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Abbreviations

AI	Artificial Intelligence
CECs	Contaminants of Emerging Concern
CSIC	Spanish National Research Council, Institute of Environmental Assessment and Water Research
EGD	European Green Deal
ERA	European Research Area
ESRs	early-stage researchers
GA	Grant Agreement
GC	Gas Chromatography
GC/MS	Gas Chromatography–Mass Spectrometry
HRMS	High-Resolution Mass Spectrometry
iBET	Instituto de Biologia Experimental e Tecnológica
IDAEA	Institute of Environmental Assessment and Water Research of the Spanish National Research Council (CSIC)
LC	Liquid Chromatography
LC-MS/MS	Liquid Chromatography with Tandem Mass Spectrometry
MS	Mass Spectrometry
MSCA	Marie Skłodowska-Curie Actions
NOVA ITQB	Instituto de Tecnologia Química e Biológica António Xavier at UNL
NTA	Non-Targeted Analysis
PCA	Principal Component Analysis
PFAS	Per- and Polyfluoroalkyl Substances
PhACs	Pharmaceutically Active Compounds
PST	Project Steering Team
SSA	Suspect Screening Analysis
TFNS	Faculty of Technology Novi Sad
TU Delft	Delft University of Technology
UNL	NOVA University of Lisbon
WP	Work Package

Table of content

1. Executive summary

This deliverable provides an overview of the activities conducted after the Mid-term Report on the performed trainings of researchers from University of Novi Sad, Faculty of Technology Novi Sad (TFNS) within the TwiNSol-CECs project, including the upgrade of TFNS equipment, online and onsite trainings within the consortium partnership, but not limited to it, as additional options for the upgrade of the knowledge and practice outside of the consortium ("external" trainings) appeared in the meanwhile based on the new links formed during the TwiNSol-CECs activities. The focus remained on reinforcing TFNS research capacities in the domain of advanced analytics and innovative removal technologies for Contaminants of Emerging Concern (CECs).

The document gives background information on the planned reinforcement activities in the Introduction section, followed by description of upgrade of the TFNS equipment for widening the scope of the CECs research and on the performed onsite/online trainings given by the researchers from the partner institutions, Institute of Environmental Assessment and Water Research of the Spanish National Research Council (CSIC) and Nova University of Lisbon, NOVA School of Science and Technology (UNL), but also by outstanding researchers outside the TwiNSol-CECs consortium. In the second reporting period, 3 onsite trainings were organized: 1 trainings at CSIC, and 2 trainings at UNL. TFNS researchers attained 5 external trainings/summer schools.

The deliverable D3.4 is the public document, and it is based on continuously prepared reports on each TwiNSOl-CECs training session organized in the second reporting period, which have been published at the project website; these reports are appropriately linked (cited) throughout this document. In the Annexes of D3.4, the programs of each onsite TwiNSol-CECs training session are presented.

2. Introduction

To step up the excellence of TFNS resources in environmental protection research, the TwiNSol-CECs project foresees reinforcement of human and material capacities. WP3 focuses on transferring advanced knowledge from EU partners CSIC and UNL through onsite and online trainings, practical sessions, and equipment upgrades. The reinforcement is expected to enable gaining of knowledge and skills of the TFNS researchers necessary to tackle the challenges related to CECs, which will influence positively the level of the TFNS integration in the EU networks of excellence, also making the region of Western Balkans more visible within the European Research Area (ERA). This corresponds to the general goal of the project as it targets the harmonization of advanced research and innovation efforts important for the overall faster and sustainable transition of whole Europe foreseen by European Green Deal (EGD) towards zero-pollution, toxic free environment. Enhancement of scientific competences and raising the research profiles of TFNS (senior and early-stage) researchers are planned to be realized by intensive networking with the EU project partners, CSIC and UNL, through performing different joint activities, which are gathered within WP3 - Reinforcing research knowledge and skills of TFNS.

