Biointerphases®

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Nanostructures Take on Biofouling Organisms

Thirty one members from the European Union (EU) have come together to develop nanostructured surfaces that could be the answer to that age-old problem of aquatic biofouling. [Rosenhahn, *et al., Biointerphases* (2008) **3**, 1].

The marine industry is plagued by barnacles, bacteria, and algae that stick onto the surfaces of vessels. In fact, it is estimated that the extra weight on ship hulls and increased drag results in the consumption of an extra 300 million tons of fuel per year, worldwide.

So far, the answer to biofouling has been in the form of protective coatings containing tributyltin (TBT). However, these coatings have become increasingly restricted by the International Maritime Organization because they are toxic.

A concerted effort funded by the EC Framework 6 Integrated project AMBIO (Advanced nanostructured surfaces for the control of biofouling, http://www.ambio.bham.ac.uk/), coordinated by Prof. J.A. Callow (University of Birmingham) is focusing on engineering new protective coatings that do not contain TBT and researchers are looking to nanomaterials to provide all the key elements necessary for an ideal antifouling material.

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"Adhesion involves interfacial interactions, between the living organisms and the marine structure, which occur within a few nanometers of a surface," Axel Rosenhahn of the University of Heidelberg in Germany explains.

One approach is the formation of self-assembled monolayers (SAMs), layers of molecules that assemble on surfaces in a highly ordered fashion. The studies show that there is a marked improvement in antifouling properties when SAMs have an exposed hydrophilic group. Topology of coatings on the nano- and micrometer scale can change the materials` biofouling properties significantly. For a selected class of marine biofoulers, carbon nanotube□filled silicone coatings and amphiphilic block copolymer coatings that exhibit a self-assembling nanoscale surface morphology after immersion, show a marked improvement in antifouling or foul release properties, but generalization is not yet possible.

"Innovation is especially important in the current legislative climate in which environmentally benign products are increasingly sought," says Rosenhahn. "Emerging technologies, such as nanostructuring of coatings, will provide such a source of innovation."

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Advanced nanostructures for the control of biofouling: The FP6 EU Integrated Project AMBIO,
Axel Rosenhahn, Thomas Ederth, and Michala E. Pettitt
http://scitation.aip.org/journals/doc/BJIOBN-ft/vol_3/iss_1/IR1_1.html