Functional Test: Prevention of Fouling without Chemicals

Customer:

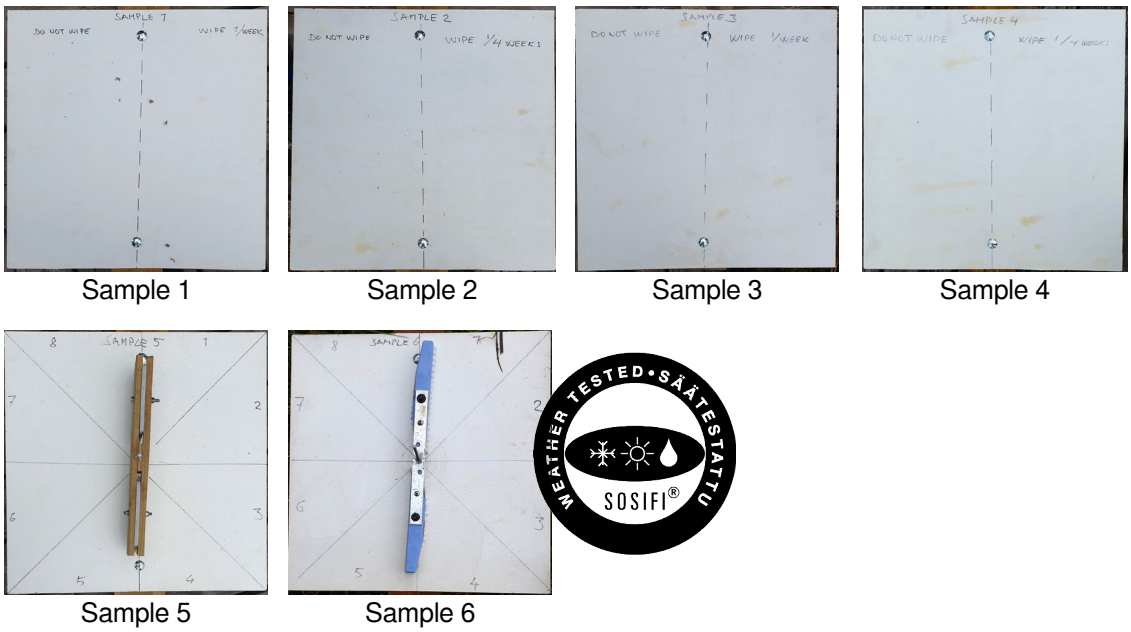
FoulFighter Oy
FI-20660 Littoinen, Finland

Purpose of the Test:

The purpose of the test is to investigate the appearance of fouling in the Baltic Sea and to provide evidence that frequent soft wiping without any chemicals prevents fouling of surfaces.

Target:

Fouling in seawater.
Metal sheets with epoxy primer surface treatment are used as test specimens (see Fig. 1).
The samples were numbered from 1 to 6. Sample size was 500 mm × 500 mm.



Sample 1 | Sample 2 | Sample 3 | Sample 4

Sample 5 | Sample 6

Fig. 1. *Test specimens, Samples 1 – 6: Metal sheets with epoxy primer. Samples 5 and 6 were equipped with rotatable wiping tools: Windscreen wiper (Sample 5) and brush (Sample 6).*

Testing Time:

The start of the test: 4th July, 2020
Estimated end date: End of September, 2020

The results reported here are from 4th July - 11th September, 2020.

Test Method:

Test Procedure

- The test specimens are kept in seawater at a depth of two meters.
- Weekly, the test specimens are lifted out of the water for actions and inspections.
- Actions according to the Treatment Plan (see below) are performed.
- The test specimens are inspected and photographed.
- The seawater temperature is measured.
- The test specimens are placed back to the seawater.

Treatment Plan
The test specimens are wiped as follows:

Samples 1 and 3:	One half of the surface is wiped with a rag every one week The other half is not wiped (reference)
Samples 2 and 4:	One half of the surface is wiped with a rag every four weeks The other half is not wiped (reference)
Samples 5 and 6:	The wiping tool is rotated 45° clockwise, i.e. over one segment marked on the sheet, every one week

Feasibility of the Test Method:

The test method was created by FoulFighter Oy. This simple experimental configuration is very similar to the actual conditions under which fouling occurs. For example, fouling accumulates in parts of ships that are constantly under water.

Selected frequency of wipes, one week or four weeks, represents a schedule that could be implemented in real use, e.g. in cleaning of ships. In addition, the rotatable wiping tools provide information on the development of fouling after wiping in one week intervals, i.e., how the surface looks after one, two, three and four weeks after wiping. In this way, a sufficient frequency can be estimated.