Online and onsite trainings are part of these WP3 activities foreseen as an events of the knowledge- and skill- transfer from CSIC and UNL to the TFNS researchers (both senior and early-stage researchers (ESRs), including PhD students) in domain of the CECs research or on complementary issues important for multidisciplinary approaches in large international research consortia. The training activities are gathered under the Task 3.2 of WP3, which is divided into several subtasks:

Subtask 3.2.1 - Meetings for preparation of the trainings

Subtask 3.2.2 - Organization of the onsite trainings at TFNS

Subtask 3.2.3 - Organization of practical trainings at CSIC and UNL

According to Annex I of Grant Agreement (GA), it was planned to cover different topics in domain of CECs analysis during the onsite trainings at TFNS by CSIC researchers, such as:

- sample preparation and targeted analysis of main group of contaminants of emerging concern in complex samples,
- introduction to suspected screening and non-target analysis by LC and GC coupled to HRMS,
- suspected screening of relevant CECs groups such as micro- and nanoplastics,
- environmental and human health relevancy of CECs determination in water, environmental and food samples,
- introduction to biomonitoring of CECs.

Some of the topics that have been planned originally to be covered by UNL trainers during the onsite trainings at TFNS are:

- adsorption and membrane processes for the removal of organic contaminants from water,
- UV and solar radiation-based processes for CECs degradation,
- linking sustainable development principles and wastewater treatment processes,
- process monitoring, automation, and advanced control,

- data acquisition and data analysis (including machine learning techniques, when appropriate).

For the onsite trainings at CSIC and UNL, the fixed amount of budget ("grant") is planned per trainee to cover the costs of travel and stay, so it is planned that Committee for Trainings' Grant Approval will be in charge of the trainees' selection based on their motivation letters and CVs (i.e. the main research field). In total, 5 "grants" are planned for the trainings at CSIC and 7 at UNL; additionally, visit of 3 senior TFNS researchers to CSIC are also included in WP3 based on the approved modifications of the project description.

The online trainings are planned to be held as sessions supporting the corresponding onsite trainings and whenever the transfer of knowledge is necessary for enabling continuous research at TFNS.

Additionally, upgrading of the existing advanced analytical instruments at TFNS is planned by GA, enabling the broadening of the CECs-related research at TFNS:

a) installation of a special software with integrated set of MS libraries, for processing of HRMS data is planned, allowing suspect screening besides the already proven target analysis at TFNS (reported in the Mid-term report on performed trainings),

b) installation of pyrolitic unit on the existing GC/MS will enable additional analysis towards characterization of solid particles, including qualitative analysis of microplastics in water samples, and of various biomaterials (e.g. biochar or other biomass-based products, which are planned to be studies as a "green" adsorbents for the CECs removal from water in WP4) (reported in the Mid-term report on performed trainings),

c) upgrade of the existing membrane systems to improve the TFNS's technical capabilities for conducting high-pressure-driven processes, such as nanofiltration of water samples for the removal of CECs. One upgrade was reported in the Mid-term Report on Performed Trainings, while the continuation of another unit's upgrade is presented hereafter.

A part of the training sessions is planned to cover the work with the upgraded equipment at TFNS.

The first reporting period (August 2022 – October 2023)[1] included five onsite trainings and a series of online sessions, with topics covered during these events such as CEC analytics, HRMS screening, membrane processes, and computational tools. During this period, five researchers from CSIC and two from UNL visited TFNS for onsite trainings, while five grants supported TFNS researchers' visits to CSIC for two onsite trainings, and three grants were used for visits to UNL for one onsite training.

This Final Report summarizes the activities carried out after the Mid-term Report, covering the period from October 2023 to July 2025. During this time, an important upgrade of the TFNS pilot membrane system was implemented, and three onsite trainings were conducted, further supporting the achievement of the project goals. In total, four grants were used for TFNS researchers' visits to UNL for one-week trainings, and three grants (approved through the budget modification) for senior researchers' one-week visits to CSIC.

[1] https://www.twinsol-cecs.com/images/documents/d3_3-mid-term_training-oct2023-final.pdf

Additionally, several trainings organized by external institutions (outside the TwiNSol-CECs consortium) were attended by TFNS researchers, as these were recognized as valuable opportunities to broaden knowledge and understanding of key aspects of CECs research. These included a summer school organized within Horizon Europe twinning projects, courses hosted by a renowned academic institution, and training provided by a specialized company that manufactures the equipment installed at TFNS, which was upgraded during TwiNSol-CECs for advanced CEC analysis.

