Corrosion monitoring and modelling in the ports of Ostend and Flushing

Witteveen Wikke[1], Horvath Joeri[2], Verhasselt Katrijn[2], Meskens Raf[2], De Baere Kris[2], Lenaerts Silvia[3], Vanoppen Marjolein[4] and Potters Geert[2]

[1] AMACORT, Nautical Sciences, Antwerp Maritime Academy, Noordkasteel-Oost 6, 2030 Antwerp, Belgium
E-mail: wikke.witteveen@hzs.be
[2] Bioscience Engineering, University of Antwerp, Groenenborgerlaan 171, 2020 Antwerp, Belgium
[3] Green Chemistry and Technology, UGent, Coupure Links 653, B9000 Ghent, Belgium

The corrosion of structural steels and stainless steel in an aquatic environment is a complex phenomenon, driven by a non-linear interplay of various physicochemical causes, such as temperature, pH, salinity and oxygen concentration. This interaction is further modulated by the activity of different bacterial consortia. The SOCORRO project (www.socorro.eu), therefore seeks to assess the environment rather than focusing on corrosion itself - using physicochemical and microbial parameters that determine the risk of corrosion as markers instead of causal factors. The accumulated corrosion risk can then be determined by measuring environmental markers over time, thereby allowing for planned inspections and maintenance or to provide data in relation to lifetime expansion.

To explore the relation between the environment and corrosion, machine learning and a correlation analysis are conducted by measuring environmental markers and corrosion in several industrial settings to generate an extensive dataset.

Sensor units were placed in the port of Ostend (Belgium) and Flushing (The Netherlands) to generate the abovementioned dataset, over the course of six to nine months. Corrosion rates were obtained from frequent mass loss measurements (using steel coupons of Grade A S235 carbon steel, S355 carbon steel and 316L stainless steel) as well as half hourly determination of linear polarization resistance (LPR with electrodes of the same steel types). Environmental markers (dissolved oxygen, temperature, conductivity, pH, chloride content, redox potential and chlorophyll) were measured half hourly as well, with a commercially available multiprobe (Scuba90).

Insights into the most prominent corrosion markers, the main difficulties of performing long term linear polarization experiments (and potential differences between measuring methods) and the main difficulties of measuring environmental parameters in these industrial environments are presented.

Keywords
Corrosion; Port; Ostend; Flushing; modelling; Low-alloyed carbon steel; Port infrastructure