

Construction and Development of a Tank for the Reproducible Simulation of Biofouling Processes

Biofouling refers to the undesired colonization of technical surfaces in water by organisms such as algae, mussels, or bacteria. For scientific applications, this is particularly problematic because fouled measuring probes, sensors, or underwater vehicles deliver erroneous data, experience increased hydrodynamic drag, and require more frequent maintenance. As a result, costs, energy consumption, and the risk of system failure increase, while long-term measurement series lose accuracy. Biofouling therefore not only impedes operation but also jeopardizes the scientific quality of the collected data.

A test tank offers significant advantages for the investigation of biofouling and the evaluation of marine technologies. Instead of conducting time-consuming and weather-dependent field experiments, experiments can be initiated directly on site and without long preparation times. Within this controlled environment, parameters such as temperature, flow conditions, light, or nutrient concentration can be deliberately adjusted and kept constant—something that is hardly possible in the open sea. This enables targeted monitoring of biofouling, its reproducible initiation, and systematic analysis. At the same time, costs and risks are reduced, as no ship operations are required and instruments remain easily accessible. A test tank thus improves scientific quality, efficiency, and safety in the development and assessment of marine sensors and materials.

The objective of this master's thesis is the development and evaluation of a functional prototype of a biofouling test tank. The focus lies on the reproducibility of processes and the targeted control of environmental parameters.

The following aspects are to be addressed in detail:

- Literature review of naturally occurring biofouling processes
- Derivation of functional and technical requirements for the tank
- Development of a concept for precise control of relevant parameters
- Design and construction of a biofouling test tank
- Experimental evaluation of the prototype with regard to performance, reliability, and practical applicability in the context of repeated biofouling processes