Performed Actions:

Sample Preparation
The sample preparation was performed by FoulFighter Oy.

The metal sheets were cut to a size of 500 mm × 500 mm. The surfaces were sanded and treated with epoxy primer. Three coats of the primer were applied. The samples were attached to wooden poles. Rotatable wiping tools were attached to Samples 5 and 6, a windscreen wiper for Sample 5 and a brush for Sample 6. The surface of Samples 1 – 4 was divided into two halves. One half is wiped according to the Treatment Plan and the other half is not. The surface of Samples 5 and 6 was divided into 8 segments, along which the wiping tools are rotated according to the test plan. See Figs 1 and 2.

Fig. 2. *Sample preparation. See the text for more details.*

Test Arrangement
The samples were placed in seawater to a depth of two meters. The test arrangement is shown schematically in Fig. 3. Figure 4 shows the test site in Naantali in the Baltic Sea.

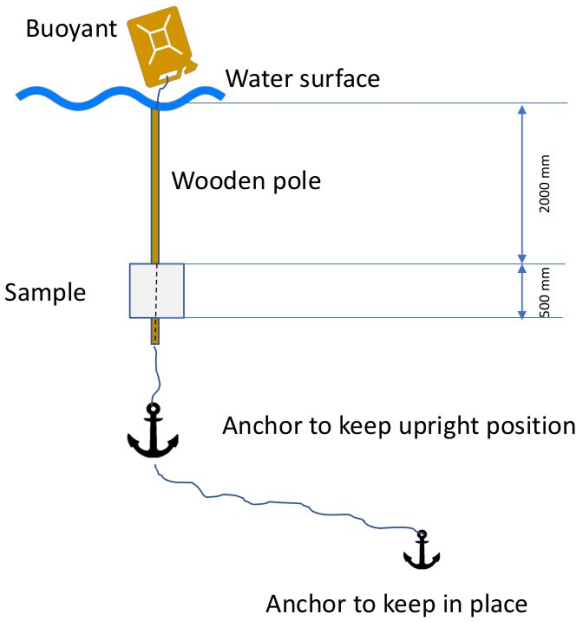


Fig. 3. *Test arrangement by which the samples were kept in seawater.*

Fig. 4. *Test site in Naantali in the Baltic Sea.*

Test Execution

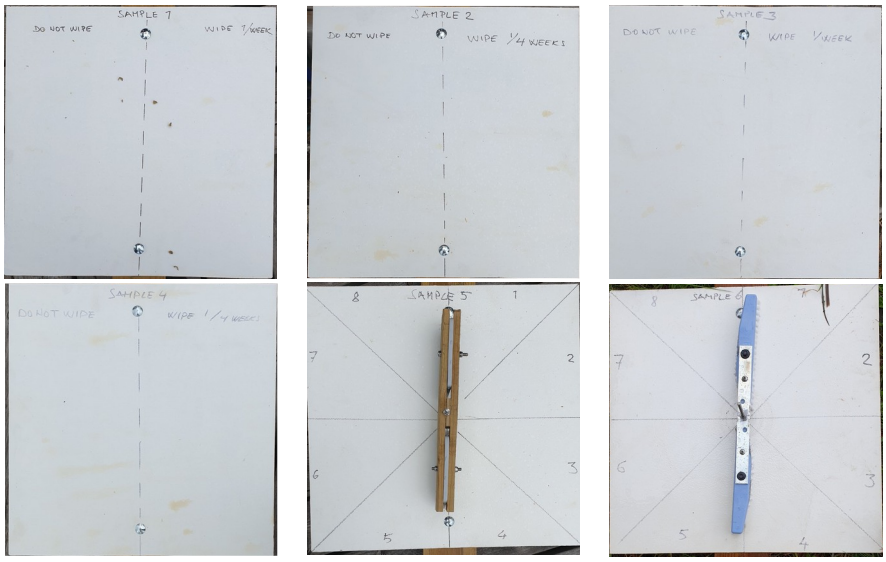
- The test specimens were kept in seawater at a depth of two meters.
- Weekly, the test specimens were lifted out of the water for actions and inspections.
- Actions according to the Treatment Plan were performed.
- All test specimens were inspected and photographed.
- The seawater temperature was measured.
- The test specimens were placed back to the seawater.

Results
As assumed, fouling was found to be significant in the Baltic Sea. It was evidenced that frequently repeated wiping prevented fouling.

