycin from water samples using nanofiltration and reverse osmosis**

10:50 – 11:10 Vesna M. Vasić, Dragana V. Lukić, Marina B. Šćiban – **Sewage sludge biochar as a sorbent for contaminants of emerging concerns removal from water**

11:10 – 11:30 Gábor Veréb, Laura Fekete, Tímea Miklós, Kata Fejes, Renáta Kovács, Ákos F. Fazekas, Erika Nascimben Santos, Szabolcs Kertész, Sándor Beszédes, Cecilia Hodúr, Zoltán Jákói, Gábor Kovács, Zsolt Pap, Tamás Gyulavári, Klára Hernádi, Zsuzsanna László – **TiO₂/CNT-**

modified pvdf composite membranes for enhanced membrane filtration of oily wastewaters

11:30 – 12:00 *Coffee break*

12:00 – 12:20 Dragana, V. Lukić, Vesna, M. Vasić, Marina, B. Šćiban – **Multicomponent adsorption kinetics of micropollutants onto lignocellulosic biosorbents**

12:20 – 12:40 Nenad R. Grba – **Nano-geopolymer based remediation techniques for purification of different type of groundwater with high Mn, Fe and other metals/metalloids (As) content**

Oral presentations (10 min per lecture + 5 min for Q&A after each lecture):

12:40 – 12:55 Zoltán P. Jákói, Cecilia Hodúr, Sándor Beszédes – **Dielectric monitoring in wastewater-treatment and sludge utilization processes**

12:55 – 13:10 Maja Vujić, Vasiljević Sanja, Tajana Simetić, Jelena Molnar Jazić, Marijana Kragulj Isakovski, Jasmina Agbaba, Aleksandra Tubić – **Adsorption kinetics of organic pollutants on microplastic fibers in water**

13:10 – 14:10 *Lunch with coffee*

Afternoon session, Faculty of Technology Blue Hall

Invited lectures (15 min per lecture + 5 min for Q&A after each lecture):

14:10 – 14:30 Ferenc E. Kiss – **Lessons learnt from life cycle assessment of advanced wastewater treatment processes**

14:30 – 14:50 Igor Antić, Jelena Živančev, Maja Buljovčić, Dušan Rakić, Nataša Đurišić-Mladenović – **Role of a high-resolution mass spectrometry in investigating processes for removal of contaminants of emerging concern from water**

Oral presentations (10 min per lecture + 5 min for Q&A after each lecture):

14:50 – 15:05 Marija Šobić, Mirjana Petronijević, Sanja Panić, Igor Antić, Jelena Živančev, Milan Tomić, Nataša Đurišić-Mladenović – **Removal of micropollutants from water using hydrochar obtained with process water recirculation**

15:05 – 15:20 Arijit Nath, Geremew Geidare Kailo, Abraham Amankwaa, Gabriella Kiskó, András Koris – **Production of Bioactive (Antioxidant and Antibacterial) Peptides from Soybean Milk Proteins by an Enzymatic Membrane Reactor**

15:20 – 15:40 Concluding remarks

Poster presentations (set-up: June 6, 11:25 – 11:55, dismantling: June 7, 13:10 – 15:40)