3. Continuation of TFNS Resource Upgrade for Advancing CEC Studies

The upgrade of the existing material capacities at TFNS for the advanced analytics and membrane processes for CECs in water started from the very beginning of the project in order to prepare the equipment for the training sessions on time taking into account the expected very long procurement procedures. The upgrades prolonged the life of the equipment and widened the scope of its application, including the advanced and innovative approaches in the analytics of organic micropollutants and their removal from water. Besides upgrade performed in the first reporting period (reported in D3.3 Mid-term report on performed trainings, October 2023), additional upgrade of the existing membrane system at TFNS was planned within the TwiNSol-CECs project and WP3, but also to boost the research capacity and ensure sustainable research infrastructure of TFNS[2]. In the very beginning of the project, the upgrade of existing membrane filtration unit has been agreed and discussed with Prof. Joao Crespo, a leading investigator from the project partner institution, NOVA University of Lisbon (UNL), as well as other UNL representatives during the onsite trainings and mobilities at UNL having in mind expertise of UNL team members in corresponding scientific topic. Prof. Crespo suggested that upgrade of the existing equipment of TFNS should be directed towards the possibility to test larger amounts of water samples coming both from real time surface water streams and prepared model solutions in the laboratories. Furthermore, highly significant discussion and suggestions were obtained in the meetings with representatives from companies which were involved in the process of upgrading giving large number of ideas and practical examples of good processing practices on market.

The upgrade included several new operating parts, which all combined opened the possibilities for high pressure membrane filtration processes in crossflow regime. All parts were welded using TIG technique and no plastic parts were used in the production, only stainless steel. New parts included:

1. High pressured multistage pump
2. Digital pressure sensors
3. Digital temperature sensors
4. Electromagnetic flowmeter

[2] https://twinsol-cecs.com/images/documents/r3_2-nanofiltation_upgrade_unit_tfns-30may2024.pdf

5. Membrane module (for spiral wound membranes)
6. Pipes, valves and gaskets
7. Collecting tank.

The upgraded equipment was successfully installed at TFNS (Figure 1) by the representatives of the company involved in upgrading equipment under the supervision of Dr. Nikola Maravić, Prof. Zita Šereš, and Jelena Šurlan, PhD student, as members of membrane filtration research team within TwiNSol-CECs project. The initial testing was performed in the presence of contracted company representatives.

The conducted upgrade provides possibilities to create in line micro-, ultra-, and nanofiltration treatments of water samples. Furthermore, all parts are designed to facilitate easy installation of future upgrades, enabling this pilot unit to serve as a means for TFNS's future research endeavors in addressing CEC removal at higher levels of technology readiness.

This pilot membrane unit has been included in new project proposals prepared jointly with UNL and CSIC during the TwiNSol-CECs implementation (WP3). Additionally, the preliminary tests on real wastewater samples have been conducted within WP4 (TwiNSol-CECs research projects) in order to check the removal efficiency of different CECs and compare with other relevant results obtained within TwiNSol-CECs.

