Sensing toxicants in
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Instrument
FP7-OCEAN-2013 .1
Biosensors for real time monitoring of biohazard and man-made chemical contaminants in the marine environment.

Duration
45 MONTHS

Start Date
01.12.2013

Consortium
10 PARTNERS

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 613844

The Challenge
The increasing demand by citizens and environmental organizations for the protection, preservation and possible restoration of the marine environment has made seawater quality assessment and control urgent priorities of the EU. At the same time, the Blue Growth Strategy aims to support the growth of maritime activities in a way that is compatible with environmental sustainability. The SMS project will promote the development of novel sensing devices for seawater quality monitoring. In consequence, SMS results are expected to have a major impact on economic activities such as tourism, fisheries, and aquaculture, and to create novel business opportunities.

Project Objectives
SMS will deliver a novel automated networked system that will enable real-time in-situ monitoring of seawater chemical and ecological status in coastal areas by the detection of a series of pollutants. The compounds specifically targeted by the project are indicated as priority substances and/or "emerging pollutants" by the Water Framework Directive. They cover a wide spectrum of chemicals that have detrimental effects on the marine environment such as the algal toxins, the antifouling agents, the flame retardants and the pharmaceuticals that will be measured using innovative probes.

Methodology
SMS will design a multi-modular apparatus that will host both a Sampling Module and an Analysis Module in a single unit, namely the Main Box. In addition, temperature, pH, salinity, dissolved oxygen, nutrients and turbidity, will also be measured by commercially available sensors to obtain an improved picture of the chemical and environmental status of the seawater and the conditions in which toxic algal species thrive. The Main Box, hosting the validated probes, will be tested in different marine areas of Europe: the Alonissos marine park in Greece (Alonissos marine protected area), the Slovenian Adriatic Sea and the industrialized area of the La Spezia Gulf (Italy).

The wireless transmission capability for real-time data, as well as remote access to collected data and remote management of biosensors, will allow for automated water quality monitoring and alarm system that will be fairly easy to deploy. A major target of SMS is also to develop smart devices for water analysis that can be produced at a lower-cost and are suitable for future industrial exploitation and manufacturing.

The workplan, reported in eleven Work Packages, goes from the construction and assembling of the analytical devices, to their validation using reference procedures. It also comprises the sampling and preconcentration procedures as well as the assembling of sensors in a compact instrument that can be easily located in the marine environment for direct in situ measurements. Analytical techniques such as optical, electrochemical and separation science as well as remote control of the data will be optimised and then recommended to public institutions and stakeholders to be used for monitoring seawater quality.

The Consortium consists of six University and Research Institutes and four SMEs covering all the expertise and all the disciplines to reach the specific objectives.

Expected Results
- Development of DNA aptamer-based optical and/or electrochemical biosensors using gold nanoparticles, single-walled carbon nanotubes, or nanostructured carbon black or graphene to detect algal toxins, obtaining high stability and sensitivity;
- Development of optical or electrochemical biosensors for the detection of Tributyltin, Diuron and the flame retardants pentaBDPEs;
- Development of an electrochemical sensor for the detection of sulphonamides;
- Expansion of the "repertoire" of the existing biosensor to detect toxic algae, thus making the pre-existing ALGADEC device more universal;
- Construction of a sampling device to collect seawater samples, to perform pre-treatment processes such as filtration and pre-concentration and to deliver the sample to the sensors and to dispose it afterwards;
- Construction of analysis modules that can host different biosensors for the detection of the selected analytes to perform in situ and real time measurements;
- Assembly of individual modules and a proof of concept for the resulting network on a platform or buoy;
- Test, validation and use of the individual modules in open field;
- Development and construction of a prototype (Main Box) that will enable collection of data from the submodules (sensors), local data storage and transmission to a remote server, as well as the required external components for visualization, processing and use of the acquired data there.

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