AN AUTOMATED COLORIMETRIC METHOD FOR THE DETERMINATION OF DISSOLVED ORGANIC CARBON IN SEA WATER BY U.V. DESTRUCTION

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INTRODUCTION

Dissolved organic carbon (D.O.C.) and suspended organic carbon (S.O.C.) are quantitative parameters of water quality and can be useful in indicators of the level of biological activity. For freshwater there are several techniques; for sea water, however, no rapid and accurate method for D.O.C. analyses has been commercially available.

In the last 10 years several articles were published about photochemical oxidation (ARMSTRONG, 1968; COULDEN, 1975; EHRHARDT, 1969; COLLINS, 1977). The last two authors used a continuous photo-oxidation procedure; Ehrhardt detected the generated CO₂ by a conductrometric method and Collins with an infrared analyser. However, these instruments were partially built by themselves. The only available continuous photochemical oxidation apparatus was from Technicon and was meant to be used in analyses of fresh and sewage water.

We developed a method for sea water suitable over a range of 0.1 - 10 mg C/liter (D.O.C.).

MATERIAL AND METHODS

Apparatus.

Fig. 1 shows a block diagram of the Technicon D.O.C. analyser. It is equipped with a sampler, a peristaltic pump, an U.V. destruction cartridge, a single channel colorimeter, and a strip-chart recorder. The coil used in the U.V. destruction system is quartz in order to permit the passage of U.V. radiation. Its i.d. is 2.0 mm and its sample volume approximately 15 ml. The sample residence time is about 9 min. The U.V. lamp source is a General Electric low pressure Hg-lamp, containing a quartz envelope to permit the passage of the 185 nm Hg/ozone line.

Analytical procedure.

The photochemical oxidation of organic material deals with the chemistry of molecules in electronically exited states. When persulphate in an aqueous medium absorbs U.V. radiation, it is converted in a 4 step reaction into two extremely reactive species, namely, oxygen and hydroxyl free radicals (HOUSE, 1962). These radicals then will react with the organic material present, which is converted into carbon dioxide and water. In seawater, however, sodium chloride will be converted into chlorine and sodium hydroxide. The chlorine formed would oxidize the color reagent used. Therefore, hydroxylamine is added to react with chlorine.

Fig. 2 shows the flow diagram and the sequential steps in the oxidation process and CO₂ measurements. The sample is acidified and the inorganic carbon is removed with nitrogen. An aliquot is resampled for
Fig. 1. Block diagram of the method.