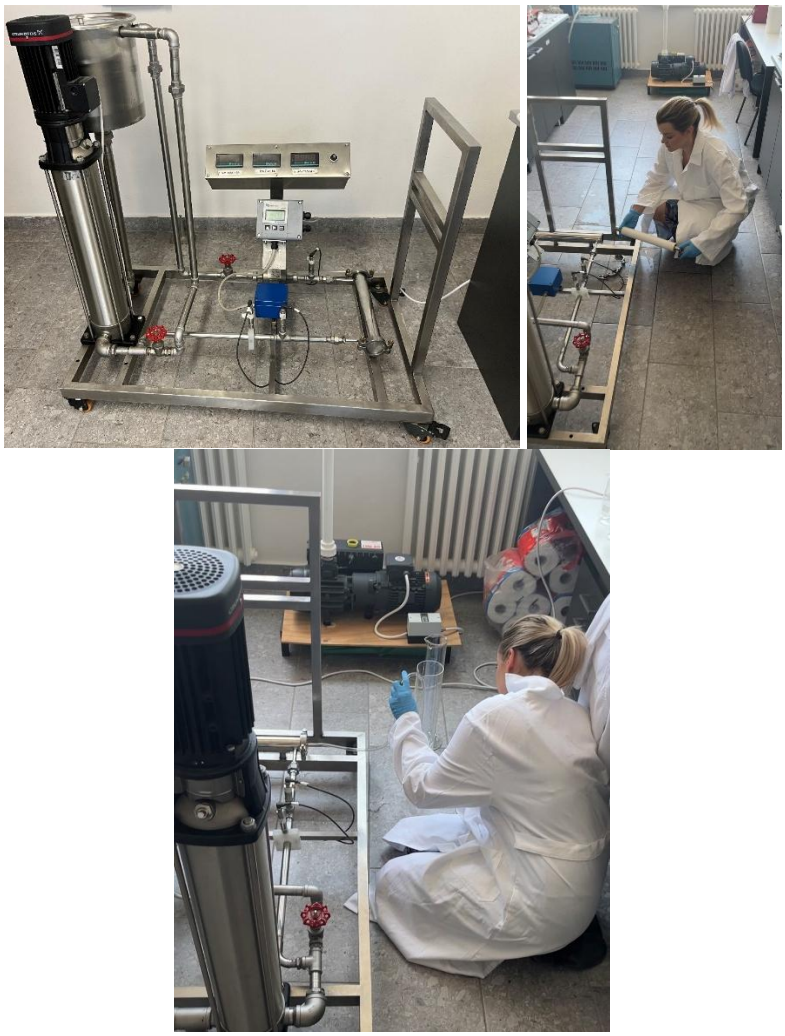

Figure 1 *Testing the pilot membrane filtration unit in the TFNS laboratory after the upgrade within TwiNSol-CECs*

4. Trainings

In line with the objectives of WP3, a wide range of research capacity-building activities have been implemented throughout the TwiNSol-CECs project. These included onsite trainings with partner institutions (CSIC and UNL), online lectures, and participation in external courses and international summer schools. The following table provides a consolidated overview of all training sessions and knowledge exchange events organized or attended during the 36 months of the project lifetime, including both consortium-based and external activities relevant to TwiNSol-CECs goals.

Table 1. *Overview of trainings and external (in orange) courses attended by TFNS researchers under TwiNSol-CECs: all trainings are listed, organized in the 1st (in grey) and 2nd reporting period*

No.	Training Title	Type	Location	Date	Reporting period	Trainers
1	Sample preparation and targeted analysis of main CEC groups	Onsite	TFNS, Novi Sad	Oct 17–18, 2022	1	CSIC
2	HRMS application in revealing the CECs presence in water	Onsite	CSIC, Barcelona	Nov 21–25, 2022	1	CSIC
3	Transfer of knowledge & best practice for TwiNSol-CECs research and strategic activities" organized at UNLd	Onsite	UNL, Lisbon	Dec 12–16, 2022	1	UNL
4	Target and suspect screening of CECs in surface waters	Onsite	CSIC, Barcelona	May 8–12, 2023	1	CSIC
5	Computational methods as support for membrane separation	Onsite	TFNS, Novi Sad	Sep 26–27, 2023	1	UNL
6	Membrane processes – online lectures	Online	TFNS, UNS, Serbia	Aug–Sep 2023	1	UNL
7	Development of pilot scale nanofiltration unit – transfer of knowledge and best practice	Onsite	UNL, Lisbon	Sept 29-Oct 4, 2024	2	UNL
8	Development of new project proposals	Onsite	CSIC, Barcelona	Oct 14–18, 2024	2	CSIC

No.	Training Title	Type	Location	Date	Reporting period	Trainers
9	Testing biomaterials for passive samplers	Onsite	UNL, Lisbon	Nov 24–29, 2024	2	UNL
10	Application of dedicated software for non-target screening	External (onsite)	Bremen, Germany	Dec 11–14, 2023	2	Thermo Fisher Scientific
11	PFAS - Persistent Micropollutants in the Water Cycle	External (online)	TU Delft	Feb 12 – Apr 2, 2025	2	PROMISCES Project (101036449)
12	PFAStwin Bonus Summer School on PFAS	External (onsite)	Faculty of Chemistry, University of Belgrade, Serbia	Jun 13–17, 2025	2	PFAStwin Project (101059534)
13	TwinSubDyn Summer School on sustainable organic amendment applications from a soil and ground water management perspective - learning, training, and knowledge exchange activity-	External (onsite)	Novi Sad, Serbia	Jun 2–6, 2025	2	TwinSubDyn Project (101059546)
14	SPECTRA Summer School - Advanced MS approaches for water quality & food safety	External (online)	Thessaloniki, Greece	Jul 14–16, 2025	2	SPECTRA Project

Trainings organized after the Mid-term Report (i.e. 2nd reporting period) continued to follow the WP3 objectives, combining theoretical lectures and practical sessions. They were arranged through direct communication with the TwiNSol-CECs Project Managers at CSIC and UNL to ensure alignment with the availability of host researchers and the relevant equipment. Based on the research interests of the TFNS researchers and their involvement in sub-projects within WP4, the trainees were jointly selected. Each training was followed by a corresponding report.

