

# Electroanalytical estimation of seawater pollution by organic substances. Analysis of North Adriatic samples

by

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Surfactant activity of organic pollutants and of surfactants of biological origin has been studied by electroanalytical methods. Seawater samples from North Adriatic have been analysed.

The applicability of the methods and the problem of differentiation of pollutants and naturally present surfactants is discussed.

Dissolved organic matter in sea water comprises a complex mixture of naturally occurring substances (products of metabolism and degradation of organisms) [DUURSMA, 1965] and artificial products (mainly pollutants like detergents, oils and other potentially harmful chemicals) [REPORT of GESAMP, 1971]. Because of very low concentration and the variety of organic compounds in sea water their analysis and characterization is difficult.

The application of electroanalytical methods in the study of organic substances in sea water is based on the well known adsorption phenomena of organic molecules at the hydrophobic surface of mercury electrode [DAMASKIN *et al.* 1971]. The adsorption depends on the electrode potential and the physico-chemical properties of adsorbable substances. Presence of organic molecules in the vicinity of electrode surface affects the processes of charge and mass transfer. The effects are measurable at very low concentrations (lower than ppm) of highly adsorbable species. Two methods :

**a.** measurements of current suppression of the polarographic maxima of oxygen and mercuric ion [ZVONARIĆ *et al.* 1972, 1974].

**b.** measurement of charging current by voltammetry with discontinuously changed potential (Kalousek commutator technique) [COSVIĆ & BRANICA, 1973; RADEJ *et al.* 1973]. were applied and compared in the analysis of seawater samples.

The surfactant activity of samples is evaluated as equivalent effect of standard reference substance. 320 surface seawater samples from North Adriatic were analyzed over the period from May 1973 to May 1974. The distribution of values for surfactant activity of samples is presented.

In order to elucidate which types of organic substances are responsible for surfactant activity, comparative measurements were carried out on samples taken from selected stations using both electroanalytical methods and the spectrophotometric methylene blue method for determination of anionic detergents [KOZARAC *et al.*, 1974].

Experimental data are discussed taking into consideration the characteristics and the degree of adsorption of different types of standard reference materials (detergents, oil, lipids, fatty acid, humic acid) at the concentration level which can be expected in unpolluted and polluted seawater.

The applicability of electroanalytical methods for simple and rapid estimation of source and level of pollution of seawater by organic substance has been discussed.

### References

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### Discussion

#### Questions :

1. If I understood you rightly your methods will give an indication of the presence of pollutants. Once you have found pollution you have to identify the pollutant with some other method e.g. gas-chromatography. (M. BERNHARD, Italy).
2. I do object to the statement that the properties of surfactants at the Hg/water interface do represent fairly those at the air/water interface, or for that matter at the biomembrane/water interface. In this sense more direct methods of analysis should be preferred. (V. PRAVDIĆ, Yugoslavia).
3. In terms of the unit you have used, you compared results of spectrophotometric measurements with those of polarography. It seems to me that your results presented in a table and those in last figure are contradictory. (R. FUKAI, Monaco).
4. It seems that you cannot distinguish between pollutants and nonpollutants by this method without arbitrarily deciding ahead of time what constituents, the types of compounds are pollutants. For example, you cannot differentiate between naturally occurring hydrocarbons and those hydrocarbons arising from pollution. (D.L. ELDER, Monaco).

#### Answers :

1. You are perfectly right.
2. The objective of this work, at present stage is not characterization of processes at the air/water interface. Electrochemical methods based on the phenomena at Hg/water interface are applied only for estimation of the degree of pollution of seawater by dissolved surfactants.
3. Spectrophotometric method is sensitive only for specific detergent, while the polarographic method measures effects of all organic compounds present in seawater.
4. No, you can not, but it is a quick and convenient method of determining levels of compounds present. In the case of hydrocarbons dissolved in seawater natural level quoted in literature is under limit of detection by electroanalytical methods.

The problem of hydrocarbons is the subject of the next paper : B. ĆOSOVIĆ, V. ŽUTIĆ, T. ZVONARIĆ and Z. KOZARAC : "Electroanalytical estimation of seawater pollution by aromatic hydrocarbons."