

White Paper
Anti-Fouling Coating
August 2019

Contents:

- Title Page page 1
- Executive Summary page 2
- Business Challenge page 2
- Solution page 3
- Target Markets page 4
- Benefits page 4
- Technical Specifications page 4
- Summary page 5
- References page 5

Issue Number	Issue Date	Revision Comment	Revision Author
0	August 2019	Original	Guy Williams

Executive Summary

Biofouling of seagoing vessels costs the vessel owner and operator time and money.

Biofouling results in additional and avoidable greenhouse emissions through increased fuel use.

Biofouling can start within hours of a vessel entering the water.

The Blocksil Anti-Fouling Coating has, at the time of writing this paper, been working for 18 months without any barnacle build up.

The Blocksil Anti-Fouling Coating is a non-sacrificial coating and does not kill the barnacles.

Business Challenge

Biofouling or biological fouling is the accumulation of microorganisms, plants, algae or animals on wetted surfaces. Such accumulation is referred to as epibiosis when the host surface is another organism and the relationship is not parasitic.

The variety among biofouling organisms is highly diverse and extends far beyond the attachment of barnacles and seaweeds. According to some estimates, over 1,700 species comprising over 4,000 organisms are responsible for biofouling.¹

Governments and industry spend more than US\$5.7 billion annually to prevent and control marine biofouling.² Biofouling occurs wherever there is water but is most significant from an economic aspect to shipping, since fouling on a ship's hull significantly increases drag, reducing the overall hydrodynamic performance of the vessel and hence increases fuel consumption.³

In some instances the ship's hull structure and propulsion systems can be damaged.⁴ The accumulation of biofouling on hulls can increase both the hydrodynamic volume of a vessel and the hydrodynamic friction, leading to increased drag of up to 60%.⁵ The drag increase has been seen to decrease speeds by up to 10% which in turn can require up to a 40% increase in fuel to compensate.⁶

Anecdotal evidence to the author has suggested that very fast boats can lose as much as 25 knots off their top speed over a six month period.

With fuel typically comprising up to half of marine transport costs, antifouling methods are estimated to potentially save the shipping industry around \$60 billion per year.⁶

Increased fuel use due to biofouling also contributes to adverse environmental effects and is predicted to increase emissions of carbon dioxide and sulphur dioxide between 38% and 72% by 2020.⁷

A tertiary effect of biofouling is the increased risk of bioinvasion. This is the undesirable accumulation of microorganisms, plants, algae and animals on submerged structures. Studies have shown that biofouling can be a significant vector for the transfer of invasive aquatic species.⁸

While ballast water is essential for safe and efficient modern shipping operations, the potential for invasive aquatic species transferred through biofouling to cause harm has been recognized by the IMO, the Convention on Biological Diversity (CBD), several UNEP Regional Seas Conventions (e.g. Barcelona Convention for the Protection of the Mediterranean Sea Against Pollution), the Asia Pacific Economic Cooperation forum (APEC) and the Secretariat of the Pacific Region Environment Programme (SPREP).⁸

All ships have some degree of biofouling, even those which may have been recently cleaned or had a new application of an anti-fouling system.

Studies have shown that the biofouling process begins within the first few hours of a ship's immersion in water. The biofouling that may be found on a ship is influenced by a range of factors, such as:

- 1 design and construction, particularly the number, location and design of niche areas (e.g. sea chests, bow thrusters, hull appendages and protrusions, etc.);
- 2 specific operating profiles, including parameters such as operating speeds, ratio of time underway compared with time alongside, moored or at anchor, and where the ship is located when not in use (e.g. open anchorage or estuarine port);
- 3 places visited and trading routes (e.g. depending on water temperature and salinity, abundance of fouling organisms, etc.);
- 4 maintenance history, including the type, age and condition of any anti-fouling coating, installation and operation of anti-fouling systems and dry-docking/slipping and hull cleaning practices.⁸

Clearly there is an economic and environmental need for an effective and safe anti-fouling coating.

Solution

As a coatings innovator, our philosophy is to create simplicity from complexity.

Anti-fouling is the process of preventing accumulations from forming. At the heart of an effective anti-fouling coating is a biocide. A biocide is chemical substance that deters or kills the microorganisms responsible for biofouling.

The route Blocksil has taken is to identify and offer a biocide that is not organic and is benign to aquatic life. In the past tributyltin (TBT) was used, but it is toxic to both microorganisms and larger aquatic organisms and so was banned in 1998.⁸

The biocide details in the Blocksil Anti-Fouling Coating are kept confidential by the inventor and manufacturer.

Our Anti-Fouling Coating works by deterring barnacle larvae from wanting to stick to the coating. It doesn't kill the larvae, just makes them "swim" away.

At the time of this paper being written, a test vessel has managed 18 months of ocean immersion without any barnacle build up. Seaweed and mollusc build up has occurred but this can be wiped of by hand. The implication being that a quick moving vessel would effectively be self-cleaning.

Target Markets

Industries that could use the Anti-Fouling Coating and help reduce their energy consumption are clearly marine based.

The most obvious being ocean going vessels of all types, from transport through pleasure to military.

The Blocksil Anti-Fouling Coating is of benefit to any country with ocean going vessels.

Benefits

- It works
- Easy to apply with minimal training
- Long lasting
- Permanent – not sacrificial
- Reduces fuel consumption and hence greenhouse gas emissions
- Maintains the speed of the vessel

Technical Specifications

- Apply as a coating by brush, roller or spray
- Two pack system with one hour pot life
- Different colours available
- Application equipment can be cleaned in water
- Faint odour
- Theoretical coverage of 4 to 5 square metres per litre at 100 microns dry film thickness

Summary

By using Anti-Fouling Coating, the vessel owner or operator can make long term savings in fuel through a maintained performance.

The energy and environmental savings will become ever more valuable as we continue on the path of climate change.

The Anti-Fouling Coating does not kill the animal life trying to attach itself to the vessel's hull.

References

- 1 Almeida, E; Diamantino, Teresa C.; De Sousa, Orlando (2007), "Marine paints: The particular case of antifouling paints", *Progress in Organic Coatings*, 59 (1): 2–20, doi:10.1016/j.porgcoat.2007.01.017.
- 2 Rouhi (1998), <http://pubs.acs.org/doi/abs/10.1021/cen-v076n017.p041>.
- 3 Woods Hole Oceanographic Institute (1952), "The Effects of Fouling", *Marine Fouling and its Prevention (PDF)*, United States department of the Navy, Bureau of Ships.
- 4 L.D. Chambers; et al. (2006). "Modern approaches to marine antifouling coatings". *Surface and Coatings Technology*. 6 (4): 3642–3652. doi:10.1016/j.surfcoat.2006.08.129.
- 5 Vietti, Peter (4 June 2009), New hull coatings for Navy ships cut fuel use, protect environment, Office of Naval Research, retrieved 21 May 2012.
- 6 Vietti, P. (Fall 2009). "New Hull Coatings Cut Fuel Use, Protect Environment" (PDF). *Currents*: 36–38. Archived from the original (PDF) on 5 October 2011. Retrieved 6 June 2011.
- 7 Salta, M.; et al. (2008). "Designing biomimetic antifouling surfaces". *Philosophical Transactions of the Royal Society*. 368 (1929): 4729–4754. Bibcode:2010RSPTA.368.4729S. doi:10.1098/rsta.2010.0195. PMID 20855318. Retrieved 25 May 2011.
- 8 International Maritime Organization.