MESTECH Research Project

Project Title: Novel anti-fouling strategies based on materials doped with nanoparticles for use in environmental monitoring technologies.

Project Researcher: James Chapman

Funding Body: The QUESTOR Centre

Project Summary: Biofouling is defined as the undesirable accumulation of micro-organisms, flora and fauna upon an immersed substrate and causes economic loss of more than $3 billion dollars per annum. The process poses deleterious effects upon objects that come into contact with the substrate; prevailing as turbulent drag on ships or hydro-electric pipelines causing inefficiency on water dynamics or reduction of water flow. Engineered structures such as marine platforms, offshore rigs, pipelines or sensors that are built into fresh and sea water environments undergo constant attack from the marine environment. The biofouling sequence, comprises of three main stages, the adsorption of a conditioning layer, adhesion of the bacteria, growth of a biofilm and macrofouling. This is not easy to predict owing to the development of substrates by the higher fouling organisms. Initial biofilm formation is often a precursor to subsequent fouling of macro-organisms to the substrate. This settlement process is influenced by environmentally specific physical, chemical and biological factors. It is accepted that the most influential of these originate from the biological source, and are of a chemical nature. Considerable effort has been dedicated to understanding the interactions associated with organism adhesion factors to surfaces and employing methods to counteract this.

The project proposes the development and characterisation of novel materials doped with nanoparticles and other anti-microbial agents for the prevention of biofouling. Materials that inhibit the initial attachment of microorganisms are far more effective as an antifouling measure, because it is the intial stages of biofouling that are of most importance. If initial microorganism fouling is prevented then this will therefore rule out the subsequent macro-fouling stage. The project relies on fundamental chemistry and natural product based compounds in order to ensure a novel environmentally firendly approach.