- P1** APPLICATION OF PHYSICALLY ACTIVATED BIOCHAR FOR THE REMOVAL OF PHENOL FROM WATER
Aleksandra Adamović, Mirjana Petronijević, Saša Savić, Sanja Panić, Sanja Petrović, Nataša Đurišić-Mladenović
- P2** POTENTIAL OF HYDROCHAR AS BIOSORBENT FOR HEAVY METAL IONS REMOVAL FROM WATER
Marco Barbanera, Alessandro Cardarelli, Vesna M. Vasić, Dragana V. Lukić
- P3** INFLUENCE OF SELECTED CARRIER MATERIALS ON NATURAL COAGULANT PRODUCTION YIELD
Sanja Cojbasic, Maja Turk Sekulic, Jelena Prodanovic
- P4** APPLICATION OF LEDs IN UV/CHLORINE AOPs FOR THE TREATMENT OF AQUEOUS SOLUTIONS OF POPs SUCH AS PHARMACEUTICALS
Anett Čović, Luca Farkas, Constance Csaplár, Teodóra Dragić, Tünde Alapi
- P5** PREDICTION THE PHOTOCATALYTIC DEGRADATION RATE OF DICLOFENAC BY ARTIFICIAL NEURAL NETWORKS
S. Roy, L. Das Samanta
- P6** ACTIVATION OF PEROXYMONOSULFATE WITH BIOCHAR - ADSORPTION AND ELIMINATION OF TRIMETHOPRIM ANTIBIOTIC FROM WATERS
Dinesh Chandola, Erik Sinkovics, Zsuzsanna László, Tünde Alapi
- P7** COMBINED ION EXCHANGE AND MICROFILTRATION
Marijana Dragosavac
- P8** LIGNIN DERIVED FROM CYNARA CARDUNCULUS AS AN EFFICIENT BIOSORBENT FOR CHROMIUM(VI) ION REMOVAL FROM WATER
Jorge Gominho, Ana Lourenço, Ricardo A. Costa, Duarte M. Neiva, Vesna M. Vasić, Dragana V. Lukić, Marina B. Šćiban
- P9** JUTE FABRIC WASTE AS A PROMISING ADSORBENT FOR HEAVY METAL IONS AND ORGANIC DYES: A COMPREHENSIVE REVIEW
Aleksandra M. Ivanovska
- P10** REMOVAL OF PHENOL FROM WATER BY USING FREE AND IMMOBILIZED HORSE RADISH PEROXIDASE CATALYZED PROCESS
Milan P. Nikolić, Slobodanka Stanojević-Nikolić
- P11** PRODUCTION OF ANTIOXIDANT AND ANTIBACTERIAL PEPTIDES FROM SOYBEAN MEAL BY AN ENZYMATIC MEMBRANE REACTOR
Arijit Nath, Geremew Geidare Kailo, Abraham Amankwaa, Gabriella Kiskó, András Koris
- P12** APPLICATION OF LIGNOCELLULOSIC BIOSORBENT FOR SUGAR JUICE PURIFICATION IN FIXED-BED COLUMN
Lidija E. Perović, Jelena A. Miljanić, Julija Šupljika, Ivan Zdjelarević, Nikola R. Maravić, Zita I. Šereš