Figure 5 shows the results of the weekly inspections of the samples. Samples 1 and 3 were wiped with a rag every one week, Samples 2 and 4 were wiped with a rag every four weeks and the wiping tools of Samples 5 and 6 were rotated clockwise over one segment (45°) every one week. Comparing Samples 1 and 3 to Samples 2 and 4, it can be seen that a one-week wiping interval is sufficient to keep the surfaces clean while a four-week interval is not. Looking at the segments of Samples 5 and 6, it can be seen that even after two weeks the surface is clean, but after three weeks fouling starts to appear.

The seawater temperature was in the range of 16 – 22°C during the test.

0 weeks
04-07-2020
+18°C



1 week
11-07-2020
+17°C

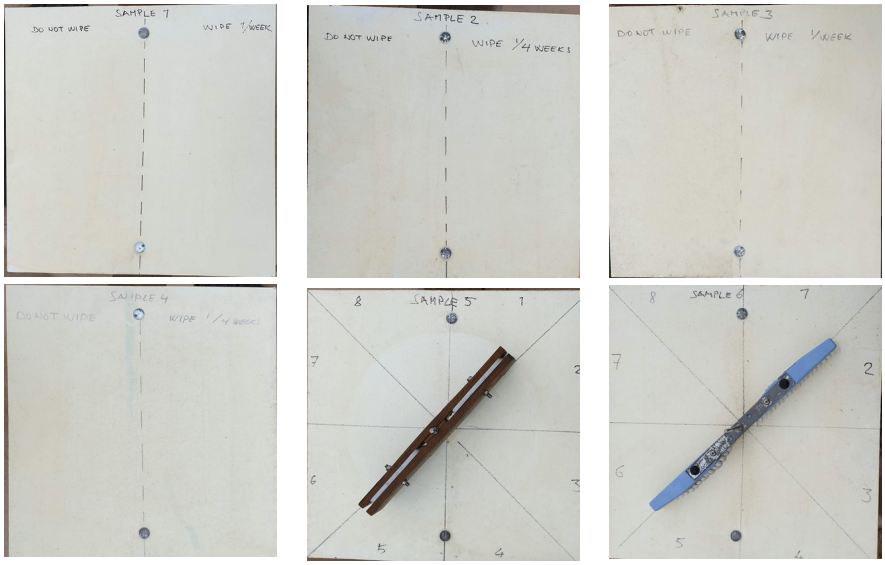
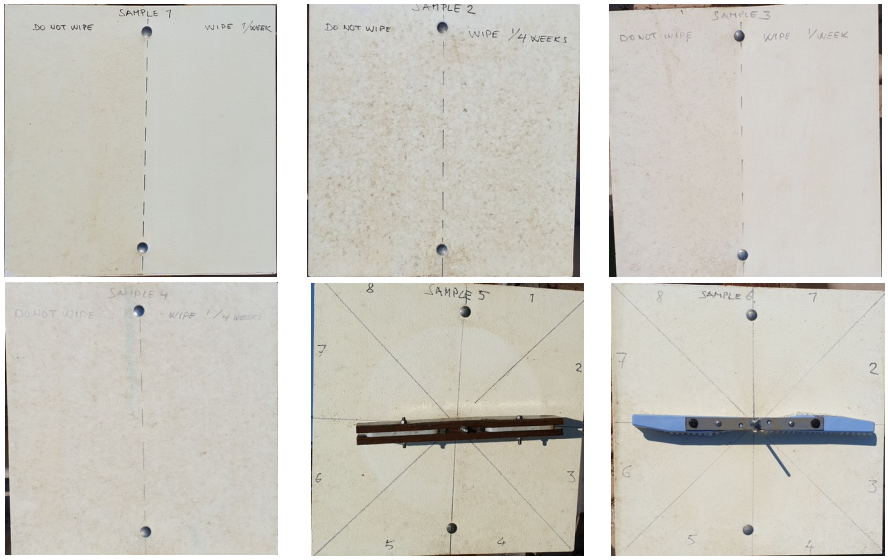


