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Abbreviations

AOP	Advanced oxidation processes
CECs	Contaminants of emerging concern
CSIC	Institute of Environmental Assessment and Water Research of the Spanish National Research Council
EGD	European Green Deal
GA	Grant Agreement
GC-MS	Gas chromatography–mass spectrometry
MSCA	Marie Skłodowska-Curie Actions
OA	Open Access
PhACs	Pharmaceutically active compounds
PFAS	Per- and polyfluoroalkyl substances
STSE	Short-term Staff Exchange
TFNS	Faculty of Technology Novi Sad
UASE	Ultrasonic-assisted extraction
UHPLC- HRMS	Ultra-high-performance liquid chromatography high-resolution mass spectrometry
UNL	Nova University of Lisbon
WP	Work Package

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1. Executive summary

This final report documents the Short-term Staff Exchanges (STSEs) conducted within the Horizon Europe TwINSol-CECs project (GA 101059867) in the second reporting period, i.e. from November 2023 to the 36th project month (July 2025). These exchanges have been instrumental in building research capacity at the Faculty of Technology Novi Sad (TFNS) through collaboration with leading EU research institutions: the Institute of Environmental Assessment and Water Research of the Spanish National Research Council (CSIC-IDAEA) and the NOVA University of Lisbon (UNL). The report outlines the exchange activities, key research objectives, work conducted, and outcomes achieved. The exchange program significantly contributed to strengthening the scientific excellence of TFNS in the field of contaminants of emerging concern (CECs).

This is the publicly available deliverable (D3.8) of the project Work Package (WP) 3 - Reinforcing research knowledge and skills of TFNS. In the Introduction of the document, the aim of STSEs is presented together with the activities planned by Grant Agreement (GA), followed by the section describing the performed STSEs in the period Nov 2023-July 2025.

2. Introduction

The general objective of the TwINSol-CECs project is to enhance the research and innovation potential of TFNS in the domain of CECs by fostering collaborations with EU partners. Work Package 3 (WP3) focuses on reinforcing knowledge and skills of TFNS researchers. There are four tasks within WP3 in total, with task 3.4 dedicated to the so-called Short-term Staff Exchanges (STSEs) under leadership of TFNS. This task is further subdivided into 2 subtasks:

- Subtask 3.4.1 - Meetings for preparation of STSEs and calls for STSEs: it is planned to have the consortium working meetings dedicated to arrangements of the STSEs, call conditions, and STSEs evaluation,
- Subtask 3.4.2 – STSEs: implementation of STSEs and the reporting

Thus, task 3.4 is specifically dedicated to Short-term Staff Exchanges (STSEs), which are structured to promote knowledge transfer, enhance scientific collaboration, and contribute to joint research activities within TwINSol-CECs. This report captures all STSEs undertaken within the consortium describing the mobility of researchers of TFNS to CSIC and UNL, as well as from CSIC and UNL to TFNS.

In accordance with the approved TFNS budget modification during project implementation, 13 STSEs of TFNS researchers at the premises of EU partners were planned. Additionally, shorter inbound STSEs (1–2 weeks), as opposed to the originally planned durations (3 weeks to 2 months), were mutually agreed upon by the partners as a more realistic option due to the very demanding professional schedules of the researchers, particularly those from the EU partner institutions. Similarly, STSEs involving senior TFNS researchers were shortened per exchange due to their limited time availability due to busy schedule at TFNS. All STSEs were carefully planned so as not to compromise project outcomes. STSEs are intended to support PhD students from TFNS working in research areas relevant to TwINSol-CECs, who are motivated to undertake collaborative work at EU partner institutions. Additionally, other researchers conducting research aligned with TwINSol-CECs interests are also eligible for TFNS-STSE support. There are three possible objectives for the project's STSEs:

1. Mutual exchanges to validate analytical protocols and apply software for wide-range screening of CECs,
2. Mutual exchanges to carry out TwINSol-CECs research projects, including research activities, results evaluation, and preparation of joint research papers, and
3. Mutual exchanges to discuss and work on novel research and collaborative projects within the scope of TwINSol-CECs.