- P13** REMOVAL OF CONTAMINANTS OF EMERGING CONCERN FROM WATER USING UV-H₂O₂ ADVANCED OXIDATION PROCESS
Mirjana Petronijević, Sanja Panić, Jelena Živančev, Igor Antić, Dušan Rakić, Nataša Đurišić-Mladenović
- P14** Cu²⁺ ADSORPTION FROM AQUEOUS SOLUTION BY WASTE EGGSHELL POWDER
Sanja Petrović, Saša Savić, Mirjana Petronijević, Bratislav Todorović, Staniša Stojiljković
- P15** PHENOL REMOVAL FROM WATER SOLUTION USING PEROXIDASE EXTRACTED FROM POTATO PEEL
Saša Savić, Sanja Petrović, Mirjana Petronijević
- P16** THE MICROPLASTIC IS VISIBLE BY FLUORESCENCE UNDER STEREOMICROSCOPE
Živa Kolenc, Kaja Adamek, Sonja Smole Možina, Anja Klančnik
- P17** THE ADVANTAGE OF LPM LAMPS EMITTING AT 185 NM - A SIMPLE SOLUTION TO ENHANCE THE EFFICIENCY OF PHOTOCHEMICAL WATER POST-TREATMENT PROCESS FOR ELIMINATING NON-BIODEGRADABLE ORGANIC POLLUTANTS
Tünde Alapi, Anett Čović, Luca Farkas, Réka Bíró, Gyöngyi Orosz
- P18** INACTIVE BIOMASS OF THE FUNGUS *Ganoderma applanatum* AND ITS BIOSORPTIVE POTENTIAL FOR REMOVING MALACHITE GREEN FROM WASTEWATER
Natalija Velić, Marija Stjepanović, Jelena Vukoje, Janez Gorenšek, Sandra Budžaki, Marta Ostojčić
- P19** EFFECT OF SODIUM CHLORIDE ON THE REMOVAL OF PHARMACEUTICALLY ACTIVE COMPOUNDS FROM WATER BY A REVERSE OSMOSIS MEMBRANE
Jelena Šurlan, Zita Šereš, Nikola Maravić, Nataša Đurišić Mladenović, Igor Antić, Jelena Živančev, Carla Brazinha, João G. Crespo
- P20** PRELIMINARY PRODUCTION COST ESTIMATION FOR BIOSORBENTS DERIVED FROM PEACH STONES
Danijela Z. Stefanović, Marija R. Miladinović, Biljana S. Đorđević, Milan D. Kostić, Olivera S. Stamenković
- P21** ADSORPTION EFFICIENCIES OF INDIAN NEEM LEAVES FOR REMOVAL OF CONGO-RED DYE FROM AQUEOUS SOLUTION FOR SUSTAINABLE ENVIRONMENT
Radharani Das, Ishita Sinha, Soumyajit Maity, Subhojit Ash
- P22** ADSORPTIVE REMOVAL OF Cr (VI) FROM SYNTHETIC WASTES USING AGRICULTURAL WASTES: A GREEN APPROACH
Radharani Das, G. Roymahapatra, Ishita Sinha, Soumyajit Maity, Subhojit Ash

Annex II

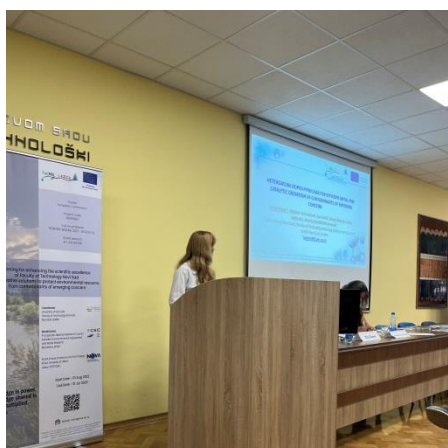
Selected photos took during the Workshop



The opening ceremony: speech of Prof. Biljana Pajin, Dean of TFNS, also a leader of TwINSol-CECs WP6 (up) and Prof. Zita Šereš, Chair of the Workshop and Vice Dean for Science of TFNS (down)



Plenary lectures of Prof. Dr. João G. Crespo (left) and Prof. Dr. Olívia Salomé G. P. Soares (right) during the morning session of the 1st day of the Workshop



Invited lectures of Dr. Sanja Panić (up left), Prof. Nandor Nemestothy (up right), and Dr. Minja Bogunović (down)



Lunch break during the 2nd Workshop



Details from the 2nd Workshop poster session



Invited lecture of Prof. Dr. Djurdja Kerkez (left) and oral presentation of Prof. Dr. Szabolcs Kertész (right)



Plenary lecture of Prof. Dr. Vanessa Pereira during the morning session of the 2nd day of the Workshop



Invited lectures of Dr. Nikola Maravić (up left), Dr. Dragana Lukić (up right), and Dr. Nenad Grba (down)



Invited lectures of Dr. Ferenc Kiss (left) and Dr. Igor Antić (right)



Local TV crew recording Prof. Zita Šereš statement on the 2nd Workshop before the official start of the Workshop



The Workshop registration desk with TFNS members of TwINSOL-CECs team responsible for the participants' registration (left) and the registration pack (right)

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