During the implementation of the TwiNSol-CECs project, meaningful connections were established with research institutions and expert teams outside the project consortium. These collaborations involved researchers working on similar scientific challenges, particularly in the field of environmental pollution caused by micropollutants.

The open and mutual exchange of knowledge and experiences fostered a two-way flow of information, enabling TwiNSol-CECs researchers to stay informed about ongoing capacity-building and knowledge-

transfer initiatives within other related projects. As a result of this visibility and scientific alignment, TFNS researchers were invited or registered to participate in externally organized training activities and summer schools.

4.1. Trainings by CSIC

The **7th onsite TwiNSol-CECs training** was held from October 13-18, 2024, at CSIC-IDAEA in Barcelona, Spain. The main focus of this training was the development of new project proposals aimed at strengthening collaboration between TFNS and CSIC-IDAEA in the field of environmental pollution and protection. Visiting researchers, Prof. Biljana Pajin, Prof. Nataša Đurišić-Mladenović, and Dr. Jelena Živančev, engaged in intensive discussions with the host researchers, Dr. Marinella Farré and Dr. Marta Llorca (Figure 2). Key topics included preparation for the upcoming Marie Sklodowska-Curie Doctoral Networks. Besides MSCA, twinning call was also discussed as a topic of common interests for further involvement of both partners. Both programmes were considered in line with the strategic interests of TFNS, specifically focusing on CECs. Other activities during this visit included reviewing HRMS data analyses, joint manuscript proofreading (accepted in Environmental Pollution), and attending PLASTIC'2024 conference. Discussions also addressed planning of final-year activities, mutual visits, and joint publications and presentations at upcoming events are planned to share the project's findings on the wide-range surveillance of CECs in Serbia's surface waters. Provisional dates for further mutual visits were discussed in accordance with the planned and remaining budget shares [3].

Figure 2. *Working meeting of 3 TFNS senior researchers, Prof. Biljana Pajin, Prof. Nataša Đurišić-Mladenović, and Dr. Jelena Živančev at CSIC-IDAEA with Dr. Marinella Farre and Dr. Marta Llorca, during a one-week visit 13-18 October 2024*

[3] https://twinsol-cecs.com/images/documents/r3_2-7th_onsite_trening-csic-13-18oct2024.pdf

4.2. Trainings by UNL

The 6th onsite TwiNSol-CECs training took place from September 29 to October 4, 2024, at UNL, Faculty of Science and Technology (FCT), Portugal. The training involved two researchers from TFNS, Dr. Nikola Maravić and PhD student Jelena Šurlan, and was hosted by Prof. Joao Crespo, supported by Dr. Claudia Galinha and Dr. Carla Brazinha (Figure 3). The visit was focused on the development and transfer of knowledge related to pilot-scale nanofiltration units, aligning with WP3 of the TwiNSol-CECs project. Key discussions centered around the upgrade of the nanofiltration unit at TFNS, planning future experiments, finalizing the first joint manuscript, and interpreting multivariate statistical analysis results. Prof. Crespo provided detailed feedback on the manuscript draft, while further research directions were explored, including optimization of water pretreatment processes, potential scale-up of filtration, and enhanced safety features. Additionally, future research which is to be conducted at the upgraded pilot scale equipment at TFNS was discussed, including water sources which will be used, water pretreatment and possibility of increased volume and duration of filtration process. During their stay, TFNS researchers toured several UNL laboratories, gaining practical insights into flat-sheet and spiral-wound membrane systems. The visit significantly contributed to strengthening collaborative research, building technical capacity at TFNS, and setting the stage for future joint publications and experimental work within the project [4].