During each STSE, researchers are assigned a supervisor/host at the receiving institution to monitor progress and support the successful completion of planned tasks. After completing the STSE, the visiting researcher(s) prepared a report, and at the host institution, presented the work to the supervisor. All reports on STSEs have been uploaded to the internal page of the project website. Upon returning to TFNS, the researchers shared their activities and outcomes with the TwINSol-CECs co-workers.

3. STSEs in the first reporting period

In order to follow the original idea from the project description in GA, the Committee for STSEs Grant Approval was established during the 6th-project month meeting, February 6, 2023, consisting of Dr. Marinella Farre, CSIC, Prof. Joao Crespo, UNL, and Prof. Zita Šereš, TFNS. They have been in charge of arranging distribution of the STSEs' grants to the researchers based on their main research interest in accordance to overall project interest to level up the competences and be prepared for the project research. Ten TFNS researchers, including two PhD students, from the TwINSol-CECs project team, whose research interests coincide with the TwINSol-CECs research topics, prepared motivational letters explaining why they would like to have possibility to visit the partner institution and perform the research at CSIC and UNL, and what they expect from the visits with expected outcomes on their career. Additionally, senior researchers are planned for STSEs to work on strategic issues important for the project outcomes. The finally performed STSE are presented in Table 1.

Table 1. Overview of STSEs performed by TFNS researchers under TwINSol-CECs: all STSEs are listed, organized in the 1st (in grey) and 2nd reporting period

Dates	Location	Participants (institution)	Main Activities	Host(s)
16 May-14 Jun 2023	UNL, Lisbon, Portugal	Dr. Nikola Maravić, Jelena Šurlan (TFNS)	Nanofiltration; Sorption studies; FTIR, Fluorescence; CFD methodology planning	Prof. Joao Crespo, Dr. Claudia Galinha, Dr. Carla Brazinha
26 Jun-07 Jul 2023	TFNS, Novi Sad, Serbia	Dr. Nicola Montemurro (CSIC)	Summer School coordination; LC-HRMS method development; EXIT sampling campaign planning	Prof. Nataša Đurišić-Mladenović, Dr. Jelena Živančev, Dr. Igor Antić
05-10 Nov 2023	TFNS, Novi Sad, Serbia	Dr. Sergio Santana Viera, Olga Gómez Navarro (CSIC)	Sampling campaign; Lectures; Joint research planning	Prof. Nataša Đurišić-Mladenović, Dr. Jelena Živančev, Dr. Igor Antić
02-30 Nov 2023	NOVA University of Lisbon, Portugal	Dr. Vesna Vasić, Dr. Mirjana Petronijević, Jelena Šurlan, PhD student (TFNS)	Membrane separation; Adsorption; FTIR, UV processes; Fluorescence determination	Prof. Joao Crespo, Dr. Claudia Galinha, Dr. Vanessa Pereira, Dr. Carla Brazinha
03-23 Feb 2024	CSIC, Barcelona, Spain	Dr. Jelena Živančev, Dr. Igor Antić, Dušan Rakić, PhD student (TFNS)	Target/suspect screening of CECs in water; UHPLC-HRMS analysis; Data processing	Dr. Marinella Farre
30 Mar-17 Apr 2025	NOVA University of Lisbon	Dr. Dragana Lukić, Dr. Mirjana Petronijević, Dr. Maja Buljovčić, (TFNS)	Passive samplers, AOPs, UV reactor studies; HPLC; Presentation at Membrane Day	Prof. Joao Crespo, Dr. Vanessa Pereira

15-28 Jun 2025	CSIC, Barcelona, Spain	Dušan Rakić, PhD student, Dr. Maja Buljovčić (TFNS)	Micro/nano/bioplastics analysis; GC-MS training; Seawater sampling	Dr. Marinella Farre, Dr. Marta Llorca
04-12 Jul 2025	NOVA University of Lisbon	Prof. Nataša Đurišić-Mladenović	TwINSol-CECs Strategy meeting; Passive samplers research; Budget and publication planning; Road Map review	Prof. João Crespo, Dr. Vanessa Pereira

3.1. STSEs of TFNS researchers

Three researchers from TFNS, Dr. Vesna Vasić, Dr. Mirjana Petronijević, and Jelena Šurlan, PhD student, visited NOVA University Lisbon (UNL) from **November 2-30, 2023**, as part of TwINSol-CECs activities under WP3 and WP4. Hosted by Prof. Joao Crespo and coordinated with Dr. Claudia Galinha, Dr. Vanessa Pereira, and Dr. Carla Brazinha, the visit focused on membrane separation, adsorption, passive samplers, advanced oxidation processes (AOPs), and biosorbent characterization. Some photos taken during this visit are given in Figure 1.

