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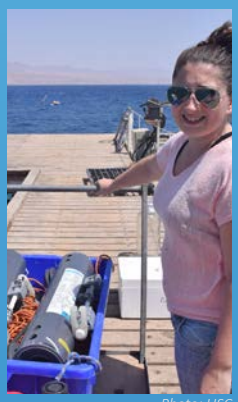
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Summary description of project context and objectives

Biofouling impacts many of maritime activities, including maintenance expenses of (partially) submerged man-made surfaces (including ship transport, buoys, aquaculture, but also membrane bioreactors and desalination units, power plants' cooling water systems and oil-pipelines). It also impacts the aquaculture industry, particularly marine finfish aquaculture. Settlement of marine invertebrates or algae on ship hulls results in increased surface-erosion, reduction of speed, increased fuel consumption and, therefore, increased air pollution and CO_2 emission.

The BYEFOULING project, supported in the framework of the Ocean of Tomorrow by the European Commission, seeks design, develop and upscale novel low-toxicity, cost-efficient, environmentally-friendly antifouling coatings with enhanced performance compared to currently available products.
The specific objectives of BYEFOULING are:

- obtain coatings with extended service life
- reduce VOC content in coating formulations
- reduce fuel costs due to drag reduction in maritime transportation and fishing vessels
- increase operation life of floating devices
- reduce fish mortality from conventional biofouling processes and respective control measures
- reduce maintenance costs

Description of work performed and main results

In the project management tasks, a homepage is made available for public access (www.byefouling-eu.com) and an internal website (eRoom) was created exclusively for BYEFOULING partners.. The 6M meeting was held on 27-28. May 2014 in San Sebastian and the 12M meeting was held on 19.-20. November 2014 in Athens.

Innovative antifouling approaches have been focused on studies on surface structuration, protein-adsorption inhibitors, quorum-sensing inhibitors (QSI), natural biocides and living active species. For surface structuration, the feasibility of obtaining double-wavelength wrinkled surface has been demonstrated and textured sample production has started. Protein adsorption inhibitors, peptide-like and poly-zwitterionic materials have been studied. Different peptoids were successfully synthesized and the synthesis capacity increased; the set-up and optimization of a testing protocol for zwitterionic materials under development is established and a robust protocol for synthesis of different "zwitterionic polymers" launched. For quorum sensing inhibitors and natural algal biocide, focus has been on establishing the appropriate microorganisms and techniques for screening. Different QSI compounds/extracts from the literature were tested and anti-algae activity of extracts of micro-algae assessed. For Living Active Species, freeze-dried cells of different bacteria strains were produced and sent to several partners for further formulation.

The tasks related to the development of antifouling coatings was dedicated to synthesis and characterization of nanostructured inorganic, hybrid and polymeric materials for use as reservoirs for encapsulation of active species, as well as synthesis of fillers with functional groups attached to the surface to impart hydrophobic or biocide functionalities. Encapsulation of living microorganisms prepared has started; samples are already sent for assessment of antifouling activity.

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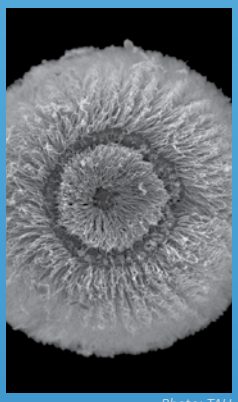
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In the task on antifouling performance and benchmarking, normalization of procedures to characterize antifouling systems has been completed and verified by using commercial samples. Protocols are completed for laboratory tests on anti-microfouling efficacy and anti-macrofouling efficacy, mesocosm efficacy tests of antifouling paints and field efficacy tests of antifouling paint prototypes.
Data on surface characterization have been acquired in the coating testing activity. Partners have performed a literature review, established experimental characterization techniques; and bacteria cultures now produce biofilms. Initial experimental results have been obtained on biocorrosion.
Activities related to the development of mathematical models for drag reduction prediction and to LCA have been realised.
Several dissemination activities have been realised during the first 12 months, including logo design, launching a user-friendly website (www.byefouling-eu.com), a promotional leaflet published by the European Commission, in local press, international journals and conferences; design of a poster and a general presentation of the project. The dissemination plan and activities was outline during the project kick-off meeting. The first internal training course was held for young researchers and the organization of the first BYEFOULING workshop (June 2015) was initiated.

Expected final results and potential impacts

The BYEFOULING project addresses high-volume production of low-toxicity and environmentally-friendly antifouling coatings for mobile and stationary maritime applications. The technology will answer the coating requirements, due to incorporation of novel antifouling agents and a new set of binders into coating formulations for maritime transportation, fishing vessels, floating devices and aquaculture facilities. These novel antifouling coatings will increase maritime industry efficiency and facilitate the technology for novel products.
Internally, academic partners of BYEFOULING will encourage young researchers in an interdisciplinary endeavour, with biology, marine sciences, chemistry, physics, materials science and engineering, and coating technology combining to generate environmentally-friendly, high performance products. This is extremely positive regarding higher education and job competitiveness in the global market. The generated knowledge will also be reflected in publications, a major factor for assessment of public institutions when seeking high international standards. From an industrial perspective, the involved SMEs and large industries provide a unique opportunity to establish transnational networking, developing high-level products for global distribution.
Externally, the impact of BYEFOULING in the ship transport sector, will offer more efficient and less toxic antifouling coatings; operation and lifecycle costs will be significantly reduced, increasing efficiency and competitiveness of the ship transport industry. The project will reduce the negative impact of fouling and anti-fouling materials on the marine environment, and reduce CO_2, NO_x and SO_x emissions. In aquaculture BYEFOULING products will improve marine operation performance, with better growth rates, improved water quality, better control of disease vectors; reducing costs associated with copper waste disposal; enabling lighter structures and improved resistance to extreme weather; and enhancing the viability of more stringent regulations regarding biocides.
BYEFOULING offers a project that provides new societal insights by taking into account national and transnational objectives within the EU for the future. Specifically, it pertains to several aspects of what is termed “blue growth”. BYEFOULING thus targets a new generation of materials derived directly from marine renewable resources; while the impact of antifouling coatings generated in the project will profoundly affect industrial activities directly related to the marine realm.

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