Figure 3. *Meeting of Dr. Nikola Maravić and Jelena Šurlan, PhD strudent, with Prof. Joao Crespo during the visit to UNL for training from Sept 29-Oct 04, 2023*

The 8th onsite TwiNSol-CECs training entitled *"Testing Biomaterials for Passive Samplers Development – Transfer of Knowledge and Best Practice"*, took place from November 25 to 29, 2024, at the Laboratory of Membrane Processes at NOVA School of Science and Technology and iBET in

[4] https://twinsol-cecs.com/images/documents/r3_2-6th_onsite_trening-unl-29sep-04okt2024.pdf

Portugal. Researchers from TFNS, Dr. Vesna Vasić and PhD student Dušan Rakić, participated in this training as part of WP 3 activities aimed at reinforcing research capacities at TFNS. The training was hosted by Prof. Joao Crespo, leader of WP2 and WP5, along with Dr. Vanessa Pereira (Figure 4). The program focused on testing biomaterials for passive samplers and included discussions on the design and development of these systems. Key topics covered during the meetings were the selection and performance of biomaterials, planning future experiments in TFNS laboratories, the preparation of a review manuscript on passive sampling techniques, and strategies for upcoming publications. The TFNS researchers also conducted initial laboratory experiments and demonstrated sampler construction techniques. Additionally, they visited laboratories at NOVA ITQB/iBET in Oeiras, where they explored avenues for future collaboration. The training significantly contributed to the practical skill development of TFNS researchers and furthered joint research efforts in innovative environmental monitoring technologies[5].

Figure 4. *Meetings between TFNS researchers with Prof. Joao Crespo and Vanessa Pereira*

4.3. External Trainings

Two TwiNSol-CECs team members from TFNS, Dr. Igor Antić and Dušan Rakić (PhD student), participated in **the 7th Compound Discoverer Users Meeting**, held on December 12–13, 2023, in Bremen, Germany (Figure 5)[6]. The event served as a specialized training on the use of Compound Discoverer software for non-target screening via high-resolution mass spectrometry (HRMS). This software was acquired through the TwiNSol-CECs project as an upgrade to the existing UHPLC-HRMS instrument at TFNS (see D3.3 Mid-term report on performed trainings). The meeting concluded with a factory tour of Thermo Fisher's mass spectrometry production facility, where participants gained insights into the development and manufacturing of Orbitrap-based HRMS instruments, one of which

[5] https://twinsol-cecs.com/images/documents/r3_2-8th_onsite_trening-unl-24nov-29nov2024.pdf
[6] https://twinsol-cecs.com/images/documents/r3_3-cd_training_bremen_dec_2023.pdf

is installed at TFNS. The event also provided an opportunity to meet the eminent Prof. Dr. Alexander Makarov, who led the development of Orbitrap-based HRMS technology (bottom right)

Figure 5. *Dušan Rakić (top) and Dr. Igor Antić (bottom left) at the 7th Compound Discoverer Users Meeting, held on December 12–13, 2024; the event also provided an opportunity to meet the eminent Prof. Dr. Alexander Makarov, who led the development of Orbitrap-based HRMS technology (bottom right)*

Dr. Igor Antić, a TwiNSol-CECs team member, successfully completed the online course ***"PFAS – Persistent Micropollutants in the Water Cycle"***, organized by the **PROMISCES project** (101036449) and TU Delft Extension School from February 12 to April 2, 2025. The six-week course provided an in-depth exploration of per- and polyfluoroalkyl substances (PFAS), one of groups that belongs to CECs, covering their chemical structure, environmental persistence, toxicology, regulatory frameworks, and advanced analytical methods such as chromatography and mass spectrometry. Through interactive modules, participants learned about PFAS pathways in the environment, concentration and destruction technologies, and current legislation and management practices worldwide. The course featured expert-led webinars, case studies, quizzes, and collaborative discussions, offering a comprehensive understanding of PFAS monitoring and treatment challenges. Dr. Antić gained valuable insights into state-of-the-art removal and degradation technologies for PFAS, including ion exchange, membranes, foam fractionation, and advanced oxidation processes. This training has significantly strengthened his capacity to contribute to environmental monitoring and risk assessment activities within the TwiNSol-CECs project, particularly regarding non-target analysis and PFAS-related water quality challenges. Dr. Antić shared with colleagues from the so-called HRMS group involved in

TwiNSol-CECs the knowledge gained on PFAS during the course, as well as information about the course structure and materials, suggesting it as a potential model for developing similar knowledge-sharing courses within the group.