The visit began with planning meetings and lab preparation for cross-flow filtration experiments. During the first week, the team completed experiments on polypiperazine and cellulose acetate blend membranes at various pH levels, followed by solid and liquid phase extractions. They also participated in a group seminar where Dr. Ana Almeida presented research on bioinspired cellulose membranes for water collection. Subsequent weeks included experiments with reverse osmosis membranes, fluorescence spectroscopy, and discussions on PCA analysis with Dr. Galinha. The team also visited NOVA ITQB/iBET¹ laboratories, guided by Dr. Vanessa Pereira, where they learned about passive samplers, UV reactors, and catalyst-enhanced water treatment methods.

Meetings with project hosts addressed use of biomaterials, reuse of HLB cartridges, and characterization methods such as BET, TEM, SEM, FTIR, and XPS. Sorption studies on five membranes were conducted using orbital shakers. A group meeting featured a presentation on biodegradable films by PhD student Veronica Weng, and further experimental planning for heterogeneous photocatalysis was finalized. In the final phase, researchers completed fluorescence and FTIR analysis, conducted additional filtration and extraction, and collaborated on hormone removal experiments via UV-assisted photocatalysis using magnetic catalysts. The visit concluded with data analysis sessions with Drs. Pereira and Galinha, fully achieving the scientific goals of the STSE.

¹ Instituto de Tecnologia Química e Biológica António Xavier/Instituto de Biologia Experimental e Tecnológica



Figure 1. Dr. Mirjana Petronijević, Jelena Šurlan, and Dr. Vesna Vasić (top left) upon arrival at UNL, NOVA School of Science and Technology; laboratory work with Dr. Claudia Galinha (top right) and Dr. Vanessa Pereira (middle); working meeting with Prof. Joao Crespo and Dr. Claudia Galinha (bottom)

From **3-23 February 2024**, Dr. Jelena Živančev, Dr. Igor Antić, and Dušan Rakić, PhD student, from TFNS, visited the IDAEA labs at CSIC in Barcelona. This STSE was conducted within WP4 activities focused on wide-range CECs surveillance and evaluation of innovative removal methods. The visit was hosted by Dr. Marinella Farre and the CSIC team, following procedures previously introduced during the 4th TwINSol-CECs training on target and suspect screening.

The primary objective was the analysis of surface and wastewater samples collected in Serbia during earlier campaigns. Key activities included:

- Sample preparation: Elution of multi- and single-layer SPE cartridges (Oasis HLB, WAX, WCX, Agilent PPL) for target/suspect analysis of pharmaceuticals (PhACs) and PFAS.
- Instrumental analysis: Samples were analyzed using UHPLC-HRMS (Q-Exactive). Full-scan mode supported broader suspect screening beyond standard target compounds.
- Data processing: Target compound quantification was performed using Xcalibur and TraceFinder. Preliminary suspect screening was initiated in Compound Discoverer (CD), with workflow strategies discussed in detail for future in-house analysis at TFNS using TwINSol-CECs-funded hardware/software.

The visit significantly contributed to strengthening TFNS analytical capacity for CEC monitoring and set the foundation for extended suspect screening efforts. Team-building sessions further enhanced collaboration between TFNS and CSIC teams. Some photos taken during this STSE are shown in Figure 2.



