



## AMBIO

### Advanced nanostructured surfaces for the control of biofouling

#### The Challenge

'Biofouling' is the colonisation of submerged surfaces by unwanted organisms such as bacteria, barnacles and algae, and has detrimental effects on shipping and leisure vessels, heat exchangers, oceanographic sensors and aquaculture systems.

Fouling on hulls of ships can reduce speed in excess of 10% and burn 40% more fuel which has an impact on fuel costs and additional greenhouse gas production (estimated to be 384 million tonnes per annum). The influence of biofouling on coastal and oceanographic measuring instruments is very strong and the earliest stages of biofouling, within a few days of immersion, significantly affect data quality and instrument performance. Biofouling of intake structures, screens, seawater piping systems and heat-exchanger tubes in desalination and power plants causes an overall decline in plant efficiency at great economic cost. In the area of membrane technology, microfiltration and ultrafiltration membranes are used for drinking water production and wastewater treatment. The primary limitation to the more widespread adoption of membrane filtration is fouling with microorganisms and organic molecules which leads to a significant decline of the permeate flux, higher energy consumption, and eventually, failure to meet the regulatory standards.

Finally, biofouling is a major problem throughout the European and global aquaculture industries. Biofouling on farm infrastructure greatly reduces the efficiency of materials and equipment. Problem areas include immersed offshore-structures such as cages, netting and pontoons, on-shore equipment and structures such as pipelines, pumps, filters and holding tanks. Cost estimates for small shellfish producers indicate that biofouling leads to annual costs of €96000 per year, per farm.

#### Project Objective

The overall goal of the project was to provide a combination of fundamental and application-oriented research that will lead to the development of novel coatings that will prevent or reduce the adhesion of fouling organisms through the physico-chemical properties of the surface, rather than the release of biocides. The research on nanoscale interfacial properties of different surfaces and how organisms adhere will allow understanding how anti-biofouling systems can work at the nanoscale. To achieve this goal the project aimed to take advantage of the new opportunities for designing and manipulating antifouling surfaces provided by nanotechnology.



#### EATiP Thematic Area of Relevance

**TA1:** Product Quality, Consumer Safety and Health

**TA2:** Technology and Systems

**TA3:** Managing the Biological Lifecycle

**TA4:** Sustainable Feed Production

**TA5:** Integration with the Environment

**TA6:** Knowledge Management

**TA7:** Aquatic Animal Health and Welfare

**TA8:** Socio-Economics and Management

#### Key Words

Biofouling, antifouling, nano technology, coatings, marine, infrastructure

#### Project Information

**Contract number:**  
11827

**Contract type:**  
FP6 Integrated Project

**Duration:**  
60 months (March 2005 – February 2010)

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## Key Points

- Which nano-designs show good “antifouling” properties against a range of test organisms?
- How does nanostructure influence adhesion of organisms?
- How do coatings respond to the aquatic environment and how do nanofillers influence this?
- Which design concepts show most promise as durable antifouling coatings for a range of “real-world” applications?

## Output Highlights

RTD protocol: Lab-based methods for the assessment of antifouling and fouling-release performance of coatings against representative fouling organisms.

RTD protocol: Methods for “best practice” field testing of new coatings for use in the aquaculture industry.

Prototype: New fouling-release coatings based upon amphiphilic blends of zonyl-acrylates and silicones.

## Next Steps – Suggested Actions/Follow On



**RTD**

- Still much work to do in perfecting new coatings for a range of antifouling applications including aquaculture.

## Related Publications/Projects

For a complete list of publications please refer to the website:  
<http://www.ambio.bham.ac.uk/results.shtml>

A new EU project, SEACOAT