As one of the most experience analyst among the TwiNSol-CECs researchers from TFNS, Dr. Igor Antić, participated also in the ***PFAStwin Bonus Summer School***, held from June 13 to 17, 2025, at the University of Belgrade, Faculty of Chemistry. The event, organized within the HORIZON project **PFAStwin** (101059534), gathered international experts to address pressing issues related to PFAS. The program featured lectures by renowned scientists, including Prof. Dr. John P. Giesy, who covered PFAS discovery, environmental occurrence, advanced detection methods, and risk assessment frameworks. Other notable speakers included Dr. Begoña Jiménez and Dr. Pere Colomer Vidal (CSIC, Spain), and Dr. Natsuko Kajiwara (Japan), who presented research on PFAS contamination in remote environments, remediation strategies, and recycling of hazardous materials. The summer school emphasized interdisciplinary approaches, combining environmental toxicology, analytical chemistry, and forensic science to understand PFAS behavior, pathways, and regulatory implications. Participants explored cutting-edge techniques for PFAS detection and discussed policy-relevant risk management practices. Informal networking sessions, including discussions with Prof. Giesy, provided valuable opportunities for scientific exchange and collaboration. The training significantly enriched Dr. Antić's expertise in PFAS-related challenges and supported TwiNSol-CECs objectives in environmental monitoring and research capacity building.

Dušan Rakić, PhD student from TFNS participated in the *TwinSubDyn Summer School* titled ***"Sustainable Organic Amendment Applications for Soil and Groundwater Management"*** held from June 2 to 6, 2025, at Matica Srpska in Novi Sad, Serbia[7]. Organized within the Horizon Europe **TwinSubDyn** project (101059546), the event brought together early-stage and experienced researchers to explore sustainable solutions for improving soil health and mitigating groundwater contamination through organic amendments. The scientific program covered key topics such as the stability and nutrient dynamics of organic amendments, carbonization of sewage sludge for pollutant removal, and the behavior of emerging contaminants in soil environments. In addition to lectures, participants engaged in field experiment design, statistical analysis training, and scientific writing workshops. Career development was also addressed through interactive round-table discussions. TFNS early stage researcher benefited from presenting his work on PhD thesis through poster, facilitating interdisciplinary exchange and expanding their professional networks.

Several researchers from TFNS, i.e. those from HRMS group, participated online in the *SPECTRA Summer School* titled **"Advanced MS Approaches for Water Quality & Food Safety,"** held from July 14 to 16, 2025, at the Center for Interdisciplinary Research and Innovation (CIRI) of Aristotle University in Thessaloniki, Greece (Figure 6). The event was organized by the **SPECTRA** (Horizon Europe, 101158453) project and offered an intensive program focused on state-of-the-art mass spectrometry (MS) techniques, including HRMS, LC-MS/MS, suspect screening analysis (SSA), and non-targeted analysis (NTA) for detecting emerging contaminants such as PFAS, pharmaceuticals, and nanoplastics in environmental and food matrices. TFNS researchers attended the event upon the invitation of Prof.

[7] https://twinsubdyn.pmf.uns.ac.rs/summerschool.html

Dimitra Lambrapoulou, coordinator of the SPECTRA project, who became acquainted with TFNS capacities in micropollutant research during her guest lecture at the final TwiNSol-CECs conference. Recognizing the complementarity between the two teams and their shared research focus, Prof. Lambrapoulou extended the invitation as a step toward potential future collaboration. The summer school provided both theoretical background and hands-on experience through real-case studies from EU projects and practical exercises using modern instruments. It also introduced AI-assisted workflows for enhanced data processing in non-targeted analysis. Participation in this event enabled TFNS researchers to strengthen their expertise in advanced MS-based analytical methods and explore possibilities for joint initiatives in environmental and food safety monitoring, further aligning with the strategic goals of TwiNSol-CECs.

