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This research aims at identifying a series of "guide parameters" to assess the impact produced on the marine ecosystem by the dumping of lagoon muds with a high concentration of nitrogen, phosphorus, mercury and indicators of fecal pollution in an area in front of S. Andrea Island, comprised between Porto Buso and Lignano Sabbiadoro (Northern Adriatic).

The relative proximity of the Lignano tourist resort and the continuous harvesting of edible lamellibranch mollusks from natural colonies advised to extend the investigations in order to quantify any hygienic-sanitary and toxicologic aspects related to dumping operations (1).

In the period between December 1991 and February 1992, about 60,000 c.m. of lagoon muds were dumped in a limited section of an area authorized by the Italian Ministry on Environment.

In September 1991, before these operations began, by using a modified Van Veen grab, a series of samplings were carried out on the sediments of the stretch of the Marano Lagoon that had been subjected to dredging and in the marine area chosen to receive the dredged material, with the aim to characterize the sediments and highlighting any possible differences.

Investigations were confined to the following standard regarded as the most significant: granulometric profile in order to follow sediment redistribution; total nitrogen and total phosphorus with the aim to characterize the risk of a release of "eutrophication" agents; mercury, to evaluate the risk itself and as a more general indicator of contamination from bio-cumulative stable micropolluting agents; total microbial load to evaluate the general process of microbial contamination; total coliforms to assess the infective risk related to the consumption of edible mollusks and bathing activities.

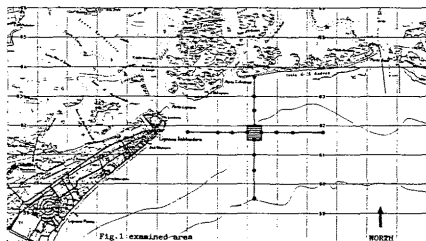
16 sampling sites were identified as indicated in the annexed figure: the first four located along the perimetric sides of the area affected by the dump (400 m wide); the following four about 500m away from the former, arranged along the orthogonal directrices to the sides; another four at another 500 m., and the last ones at 2000 m. from the first group of four.

A second series of samplings was carried out at the end of the dredging operations, in February 1992, evaluating at the same time any release phenomena into the body of water by means of a series of water samplings taken at the surface and at 1 metre from the sea-floor.

The monitoring model used allowed to underline a significant previous contamination of marine sediments with regard to microbiological parameters (sometimes of the same level) and mercury (up to 10 times more abundant than in the lagoon) in addition to underlining the great differences in the grain-size distribution of the marine sediment which, seaward, showed marked analogies with lagoon sediments. It also made possible to clearly identify the various concentrations of total nitrogen in marine sediments, 3 to 5 times lower than lagoon sediments.

The first series of inspections carried out after the dumping operations identified a considerable modification of the sediment only confined to the area affected by dumping, whereas transfer phenomena from sediments to water were not observed.

The fine fraction of lagoon sediments, resuspended by dumping operations and by the action of the waves, appears to be responsible for the transfer of pollutants.



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The increasing use of crude oil as an energy source as well as a petrochemical feed-stock has created an increased world concern regarding the environmental pollution due to petroleum hydrocarbons.

The aromatic hydrocarbons (PAH) are of particular interest because the toxicities of various oils have been associated to their aromatic content. This class of compounds are generally more soluble (1ppb-30ppm) than paraffins, with a low vapour pressure, while a considerable percentage of them, 5-20%, is considered to be carcinogenic.

Conventional Fluorescence Spectroscopy is a useful technique for the analysis of aromatic hydrocarbons due to its greater sensitivity and selectivity for this class of compounds (SAWICKI, 1964). However, the usefulness of this technique is limited by the complex nature of aromatic mixtures in petroleum and the overlapping of fluorescence patterns. LLOYD, 1971 has considerably improved this technique by varying simultaneously both λ_{exc} and λ_{em} while keeping a constant wavelength interval $\Delta\lambda$ between them. This technique of synchronous scanning has been proved very successful in multicomponent analysis, as it offers several advantages including narrowing of spectral bands, enhancement in selectivity by spectral simplification and decrease of measurement time.

In addition, the spectra maxima can be related to the number of the fused rings of the PAH. The spectrum of a higher ring number PAH occurs generally at a longer wave-length than a lower ring number compound (Fig. 1).

Therefore, we have applied the above technique for the analysis of surface marine sediments from the Aegean Sea, for the estimation of Pollution levels by petroleum hydro-carbons as well as to obtain a rough of a mixture of idea of the relative importance of the PAH sources.

Surface sediments were collected during November 1991 and the sampling sites are shown in Figure 2. PAH content was determined fluorimetrically according to the standard methods of IOC (UNESCO, 1984) and the calculated values varied from 0.5 to 1.6 $\mu\text{g/g}$ (in chrysene equivalents).

The obtained synchronous fluorescence spectra ($\Delta\lambda=4$ nm) implies the presence of naphthalenes (300-340 nm), aromatic compounds with three to four fused rings (340-400 nm) and highly condensed aromatics (400-500 nm) in considerably higher amounts. However such a wide range of aromatic compounds but with much more less amounts of multiringed aromatic compounds is typical of petroleum composition (Fig. 1). The predominance of aromatic hydrocarbons containing five and more rings indicates that these compounds are coming primarily from atmospheric dustfall and in most cases they have pyrogenic origin (products of incomplete combustion of fossil fuels).

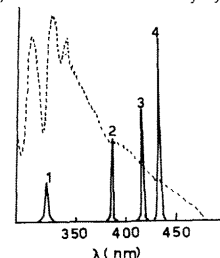


Fig.1 Synchronous fluorescence spectra ($\Delta\lambda=4$) of Kuwait crude oil (---) and a mixture of naphthalene (1), anthracene (2), benzo(a)pyrene (3) and perylene

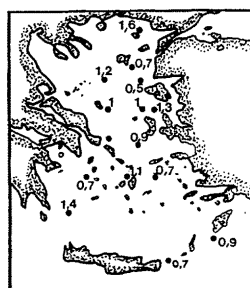


Fig.2. Sampling sites and values of PAHs in sediments of Aegean sea ($\mu\text{g/g}$ in chrysene equivalents)

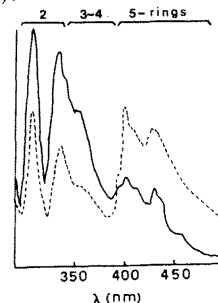


Fig. 3. - Typical synchronous fluorescence spectra ($\Delta\lambda=4$) of PAHs extract in hexane from Saronikos gulf (-) and from Aegean sea (---) sediments.

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Moreover, it is interesting to note the very intense large doublet centered at about 440nm, in all examined samples, which is indicative of the presence of perylene, a biogenic compound formed in marine sediments by reduction of land-derived nonhydrocarbon compounds, such as hydroquinones.

Finally, the spectra of sediments from Aegean Sea are compared to the corresponding typical synchronous spectrum obtained from sediments of Saronikos Gulf (Fig. 3). Saronikos is a semi-closed gulf of Greece which receives a great amount of sewage from the urban activity as well as from the industries located at the northern part of the gulf. This comparison clearly shows the higher content of two, three and four ring compounds (300-400 nm) in the case of Saronikos gulf, indicative of the petroleum origin of PAHs.

In conclusion, the results obtained in this study show that in the Aegean sea the contribution of PAHs of pyrolytic and eventually biogenic origin is the most important.

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