Figure 2. Laboratory work during the STSE of Dr. Jelena Živančev, Dušan Rakić, and Dr. Igor Antić at IDAEA-CSIC (top left); setting of UHPLC-HRMS parameters for analysis of water extracts with Arianna Bautista, Ph.D. student, and Olga Gomez (top right); data processing (Dr. Jelena Živančev - bottom left, Dušan Rakić, Olga Gomez, and Dr. Jelena Živančev (bottom right)

Dr. Dragana Lukić, Dr. Mirjana Petronijević, and Dr. Maja Buljovčić visited NOVA ITQB/iBET in Oeiras, Portugal, from **March 30 to April 17, 2025**. Hosted by Dr. Vanessa Pereira, the STSE focused on developing and evaluating passive samplers and advanced oxidation processes (AOPs) for water treatment. During the initial days, the researchers were introduced to the lab team and equipment. Dr. Lukić evaluated biomaterials for use in passive samplers, selecting biochar and hydrochar from raspberry canes for adsorption studies of compounds like levofloxacin and hormones. Experiments were conducted in spiked surface water, with samples analyzed by HPLC. Methanol was used for elution, and additional testing assessed compound stability and adsorbent loss. Water quality parameters (COD, nitrogen species, phosphorus) were also monitored. Dr. Lukić also presented TFNS and the TwINSol-CECs project at the Membrane Day event hosted by Prof. João Crespo, enhancing project visibility. Meanwhile, Dr. Buljovčić worked with HPLC systems, supported sample preparation and calibration, and gained hands-on experience in analytical procedures. Dr. Petronijević focused on AOPs combined with UV radiation for removing pollutants from spiked matrices (surface water, wastewater, drinking water). She tested UV/H₂O₂ and persulfate processes, including catalyst-assisted variations, and compared efficiency with standalone treatments. HPLC analysis was conducted with Taciana Guimarães, and all experiments were supervised by Dr. Pereira and João Filipe Sério. The STSE concluded with discussions on future experimental plans and publications. The visit significantly enhanced research collaboration and capacity in water treatment technologies. Some photos of this STSE are shown in Figure 3.





Figure 3. STSE of Dr. Maja Buljovčić, Dr. Mirjana Petronijević, and Dr. Dragana Lukić with Dr. Vanessa Pereira (top left) at UNL, 2025; Presentation of TFNS by Dr. Dragana Lukić at NOVA University-NOVA School of Science and Technology (middle); meeting with Prof. João Crespo

From **June 15 to 28, 2025**, Dušan Rakić, PhD student, and Dr. Maja Buljovčić from TFNS completed a research stay at IDAEA-CSIC in Barcelona, hosted by Dr. Marinella Farré and Dr. Marta Llorca (some photos taken during the STSE are given in Figure 4). The STSE aimed to enhance collaboration and build skills in the analysis of micro-, nano-, and bioplastics. In the first days, the researchers were introduced to the ONHEALTH lab team, safety procedures, and analytical equipment. They were trained in seawater sampling protocols, including proper collection, storage, and contamination prevention. Sample preparation involved filtration through 200 µm and 0.7 µm filters, followed by drying to constant weight. They learned ultrasonic-assisted extraction (UASE) using toluene to isolate plastic particles from filters. The extracts were combined, evaporated under nitrogen to concentrate analytes, and adjusted for injection into the chromatography system. TFNS researchers also received detailed training on operating the Q Exactive GC Orbitrap GC-MS system, including method setup, calibration, injection, and quality control practices essential for plastic-related compound analysis. The STSE concluded with a collaborative meeting at IDAEA-CSIC, where ongoing TwiNSol-CECs research was discussed, along with plans for future joint experiments and training. The visit significantly contributed to capacity building and advanced analytical skills in the field of environmental microplastic analysis.



Figure 4. STSE of TFNS team members to IDAEA-CSIC, Barcelona (top, from left to right Dr. Nicole Montemurro, Dr. Sandra Perez, Dr. Marta Llorca, Dr. Marinella Farré, Dr. Maja Buljovčić and Dušan Rakić, PhD student); Dušan Rakić, and David Alcaide Benavides, MSc, during preparation of samples; David Alcaide Benavides, MSc, and Dr. Maja Buljovčić during preparation of the instrument for analysis of micro- and nanoplastics

Prof. Nataša Đurišić-Mladenović visited UNL and its research institutes NOVA ITQB/iBET from **4-12 July 2025**. The visit focused on research development, institutional collaboration, and planning for future joint initiatives, significantly strengthening the partnership between TFNS and UNL. On 4 July, Prof. Đurišić-Mladenović attended the NOVA ITQB Anniversary Event, which highlighted the institute's achievements and inclusive community. Throughout the visit, Prof. Đurišić-Mladenović held meetings with Prof. João Crespo and Dr. Vanessa Pereira to discuss:

- UNL budget reallocation, especially redirecting unused travel funds toward open-access (OA) publishing;
- Joint research on passive samplers, including plans for co-authored publications;
- Ongoing PhD projects at iBET on pharmaceutical prioritization in surface waters and LED-based microbiological water treatment;
- Opportunities for MSCA proposals, building on TwINSol-CECs and focusing on CEC-related research;

- Finalization of a joint OA publication on membrane-based CEC removal processes;
- Review of the TwINSol-CECs Road Map, with recommendations to enhance TFNS's international visibility and readiness for Horizon Europe funding.

