

Biofouling and Ballast Water Services

The transport of invasive species through ships ballast water and biofouling poses a serious environmental and economic threat. The regulation of ballast water discharge through the United Nations (UN) and International Maritime Organization (IMO) means new guidelines are imminent for ballast water treatment (BWT). There is also increasing pressure to reduce the number and concentration of biocides for use in antifouling coatings.

PML Applications Ltd, a trading subsidiary of Plymouth Marine Laboratory (PML), is addressing these areas of concern through a multi-disciplinary scientific research team.

Biofouling - consists of unwanted organic growth on surfaces immersed in water. It poses economic and environmental problems for many industries and is particularly problematic when it encrusts the hulls of vessels. Biofouling can transport unwanted organisms into ecosystems and, through excess weight and drag, it can lower the efficiency of a vessel



producing higher fuel costs and increasing CO₂ emissions. With the world fleet producing an CO₂ into the atmosphere at volumes equivalent to a country the size of Germany, any increase is significant. The increased cost caused by drag and lowered efficiency runs into many millions of dollars each year as does the cost of removing a ship from the fleet for intensive cleaning in dry dock.

Ballast water - is a necessary ingredient of efficient shipping and the commerce it carries, but it can pose a significant environmental threat when discharge results in the introduction of 'alien' organisms into coastal waters, ports and harbours. Environmentally safe ballast water control is the subject of scrutiny by international as well as domestic agencies and the regulations concerning 'cleansing' of ballast water are subject to continuous review and tightening.



Services provided

Biofouling

- Biofilm and macro invertebrate analysis
- Modelling the fate of leached substances in the environment
- SEM and ESEM microscopy for analysis of coatings and fouling organisms
- Hydrodynamic test facilities
- Field test facility: full range of immersion tests in different environments

Ballast water

- Expertise in chemistry, microbiology, ecotoxicology, plankton ecology and modelling
- Effectiveness of ballast water treatment (BWT) systems
- Ballast water risk assessment
- Proof-of-concept & prototype testing
- Scientific coordination for technology development and applications to IMO

General services

- Technology reviews targeted to the specific needs of our customers together with advice on pending legislative requirements
- Consultancy and R&D programmes targeted to meet customer requirements

Addressing biofouling



Biofouling is a matter of great concern and potentially massive financial cost to any organisation placing an object in the marine environment. Of particular concern are vessels of all sizes, including leisure, commercial and military, and offshore renewable energy structures such as tidal turbines. Hull and turbine efficiencies can be dramatically reduced (by up to 40%) as a result of extra loads or blockages caused by encrusting

marine organisms such as algae or barnacles. A large range of chemical based 'solutions' have been proposed and used over the last few decades, but many of these carry an environmental cost that is too high e.g. Tributyltin (TBT) which was banned internationally in 2008.

Where chemical methods are proposed, PML Applications Ltd can provide detailed studies on the eventual fate and impacts of leached chemical substances into the marine environment. Further projections are enhanced by PML's sophisticated modelling suite, which can determine the fate of leachates in both time and spatial spread.

Understanding the fundamentals of conditioning layer formation and the development of biofilms together with the organisms at detailed levels is essential and key to PML Applications' approach. PML Applications Ltd can bring microscopy together with molecular techniques to reveal the intricate interactions between macrofoulers, biofilms and coatings to assess the relative efficiencies of particular methods.

Testing the impacts of biofoulers and the methods used to combat them can be carried out with hydrodynamic testing facilities at PML. A flexible approach allows the equipment to be tailored to the needs of individual customers' requirements. Longer term testing and monitoring facilities, including immersion in a variety of environments, and subsequent evaluation is readily available.

PML Applications Ltd is providing biofouling services to the renewables and oil and gas industries together with technology reviews targeted for the specific needs of our customers and advice on pending legislative requirements.

Addressing ballast water



Many companies are developing techniques and applications to combat the ballast water problem by effectively cleansing water whilst inside the ship prior to discharge. PML Applications Ltd offers a service for development of and testing the efficiency of these methods by using its expertise in microbiology, toxicology, plankton ecology

combined with superior computer modelling to 'quality control' the methods developed by external companies; and authorities.

The national and international legislation concerning ballast water discharge standards is complex. PML Applications Ltd is working with industrial partners to help develop technologies and agencies to understand the regulations so ensuring that newly developed technologies satisfy requirements.



Appraisals of developing technologies and applications for approval in a scientifically co-ordinated manner are a particular strength of the PML Applications' team ensuring that submissions are clear and logical.

PML Applications Ltd can provide reviews of current technologies and the regulations governing them to ensure best fit for commercial partners.

About PML Applications Ltd

PML Applications Ltd is the wholly owned trading subsidiary of PML (www.pml.ac.uk). It was set up in 2002 to broaden the application of PML's research products and to drive the process of knowledge transfer, identifying and bringing to market the next generation of innovation and products.

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