BIOFOULING CONTROL SOLUTIONS FOR REDUCED ENERGY CONSUMPTION IN VESSELS

INTRODUCTION

All vessels operating in water will experience marine growth on the hull. The marine growth can be classified into macro biofouling (barnacles, seaweed, etc) and micro biofouling (slime or biofilm). Biofouling will increase the weight and surface roughness of the hull, increasing ship resistance (Haslbeck and Bohlander 1992) and thereby increasing fuel consumption (Schultz, Bendick et al. 2011).

REFERENCES


RESEARCH PLAN

**WP1: Drag characterisation of marine coatings and fouling**

- Establishment of reliable drag evaluation method of hull coatings;
- Performance analysis of environmental impact of hull coatings & fouling

**WP2: Study of different stages of algae fouling**

- Characterization and modeling of different stages (e.g. microalgae-diatoms and green macroalgae-Ulva sp);
- Evaluation of roughness functions for soft fouling

**WP3: Measurement of friction drag on small-scale rotating rig**

- Collection of more drag data of different coatings using quick rotating disk tests

**Table 1.2 Estimated effect of the choice of fouling control method on annual fuel consumption and CO2 emissions. It is assumed that IMO estimations for 2020 correspond to a fleet featuring hydrodynamically smooth hulls. The increased shaft power as a function of the fouling degree is obtained from Schultz (2007) based on his calculations for an Oliver Hazard Perry class frigate sailing at 15 knots**

<table>
<thead>
<tr>
<th>Fouling Type</th>
<th>Shaft Power Increase (% of Baseline)</th>
<th>Fuel Savings (2020 tonnes)</th>
<th>CO2 Emissions (2020 tonnes)</th>
<th>Money Savings ($Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshly applied coating</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Deteriorated coating or thin slime</td>
<td>9</td>
<td>44</td>
<td>134</td>
<td>22</td>
</tr>
<tr>
<td>Heavy slime</td>
<td>19</td>
<td>92</td>
<td>279</td>
<td>46</td>
</tr>
<tr>
<td>Small calcareous fouling or macroalgae</td>
<td>33</td>
<td>160</td>
<td>488</td>
<td>80</td>
</tr>
<tr>
<td>Medium calcareous fouling</td>
<td>52</td>
<td>253</td>
<td>768</td>
<td>127</td>
</tr>
<tr>
<td>Heavy calcareous fouling</td>
<td>84</td>
<td>498</td>
<td>1238</td>
<td>204</td>
</tr>
</tbody>
</table>

**DESIGN AND MANUFACTURE OF COATING TESTING DEVICE**

Herein, a new flow channel device is proposed with the aim of culturing biofouling (i.e. algae) in flow. The device will also allow testing of drag impact of fouling to assist for further research on novel fouling control solutions.

**PROSPECTS**

Experimental and Numerical computations will provide paint manufacturers and ship owners/charterers a possibility to account for the contribution of the coating resistance in the total resistance of a vessel, both directly out of dock and after some time in service (includes paint wear and fouling), so that the ship owners will be able to actively minimize the energy consumption of vessels.