

Identification of fatty acids and their occurrence in the southern Baltic ecosystem

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Ph. D. thesis in chemical oceanography supervised by Professor Janusz Pempkowiak.

Dr. Ksenia Pazdro's Ph. D. thesis describes her research into the distribution and origin of lipids and fatty acids in the ecosystem of the southern Baltic Sea. The experiments were carried out at the Marine Chemistry and Biochemistry Department of the Institute of Oceanology, Sopot (<http://www.iopan.gda.pl>), as part of project 3.3 of the Institute's statutory activities. The aim was to discover the composition and concentrations of individual fatty acids in various components of the Baltic Sea ecosystem, and to evaluate the sources of the acids found there. This research is closely related to at least two fields of contemporary investigations into the marine environment – geochemistry and the balance of organic matter, and the identification of individual organic compounds and their transformation in the marine environment – and is therefore related to problems of the utmost practical and theoretical importance.

Dr. Pazdro decided to quantify fatty acid concentrations by means of high performance liquid chromatography with fluorescent detection. The chromatographic analyses were performed on derivatives of fatty acids, namely 4-methyl-7-methoxycoumaril esters, which are characterised by strong fluorescent properties. Before deciding on the coumaril esters of fatty acids, the author had tested two other esters: p-nitrobenzyl and 9-methylanthranlyl. All experiments were carried out on both standards and actual environmental samples. Owing to their better chromatographic properties, superior chemical stability and smaller detection limits, the coumaril esters were deemed best suited for analysis of fatty acids in the marine environment. I tend to agree with this conclusion; at the same time, I would like to point out that the comparative analysis of the applicability of the

three fatty acid esters tested to environmental analyses of the acids is unparalleled in the literature and can be regarded as an original achievement of Dr. Pazdro.

Having decided on the coumaril esters the author still had to select suitable methods for the preconcentration and isolation of free and combined fatty acids from a variety of samples of differing concentrations and matrices. These ranged from the soft tissue of mussels, rich in fatty acids, to seawater, depleted of fatty acids. This task, trivial in the case of the organic-rich matrices, required much resourcefulness and tedious analytical work in the case of seawater. The application of reverse phase trace enrichment on an SPE-18 type reverse phase proved to give better recovery of acids and reproducibility of results than extraction with chloroform or sorption on Amberlite XAD-2 resin. The quantification of the recoveries of various acids proved that they are dependent on the number of carbon atoms in the acid chain. The isolation procedure described in the thesis can be regarded as another of the author's innovations.

Dr. Pazdro went on to apply the newly-developed methods to the quantification of fatty acids in water, suspension, algae, seaweeds, zooplankton and selected invertebrates. Hundreds of samples collected from 1991 to 1995 were analysed. The majority of the results refer to the composition and content of the acids in the Baltic environment and as such are of great value. One can only wonder that in the Baltic Sea, with its long history of measurements and research, a major field of marine organic geochemistry has so far been almost completely neglected.

The identification of iso- and anti-iso-families of acids comprising 15 and 17 carbon atoms per chain in most sediment samples led the author to the conclusion that microorganisms can be regarded as a major source of fatty acids in sediments. It was also found that terrestrial run-off introduces only negligible amounts of lipids in general and fatty acids in particular to the marine environment. Investigations into the composition and content of fatty acids in biota proved that mussels are by far the more abundant in fatty acids, especially long-chain polyunsaturated ones, than phytoplankton and seaweeds.

The thesis was written according to a logical plan, the description of experiments is detailed and the discussion of results is exhaustive and supported with numerous, well-selected references. In the discussion section of the thesis the author comments on the significance of the results as regards the understanding of the origin, sources and transformations of fatty acids in the Baltic and has applied a good measure of common sense there. The overall conclusion is that there is no simple dependence between the composition of fatty acids in the environment and a single source.

The thesis was neatly presented, with great care taken with respect to the terminology, a quite remarkable feat considering that the author was dealing with such remotely related subjects as chemistry and oceanology. There are, however, some discrepancies in the nomenclature of fatty acids and structural formulas of compounds.

The thesis was publicly defended on 21 November, 1996. The Committee for Ph. D. Studies of the Scientific Council of the Institute of Oceanology in Sopot decided unanimously, in a secret ballot, to reward Ms Pazdro with a Ph. D. degree in earth sciences, speciality oceanology. I can but add my own congratulations to Dr. Ksenia Pazdro for a job well done.

Janusz Pempkowiak