

ENVIRONMENTAL TECHNOLOGY VERIFICATION (ETV)

I. FACT SHEET

TECHNOLOGY TYPE:	Autonomous, wire less, and at-site BOD5 system
APPLICATION:	Analysis of water and waste water
TECHNOLOGY NAME:	BOD Biosensor
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Performance claims tested within the EU- FP 6 funded RTD project PROMOTE 518074.	PROMOTE Project coordinator: DECHEMA e.V., Frankfurt/Main, Germany

WHAT IS ETV

The Environmental Technology Verification (ETV) system currently prepared by the European Commission as part of the European Technologies Action Plan, is designed to support the environmental industry by providing credible and independent verification of technology performance claims. The objective of ETV is to enhance the confidence of investors and potential users in promising innovative eco-technologies.

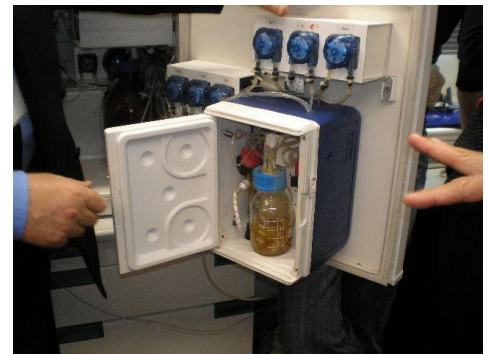
PROMOTE is one of 4 research projects funded under FP 6 which are designed to explore the characteristic features of an ETV on different technology sectors. The overall aim of the PROMOTE project is to set up a complete efficiency control and performance verification system for soil-groundwater protection and rehabilitation technologies. The system is based on a stepwise concept including generic testing at reference site and field site scale.

The given technology fact sheet, as an extended summary of the verification report, has been elaborated within PROMOTE, following the procedures described by PROMOTE and further laid down in the CEN Workshop Agreement CEN/WS 32 *Environmental technology verification – Soil and groundwater site characterization, monitoring and remediation technologies* as a first standardisation document in this field.

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TECHNOLOGY DESCRIPTION

The on-line BOD biosensor uses *Pseudomonas putida* for the measurement of the organic matter concentration. The measurement is based on the registration of the micro organism's respirometric activity when a sample is injected into a reactor chamber previously filled with the micro organisms. The system is original because of the use of a separate chemostat for the growth of the micro organisms. A small aliquot of them is extracted from the chemostat for every measurement. BOD biosensors developed by other companies use wastewater treatment plant's activated sludge or micro organisms retained within a thin membrane contacting with a signal transducer. These solutions are not resistant against toxic samples entering the reactor. The use of a separate chemostat permits the maintenance of microbial activity in optimal conditions during long periods of time. The nutritive solution for the maintenance of the micro organism culture is selected in such a way that only one and always the same micro organism (*Pseudomonas putida*) is reproduced in the chemostat. The micro organisms are continuously available for the measurements, and their concentration is maintained quite stable at the level of about 108 micro organisms per 100 ml. Because the analysis of the sample is made in a separate reactor, any toxin entering to the system does not affect the chemostat biomass, and the system became much more robust. Injections of a master solution are used both for this purpose and in order to increase the accuracy of the measurements.



RELEVANCE

BOD – Biological oxygen Demand

The biochemical oxygen demand (BOD) determination is an empirical test in which standardized laboratory procedures are used to determine the relative oxygen requirements of wastewaters, effluents, and polluted waters. The test has its widest application in measuring waste loadings to treatment plants and in evaluating the BOD-removal efficiency of such treatment systems.

This autonomous, remote controlled on line system for BOD₅ measurements gives results in just 1h 30 min instead of 5 days.

PERFORMANCE CLAIMS

The results obtained using the BOD biosensor in 1 h 30 min are comparable with those obtained with the standard method Methods 5210B in 5 days.

Claim: BOD5 can achieve comparable BOD results, within 10 % of standard deviation for fresh samples (less than 24h), without any sample pre-treatment within 1,5-2h compared to the official method testing using an oxygen electrode within 5 days. The range of operation is from 4-3000 mg/l O₂ consumption for a pH range 6-8.

The part of claim to be proven by BOD measurements in this test is that spiked real samples are comparable to the relevant results obtained by the standard method.

TEST DESCRIPTION

To verify the claim tests have been carried out in parallel using the BOD system in 1h 30 min. and using the standard method 5210B (5days).

The tests consisted of measuring 10 samples spiked with different concentrations of organic substances. The oxygen concentration was measured by BOD5 in 1,5-2 hours and compared against concentrations given by the official BOD-method (O₂ electrode) in about 5 days. Tests are performed as blind tests by the test lab to ensure objectivity.

Natural water samples were spiked with PAH's, phenols and pesticide compounds. The different spiking concentrations vary from 500 ppt to 1 ppm. The test were performed at the laboratory of CSIC in Barcelona (Spain) between February 21-26th 2008.

RESULTS AND VERIFICATION

Very good agreement was found between the official method of analysis after 5 days and the method measuring continuously and in just 2 h including washing steps of measuring cell between samples.

All samples followed the same tendency. Differences between results for the same sample were always less than the 10% of standard deviation (which is the value acceptable for the official method). One exception was observed in the case of the most complex sample tested, where the standard deviation for the results obtained by the two methods was higher than 10 %.

Conclusion of verification: The test results provided by verification in the lab prove that the results from the on line BOD system differ less than 10% of the standard deviation compared to the standard method 5210B. This has been tested and proven for samples spiked with concentrations vary from 500 ppt to 1 ppm with PAH's, phenols and pesticide compounds.

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