

Report on the outcomes of a Short-Term Scientific Mission¹

Action number: CA20130

Grantee name: Dr. Sara Taghavi Kalajahi

Details of the STSM

Title: Pilot Study of a Laboratory-Based Microbiologically Influenced Corrosion (MIC) Test Using Microbiological Consortia Sampled from the Field

Start and end date: 10.09 to 20.10.2023

Description of the work carried out during the STSM

The main objectives of the current STSM are:

- Conducting an experiment based on the laboratory-based protocol proposed by WG5 of Euro-MIC (Achieving standardization) to investigate microbial interactions in environmental samples.
- Creating experimental systems with sediment and seawater samples, utilizing metal coupons (carbon steel C1010) exposed to these systems with three replicates.
- Analyzing the corrosion rates, microbial activity, and interactions within the experimental systems to better understand the impact of microbial communities on corrosion processes in the marine environment.
- Draw conclusions and insights from the experimental results, contributing to the development of standardization and best practices for addressing MIC in marine environments.
- Share findings and recommendations with relevant stakeholders, such as Euro-MIC, to advance knowledge in the field and promote the effective management of corrosion in marine systems.

Also, the following are the objectives for the training of applicant during the current STSM:

- Develop and enhance hands-on laboratory skills through the practical implementation of the Euro-MIC laboratory-based protocol.
- Gain proficiency in sample collection, processing, and the application of microbial identification and inoculation techniques, including qPCR and most probable number (MPN) methods.
- Acquire knowledge and practical experience in designing and setting up complex experiments involving environmental samples and metal coupons.
- Learn the intricacies of creating and maintaining controlled environments, such as anaerobic chambers, for precise experimental conditions.
- Learn effective data collection methods, including measurements of corrosion rates, microbial activity, and environmental parameters.
- Gain proficiency in statistical analysis techniques to interpret and draw meaningful conclusions from experimental data.

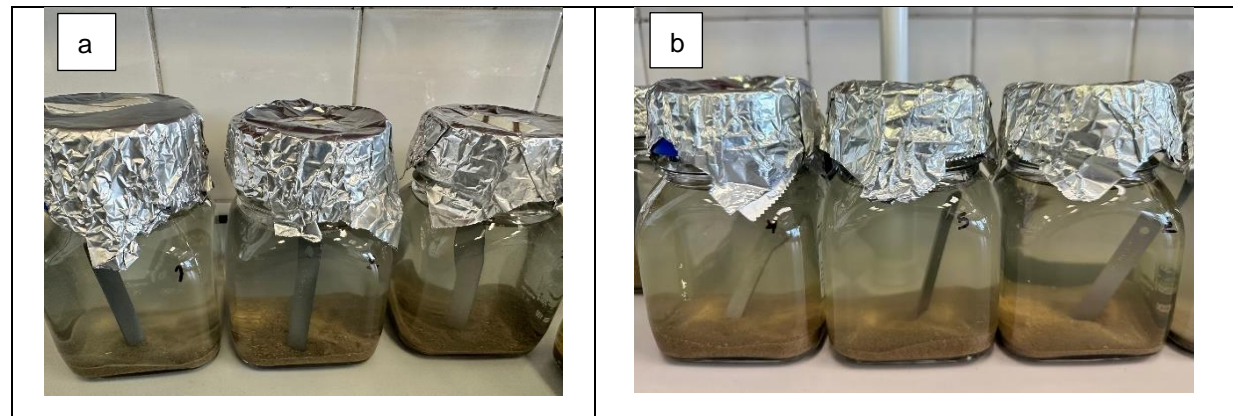
¹ This report is submitted by the grantee to the Action MC for approval and for claiming payment of the awarded grant. The Grant Awarding Coordinator coordinates the evaluation of this report on behalf of the Action MC and instructs the GH for payment of the Grant.

During the STSM, an experiment based on the laboratory-based protocol, which is proposed by WG5 of Euro-MIC (Achieving standardization), was conducted in the Endures company's laboratory. Environmental samples (sediment and seawater) were collected from the North Sea. The samples were processed as explained in the protocol for further microbial identification and inoculation (qPCR and most probable number/MPN methods were used). In preparation for our experiment, we took sediment samples weighing 100 mg each and placed them into 500 mL glass bottles. These bottles were then autoclaved to serve as our control group. The remaining sediment samples were carefully transferred into an anaerobic chamber for inoculation, ensuring an oxygen-free environment. Additionally, the black silicon caps were subjected to autoclaving to maintain being sterile. We collected 8 liters of seawater from the North Sea and placed it in an oven for sterilization. After 2 days we autoclaved the seawater. In each bottle we used 600 mL of sea water so it can cover the whole length of coupon. Also, 1 mg/Liter yeast was added for the treatments with nutrient. The metal coupons (carbon steel C1010) were exposed to the systems with sediment and seawater samples with three replicates. Four different treatments were considered: 1. Microbial inoculum, filtered test fluid, nutrients, 2. Microbial inoculum, filtered test fluid, no nutrients, 3. Filtered test fluid, nutrients (control), 4. Filtered test fluid, no nutrients (control).

Based on the laboratory protocol, the exposure should continue at least for one month. Therefore, during this time, photos were taken to monitor the changes in the systems.

