

Photochemical Sensor for Total Organic Carbon Measurement

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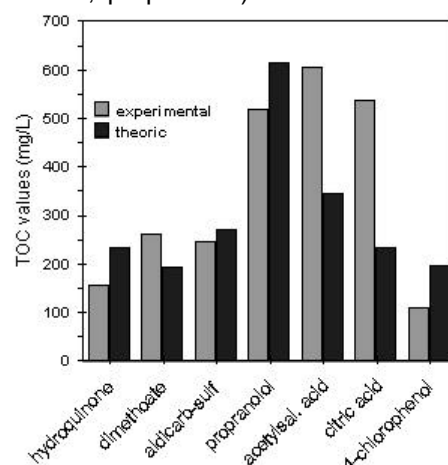
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Abstract

Analytical determination of organic load (the whole organic substance present in water as dissolved or/and in suspension form) in aqueous matrices is of continuously increasing interest in environmental chemistry. The most used indexes are BOD (Biochemical Oxygen Demand), COD (Chemical Oxygen Demand) and TOC (Total Organic Carbon); various normative and analytical line guides have been elaborated to determine these indexes [1].

TOC is a measure of organic compounds present as dissolved, not-dissolved, or suspended in water. Also this measure is a typical "alarm test" in water matrix. Its determination has been considered as a marker of water purity and it is characterised, if compared to COD and BOD analysis, by a higher selectivity because it allows to measure the effective present organic carbon, after the elimination of inorganic carbonates and others interferents; moreover it is very sensitive and of rapid performing.

The main official methods for TOC analysis are based on direct determination of CO_2 , generated by organic substances oxidation in an aqueous matrix. In this work we have tried to realise a TOC measurement apparatus based on heterogeneous photocatalysis, to degrade the organic substances, and on a gas-permeable electrode, to measure the produced CO_2 , optimising a previous prototype [2] in order to make it almost portable. The choice of the catalysts, the lamps emission spectra and the operating conditions to make the process fastest and most efficient, has been carried out by means of industrial recalcitrant dyes tests [3]. As target molecules for the funzionalità tests we have chosen various compounds with different characteristics, as their recalcitrance, their use and their environmental impact (hydroquinone, dimethoate, aldicarb-sulfite, propranolol, acetylsalicylic acid, 4-chlorophenol, citric acid, propranolol). TOC measured and theoretical values are obtained, for each compound respectively, by means of the measurement of CO_2 , produced by the photodegradation, and by the CO_2 calculated from carbon atom number present in the molecules. The comparison (see Fig.1) shows that between the two values difference up to 40% are observed; these good preliminary results urge us to optimise the light sources and the reaction cell, to obtain a global improvement of the measurement experimental apparatus.



Reference

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- [3] G. Visco, F. Bellanti and L. Campanella: "Comparison of catalytic efficiency of some industrial and nanosized titanium dioxide in heterogeneous photodegradation by chemometric analysis"; *Applied Catalysis B: Environmental*, under development, 2004