Fig. 5. *To be continued.*

2 weeks
17-07-2020
+20℃



3 weeks
24-07-2020
+19℃

4 weeks
31-07-2020
+18℃

Fig. 5. *To be continued.*

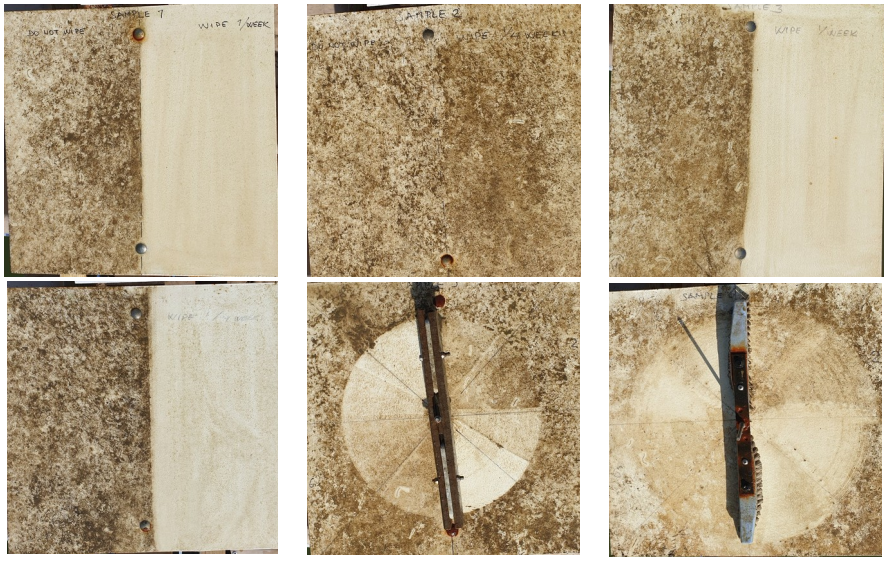
5 weeks
07-08-2020
+21°C

6 weeks
14-08-2020
+21°C

7 weeks
21-08-2020
+22°C

Fig. 5. *To be continued.*

8 weeks
28-08-2020
+20℃



9 weeks
04-09-2020
+18℃

10 weeks
11-09-2020
+16℃

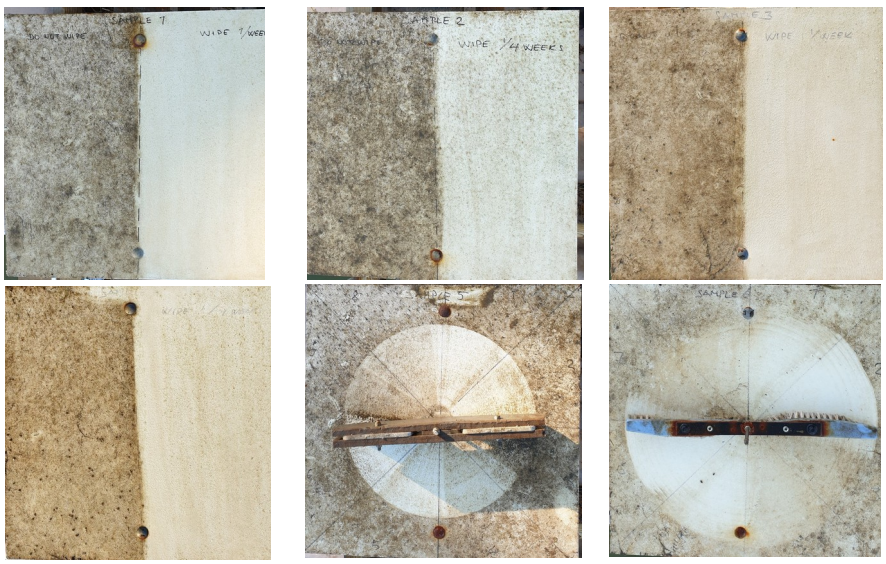


Fig. 5. *Test results. Samples are for each date from top left to bottom right: Sample 1, Sample 2, Sample 3, Sample 4, Sample 5 and Sample 6.*

Conclusions:

The formation of fouling in the Baltic Sea and its prevention were investigated. The fouling was obvious. It was evidenced that frequently performed soft wiping without any chemicals prevents fouling remarkably.

In these Baltic Sea conditions, the wiping worked as expected. A wiping interval of 1 – 2 weeks was sufficient to keep the test surfaces clean, while a wiping interval of 4 weeks was found to be too long to prevent fouling.

Recommendations:

A similar test should be repeated under different marine conditions. In the Earth's seas, salinity, marine organisms, water temperature, water flows and the effect of sunlight underwater vary. Therefore, field tests and tests on ships in motion are recommended.

Remarks:

The test was carried out by FoulFighter in the Baltic Sea in the Naantali region. One of the weekly research events was supervised by representatives of Solar Simulator Finland, R. Perälä, PhD, Materials physics, and H. Suokivi, MSc, Physics.

Signatures:

Riitta Perälä, PhD
Littoinen, 16th September, 2020
Solar Simulator Finland