Figure 6. *Cover page of the SPECTRA Summer School Program*

The list of full public reports of the TwiNSol-CECs trainings used for preparation of this Deliverable 3.4

Vendor training "7th Compound Discoverer Users Meeting" 12-13 Dec 2023, Bremen, Germany https://twinsol-cecs.com/images/documents/r3_3-cd_training_bremen_dec_2023.pdf

6th TwiNSol-CECs Training "Development of pilot scale nanofiltration unit – transfer of knowledge and best practice" 29 September-04 October 2024, Lisbon, Portugal https://twinsol-cecs.com/images/documents/r3_2-6th_onsite_trening-unl-29sep-04okt2024.pdf

7th TwiNSol-CECs Training "Development of new project proposals" 13-18 October 2024, Barcelona, Spain https://twinsol-cecs.com/images/documents/r3_2-7th_onsite_trening-csic-13-18oct2024.pdf

8th TwiNSol-CECs Training "Testing biomaterials for Passive Samplers Development – transfer of knowledge and best practice" 24-29 November 2024, Lisbon, Portugal https://twinsol-cecs.com/images/documents/r3_2-8th_onsite_trening-unl-24nov-29nov2024.pdf

Upgrade of membrane filtration unit at TFNS to crossflow nanofiltration for TwiNSol-CECs research on CECs removal from water, May 30, 2024, Novi Sad, Serbia https://twinsol-cecs.com/images/documents/r3_2-nanofiltation_upgrade_unit_tfns-30may2024.pdf

Annex I – Programs of the onsite TwiNSol-CECs trainings in the second reporting period

6th TwiNSol-CECs Training

"Development of pilot scale nanofiltration unit – transfer of knowledge and best practice"

NOVA University of Lisbon (UNL), NOVA School of Science and Technology (FCT), Lisbon, Portugal

September 29th – October 4th, 2024

PROGRAM

30.09.2024.

10,00 – 13,00 Discussion of the first manuscript within the TwiNSol-CECs project

13,00 – 15,00 Analysis of the multivariant statistical analysis research results

01.10.2024.

10,00 – 16,00 Visit to UNL laboratories - pilot scale equipment for membrane processes

02.10.2024.

10,00 – 14,00 Corrections of the first manuscript

14,00 – 15,00 Discussion on presentation of multivariant statistical analysis research results

03.10.2024.

10,00 – 12,00 Visit to UNL laboratories - pilot scale equipment for membrane processes

12,00 – 14,00 – Meeting on upgrades of pilot scale nanofiltration unit at TFNS with focus on safety

14,00 – 15,00 – Discussion on future uses of pilot scale nanofiltration equipment at TFNS

04.10.2024.

10,00 – 12,00 – Meeting regarding future research within TwiNSol-CECs project

7th onsite TwiNSol-CECs Training on development of new project proposals

with working meetings

organized at Spanish National Research Council, Institute of Environmental Assessment and Water Research (CSIC), Spain,

within the TwiNSol-CECs project (101059867)

14-18 October 2024

PROGRAM

14.10.2024

10,00-14,00 Discussion of the HRMS results processed by Compound Discoverer

14,00-16,00 A joint manuscript accepted for publication - Proof correction

15.10.2024

10,00-17,00 MSCA - Doctoral Network 2024: development of project proposal elements

16.10.2024

10,00 – 14,20 Attendance to PLASTIC'2024, CaixaForum Macaya, Barcelona

17.10.2024

10,00-15,00 MSCA- Doctoral Networks 2024: development of project proposal elements

15,00-17,00 Horizon Europe Twinning: development of a new idea on twinning

18.10.2024

09,00-12,00 Planning of the last project year – mutual visits, experiments, publications, conference appearances

8th onsite TwiNSol-CECs Training

"Testing biomaterials for Passive Samplers Development – transfer of knowledge and best practice"

Laboratory of membrane proceses at NOVA School of Science and Technology and iBET, Portugal

November 25th – November 29th, 2024

PROGRAM

25.11.2024.

10,00 – 13,00 Discussion of the first tests of biomaterials for passive sampling

13,00 – 15,00 Discussion about review manuscript

26.11.2024.

10,00 – 16,00 Set up experiments for testing biomaterials in model mixture and construction of passive samplers

27.11.2024.

10,00 – 14,00 First sampling of model mixture for analysis

14,00 – 15,00 Discussion on future experiments with biomaterials

28.11.2024.

10,00 – 12,00 Second sampling of model water for analysis

12,00 – 14,00 – Visit to iBET laboratories

14,00 – 15,00 – Discussion on future uses of passive samplers at TFNS

29.11.2024.

10,00 – 12,00 – Meeting regarding future research within TwiNSol-CECs project