The STSM successfully advanced strategic cooperation, strengthened research networks, and reinforced the long-term impact of the TwINSol-CECs project. Some photos taken during this STSE are given in Figure 5.



Figure 5. *Prof. Nataša Đurišić-Mladenović with Dr. Vanessa Pereira and Prof. João Crespo during the NOVA ITQB anniversary day (left); introduction to the ongoing research in the hosting laboratory of NOVA ITQB/iBET institutes by Dr. Vanessa Pereira and Taciana Guimarães (right)*

3.2. STSEs at TFNS

Dr. Sergio Santana Viera and Olga Gómez Navarro, PhD student, junior researchers from the ONHEALTH group at IDAEA-CSIC (Barcelona, Spain), visited TFNS, from **5-10 November 2023**. They were hosted by the TFNS team working on advanced analytics for CECs surveillance. Some photos taken during this STSE are shown in Figure 6. The STSE program included meetings on STSE planning and organizing a Danube River sampling campaign (WP4), as well as lectures and presentations. On 6 November, a working meeting was organized for detailed discussion about the STSE goals and the related activities for the whole working week. The participants of the meetings were Prof. Nataša Đurišić-Mladenović, Dr. Jelena Živančev, Dr. Igor Antić, and Prof. Zita Šereš, besides the visiting researchers. Dr. Santana, on his first visit to TFNS, toured the labs and research facilities. Materials for the sampling were prepared. The campaign was conducted on November 7 and 8 November. On November 9, the guests gave lectures at TFNS. They presented their scientific careers, highlighting opportunities for young researchers in Spain and institutions like IDAEA-CSIC. Dr. Santana also delivered a lecture titled "DESIGN OF EXPERIMENTS IN ANALYTICAL CHEMISTRY." On the final day, a wrap-up session was held to plan next steps in joint research.



Figure 6. During the STSE at TFNS (from left to right, top to bottom): Working meeting for setting the STSE goals; surface water sampling campaign; presentation of DR. Sergio Santana; presentation of Olga Gomez

3.3. Other project visits to TFNS

Dr. Vanessa Pereira and Prof. João Crespo visited TFNS and took part in the 2nd TwINSol-CECs Workshop (6-7 June 2024)² as plenary lecturers, as well as in the 2nd TwINSol-CECs Summer School (8-12 June 2024)³ as trainers (having lectures on the 2nd day of the School). Their 5-day visit was highly productive and served multiple purposes. In addition to their key roles as invited speakers and trainers, their presence was effectively used for hands-on knowledge transfer and best practice exchange within the laboratory environment. Given the intensity of scientific interaction and collaborative planning that took place, the visit was also recognized as a STSE under the TwINSol-CECs framework.

² https://www.twinsol-cecs.com/images/documents/r6_4_2nd_twinsol-cecs_workshop-report-june2024.pdf

³ https://www.twinsol-cecs.com/images/documents/r3_3_2nd_twinsol-cecs_summer_school_report_jun.pdf

Working meetings were held between Workshop and Summer School sessions to assess ongoing research at TFNS - conducted under the scientific guidance of Prof. Crespo, and to plan upcoming STSEs to UNL with both Prof. Crespo and Dr. Pereira. These meetings also served to review project results and agree on their dissemination, including an oral presentation at the upcoming EUROMEMBRANES 2024 Conference and a joint manuscript submission to an international journal.



Figure 7. Plenary lectures of Prof. João Crespo (left) and Dr. Vanessa Pereira (right) during the 2nd TwINSol-CECs Workshop, 6-7 June 2024 (top) and the 2nd TwINSol-CECs Summer School (bottom)