PRESS RELEASE

Shipping of the future: biodegradable antifouling coatings for clean seas

More sustainable antifouling coatings for ships are in demand. These innovative solutions should largely dispense with biocides and still withstand the challenges of maritime use. As part of the "BioSHIP" project funded by the German Federal Ministry for Economic Affairs and Climate Action (BMWK) under the "Maritime Research Program", industry and science are working together to develop such environmentally friendly coatings. The biodegradable, self-polishing coatings should not only offer the same functionality as conventional products, but also minimize the release of toxic heavy metals and microplastics into the sea - a major step towards green shipping.

At over 30,000 square meters, the hull area of a medium-sized container ship can reach impressive dimensions. These extensive areas provide an ideal habitat for a variety of sessile organisms such as algae, barnacles and mussels. However, this colonization causes considerable problems for shipping. The growth, also known as biofouling, increases the flow resistance and leads to increased fuel consumption. This not only results in higher costs, but also contributes to an increase in carbon dioxide emissions. There is also a risk that introduced species could endanger the stability of marine ecosystems. To combat biofouling, antifouling coatings containing biocides are generally used – highly effective but often poorly degradable substances that have undesirable effects on water quality and aquatic organisms. For this reason, a large number of different approaches have been pursued in recent decades to develop more environmentally friendly ship coatings. Nevertheless, many self-polishing coating systems are based on problematic heavy metal salts that end up in water bodies and sediments.

From biocide-containing coatings to an environmentally friendly alternative

Biocidal coatings currently dominate the market. Through the targeted release of heavy metals, they are particularly effective against biofouling and account for about 80 percent of the applications used worldwide. The most commonly used self-polishing coatings also contain special polymers that break down on contact with water and thus always create a smooth surface, which makes colonization more difficult. The aim of the "BioSHIP" project is to develop a biodegradable, self-polishing ship coating that requires significantly lower levels of toxic heavy metals and minimizes environmental pollution. A promising approach for biodegradable, self-polishing coatings lies in the targeted control of the degradation rate in order to ensure a long-lasting antifouling effect. The project focuses on more sustainable formulations, including the use of bio-based polymers such

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as polylactide (PLA) or chitosan derivatives, which degrade in a controlled manner under marine conditions without leaving harmful residues. The balance between durability and biodegradability can be further optimized through the targeted synthesis of functionalized additives.

Interdisciplinarity as the key to sustainable material innovation

The project combines expertise from various disciplines to ensure targeted development. Material development focuses on biodegradable polymers and innovative coating components that meet the requirements for durability, fouling protection, and environmental compatibility. At the same time, the coatings are tested under real marine conditions, including different geographical regions, to ensure broad applicability. In addition, the project partners are conducting ecotoxicological studies to ensure that the materials developed have no harmful effects on organisms.

Through close cooperation between science and industry, the project shows how technological innovations can help to tackle global challenges. The results of "BioSHIP" could not only make a valuable contribution to the maritime industry, but also provide impetus for other sectors that rely on sustainable material solutions. Especially in regions with strict environmental regulations, such as Europe, Australia, New Zealand or parts of the USA, the technology could establish new standards and decisively drive the transition to more sustainable shipping.

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Project partners

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- Dr. Brill + Partner GmbH (Institute for Antifouling and Biocorrosion, Norderney)
- Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM
- Hydrotox GmbH

Illustrations

Ship's hull in the dock: Barnacles and dried biofilm – typical traces of maritime fouling.

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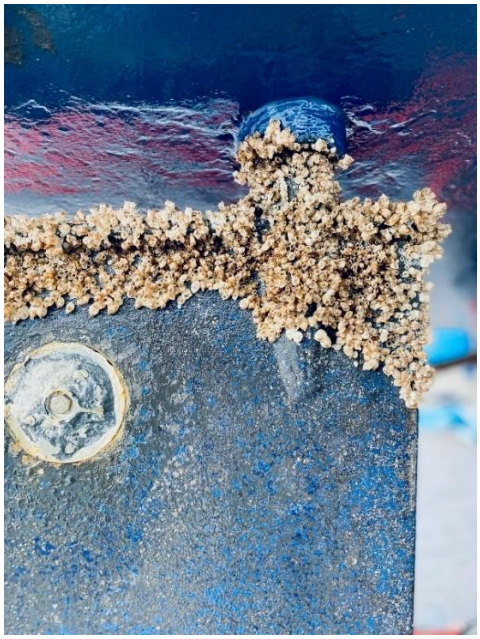

Coated Rudder blade: Despite the protective coating, there is barnacle growth, whose calcareous shells increase frictional resistance, increase fuel consumption, and can impair the rudder function. © Fraunhofer IFAM

"BioShip" project logo