

Thesis position – Open application Title: A laboratory study on microbiologically influenced corrosion (MIC) of steel used for monopile foundation of offshore wind turbine

Plats: Älvkarleby, Sweden

Kategori: Ingenjörsvetenskap/Vindkraft

Jobb-idREF4897C

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Background

Offshore wind energy is rapidly developing in recent years as an important green energy resource. Steel monopile foundation is most common foundation for offshore wind turbine support towers. Microbiologically influenced corrosion (MIC) of steel in marine environment can cause safety and environmental risk for steel monopile foundation and lead to significant financial loss due to increased maintenance costs. To inhibit MIC of steel, coating methods have been widely used. One of such methods is thermally sprayed zinc and aluminium (TSZA). TSZA is an emerging technology and its effectiveness to prevent MIC of steel in marine environment is not well understood. Long term laboratory study combined with microbes, for example, sulphate reducing bacteria (SRB) mimicking MIC in marine environment can provide useful information regarding effectiveness of TSZA on corrosion protection. One critical aspect of long-term laboratory study is to ensure that bacterial community responsible for MIC are growing properly in laboratory conditions and performing corrosion activity.

The overall aim of this thesis project is to conduct a laboratory mesocosm experiment investigating MIC of steel in seabed environment. Upon completion, the thesis project is expected to establish the laboratory setup for MIC experiment, a routine procedure for culturing the microorganism in laboratory condition for long term experiment and finally evaluate different approaches to measure MIC in laboratory condition.

Method

The experiment will be conducted at the laboratory of Vattenfall R&D, Älvkarleby, Sweden. Laboratory-scale mesocosms will be established with artificial sea water, bacteria inoculum, steel specimen. and MIC ER probes. The bacteria will be cultivated in the laboratory and then will be introduced to the mesocosms. The corrosion experiment will be run for approximately 10 weeks. During this period, corrosion of steel will be monitored by using MIC ER probes. Bacterial activity will also be measured. Environmental samples will be collected from mesocosms at certain intervals to check the bacterial community development. This master's thesis will be part of a long term (one year or longer) laboratory MIC experiment planned to conduct at Vattenfall R&D, Älvkarleby, Sweden.

Thesis project tasks

The specific tasks of the thesis project are:

- i) A short literature study on MIC of steel in marine environment and how to conduct laboratory study of MIC with microbes.
- ii) Participate in designing an experimental setup for testing MIC on steel plates used for monopile foundation
- iii) Cultivating and maintaining bacterial community, specially, SRB in test conditions for MIC experiment
- iv) Regular measurement of MIC of steel by using MIC ER probes, measuring bacterial activity and collecting samples from the experiment for further microbial community analysis
- vi) Analyzing and interpreting the data from experiment
- vii) Presenting the final report to working group of Vattenfall R&D and writing and defending the thesis at student's home university.

Learning outcomes: After successful completion of the thesis project, the student is expected to develop:

- a basic understanding of biotic (i.e., microbial) and abiotic processes involved in MIC in marine environment
 - a conceptual idea about experimental setup for MIC, designing and developing a research experiment for MIC at laboratory-scale
 - conducting and maintaining laboratory experiments with microbes and identifying factor(s) important for microbial growth and activity
 - learning different methods of determining corrosion rate of steel specimens
 - Data analysis, writing thesis, scientific presentation and research communication
- This position is for 1 or 2 student(s)

Your background

We are looking for students who want to work towards a fossil-free life within a generation and are soon graduating from your academic studies. You are also someone who identifies with our principles: Active, Open, Positive, and Safety.

We are looking for a highly motivated student(s) who has/have a problem-solving mindset, is/are eager to learn new experimental methods and techniques and, interested in doing multidisciplinary research.

- Education - The student(s) should be at his/her/their final stage of master's program, have either biology/ microbiology/environmental science education with interest for industrial application or engineering education with interest in industrial microbial ecology.
- Scope – 30hp (20 weeks)
- English

More information

- Start Date: January 2024
- Location: Älvkarleby, Vattenfall Research and Development, Infrastructure laboratory
- Application - a combined file with your CV and a personal letter, as well as a copy of your grades. The application deadline is 2023-11-30.
- Contact person and supervisor at Vattenfall: Maidul Choudhury maidul.choudhury@vattenfall.com; +46(0)70-222 84 58

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About us

At Vattenfall, we have decided to make it possible to live fossil-free within a generation. To succeed, as one of Europe's largest energy companies, we must first become completely fossil-free ourselves. But that's not enough. To contribute to a fossil-free society, we must do more than just focus on sustainable energy production.

Because we believe that to make living fossil-free within a generation possible, we need to look at the challenge from a broader perspective than just producing energy sustainably.

Join us on the journey towards a fossil-free life.

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