Non-Release marine antifouling agents: A new strategy

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Biofouling is a term used to define the adhesion and colonization on submerged surfaces by a diversity of organisms. It can cause serious detrimental effects on such surfaces and subsequent economic and environmental penalties. For marine systems transportation, it can be for instance the cause of hydrodynamic drag increasing in ships and thereby fuel consumption and greenhouse gas (SO_x, NOx, CO_2) emissions [1]. For instance, biofouling has been estimated to raise drag by much as 40% and fuel consumption by as much as 30%, being estimated to lead to powering penalty as high as 86% (IMO 2003). The International Maritime Organization (IMO, 2009) estimates that gas emissions due to increased fuel consumption by the world shipping fleet could increase significantly under extreme scenarios. They projected a maximum annual growth in CO_2 emissions from shipping of 5.1 %, which would correspond to more than the double by 2030. In addition, it is estimated that efficient antifouling coatings provide the shipping industry with annual fuel savings of $60 billion and reduce annual gas emissions by 384 million tons of carbon dioxide and 3.6 million tons of sulphur. Protection surface strategies against such organisms attach on subtracts have been widely pursued [2]. To date, the most effective strategy is to use antifouling biocide-releasing coatings, but the ecologically harmful toxicity of these biocides has led to strict regulations for their use, and those expected to come in 2013 will restrict even further the antifouling biocides currently in use. Therefore, greener antifouling alternatives are sought. In this work, a new approach for non-release antifouling marine coatings is proposed. It consists on the functionalisation of new or already proved biocide compounds (e.g. commercially available) with a functional group which possesses the ability to be covalently bonded to conventional silicone or polyurethane (PU) based marine coatings. Commercial biocides, such as Irgarol and Econea, have been already successful derivatised using this approach. The resulting derivatised biocides evidenced 7 to 11% (m/m) of the functional group, which is quite similar to the expected theoretical one (7%). FTIR analyses confirmed that the structure was not modified and that the functional group was successful attached to the expected bridging point. The ultimate goal of this work, supported by a European FP7 Programme, project FOUL-X-SPEL, is to include such functionalized biocides on marine coatings systems.

References

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