

Study of fuel consumption in the presence of biofouling growth on the underwater ship hull

Della Thomas¹, S. Surendran^{1*}, Nilesh J Vasa² and P. Sivabalan¹

¹ Department of Ocean Engineering, IIT Madras

² Department of Engineering Design, IIT Madras

*Corresponding author

Key words: biofilms, bio-fouling, resistance, powering, coating

Abstract: Tropical waters harbor millions of microorganisms which are responsible for biofouling on the underwater part of any marine structure, stationary/moving. In both types of structures, the growth of biofouling alters the actual immersed size of the structure. In the case of a moving body like ship, the growth of biofouling creates additional drag and hence increased consumption of fuels. Modern paints applied on the hull surface pose serious concern to the aquatic environment. Even though these coatings are applied with a guarantee of up to about 5 years, the toxicity of harmful ingredients in these coatings would lead to extinction of certain species in marine water. International Maritime Organization (IMO) has set stringent rules in order to monitor and hence mitigate the harmful environmental impact created by the anti-fouling coatings. A newly built ship has a paint finish of about 100 microns thickness. Within a few months of the service period of the ship, the surface roughness of the underwater hull portion gradually increases and poses a grave threat of corrosion and hence leads to exponential increase in maintenance costs.

This study deals with the influence of marine growth or its resistance effect on the powering of ships. This is important as the fuel consumed to maintain the design speed increases tremendously as the biofouling growth increases. In this study the powering criterion has been determined for various growth stages of the marine fouling. The additional power also has been determined for various loading conditions and speed ranges. Experimental and computer simulations were used to determine the power for various loads for commercial ships. It has been possible to simulate the amount of power consumption corresponding to a biofouling growth thickness. This will be a very useful parameter for a marine vessel sailing along a particular route. The pattern of growth for a particular route can predict the additional fuel required for the ship to reach the destination in a specified time. Hence, the significance of the study the growth pattern of marine biofouling is clearly highlighted.

Although many antifouling paints are available commercially, they have not been able to wipe out the problem of biofouling completely. Hence further research needs to be carried out in order to come up with better antifouling coatings. Biofouling characterization using optical methods would be carried out in order to determine its exact elemental composition and constitution. Hence, such an investigative study would serve as a critical input in the formulation of the right type of eco-friendly coating for the ship hull protection.