Description of the STSM main achievements and planned follow-up activities

The current STSM was successful to implement the planned experiments. The material preparation, exposure experiment, necessary analyses during the experiments were hold as it was planned. Fig. 1 and 2 illustrate the conducted experiment, and the changes for two weeks. However, the experiment needed to last for one month, which it was not possible to finish the experiment during the current STSM. There was no time to take out the coupons and perform the analyses on them. Therefore, it was suggested to continue the exposure experiment, and spend a second STSM in Endures to complete the task. It is planned to perform different surface analyses, wight loss, microbial identification, etc. at the end of exposure experiment (after one month) for all coupons to investigate corrosion rate, corrosion products, and biofilm. It is intended using multiple lines of evidence (MLOE) approach, investigate the differences between biotic and abiotic corrosion. Then, the collected information will be integrated and analyzed to develop the conclusions. Also, there is an information sheet, which is provide by WG5 to transfer the result in a better and more detailed way for future utilization. This form also, is intended to be completed.



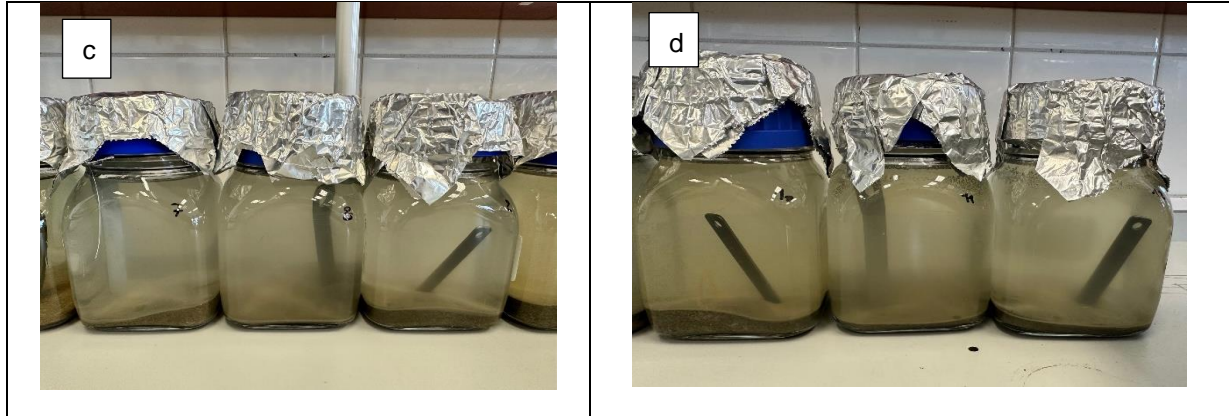


Fig.1. Pictures of the implemented exposure experiment at the first day (22.09.2023), a) control with no nutrients, b) control with nutrients, c) inoculum with no nutrients, d) inoculum with nutrients

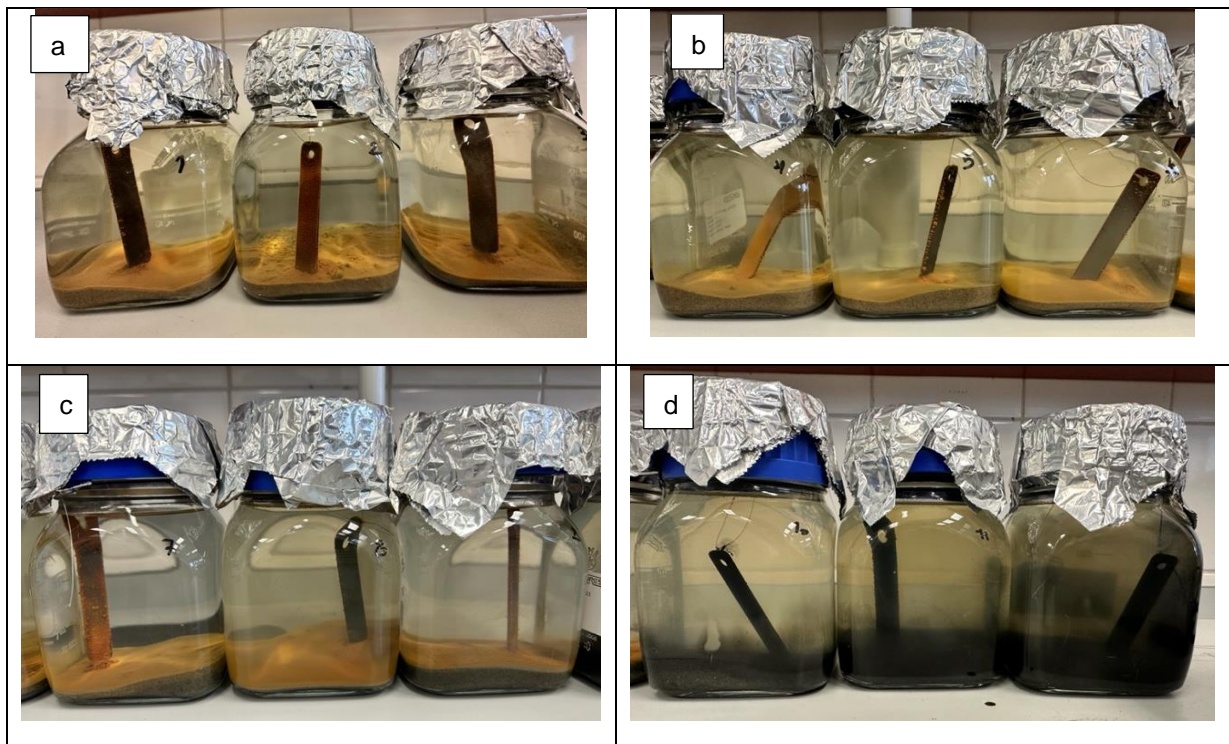


Fig.2. Pictures of the implemented exposure experiment at 12.10.2023, a) control with no nutrients, b) control with nutrients, c) inoculum with no nutrients, d) inoculum with nutrients