Σ! 2962 EUROENVION BIOSORB-TOX

Cleaning heavily polluted water at a fraction of the cost

Eureka project E!2962 Euroenviron Biosorb-Tox has succeeded in developing a water treatment system for industrial oil polluted water at a tenth of the cost of other commercially available tertiary treatments, leaving water so clean it can be pumped safely back out to sea without endangering flora or fauna.

Wastewater from ships, oil refineries and other petrochemical industries is heavily contaminated with toxic compounds. Stringent EU regulations apply to its treatment and discharge since, if left untreated, these compounds are hazardous to our health, our coastlines and deadly to all forms of aquatic life when released into our waterways.

The most complete method of treating petrochemically polluted waste water is through a series of three stages involving physicochemical and biological processes. It is the third and final stage of the treatment that renders the water clean enough to be discharged into the sea. The process is complex, requiring a combination of bioreactor, chemical coagulation, granulated activated carbon or sorption technologies.

This tertiary stage is the most expensive part of the treatment. It can also cause fouling, the growth of undesirable bacteria and problems with the waste disposal of toxic sludge produced in the process, if it isn't properly monitored.

"The cost of tertiary treatment is a big problem," says Professor Viktoras Racys at the Kaunas University of Technology in Lithuania – the main project partner. "You can treat petrochemically polluted water effectively, but it costs a lot. We set out to find a stable process which was as cheap as possible."

New solutions

The research group at the university's environmental engineering department had already developed and tested a new wastewater treatment model on a laboratory scale. "In order to apply our water treatment to large industrial practices we needed financial assistance from external sources. The Eureka partnership helped in doing this," says Professor Racys.

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Together with three partners, the project team came up with an ultra-efficient combination on an industrial scale. "We developed the treatment using three processes in one piece of equipment, a reactor," explains Professor Racys. "We use sorption, bio-degradation and filtration. The pollutants are degraded by micro-organisms created within the reactor," he says.

Teamwork

The project partners, all renowned experts in their field, came together from Sweden and Lithuania. The Environmental Chemistry Department of the University of Umeaa in Sweden specialises in the study of environmental problems caused by organic pollutants. Equipped with a cutting edge research laboratory, it provided the analysis and identification of the organic compounds contained in wastewater polluted with petrochemical products, using the latest technology. The department also developed procedures to evaluate these compounds and their degradation, and analyse the composition and toxicity of

the sludge produced by the system.

A Swedish high-technology SME, Exposmeter, developed an in-line sampling and monitoring tool to measure the system's efficiency in treating toxic compounds. It carried out full-scale tests on the operation of the equipment and validated the methods used, providing a set of standard operating procedures.

The design, manufacture and installation of the reactor was carried out by Dinaitas, a Lithuanian SME specialising in wastewater treatment plants and technologies. Dinaitas also took on the maintenance of the entire system once it was operational.

Astounding results

The system is already up and running, treating petrochemically polluted wastewater at Lithuanian oil company, Nasta. "It works great," says Professor Racys. "We couldn't believe the results the first time. It has a high capacity, processing 160 m3 per hour. The cost is 1 euro for every 3.5 litres. Effectively it's 10 or 20 times better than what else is available."

But that's not the end of it. The purity of the end water is greatly enhanced. "The water before the treatment is highly polluted, containing 1 gram of pollutant per litre. After treatment it contains only 0.1 gram of pollutant per litre. This surpasses the EU standards and the water can be put straight back into the sea," says Professor Racys.

After two years of daily operation, the system has proved to be stable and has spawned several academic publications. It is ready to use in sensitive environmental regions, for the treatment of oil production and refinery wastewater, ballast water, the run-off from car washes and car parks and any petroleum polluted wastewaters containing both legally regulated compounds and the most toxic or persistent compounds.

Professor Racys thinks the reactor can be improved and would like to take the work further forward at an industrial level. "I'm very much involved with it, as with most scientists, my work is like my child," he says. He is looking for new industrial partners, however, with operating results already as good as these, they are proving hard to find.

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Lithuania, Sweden

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