Electrophoretic Studies of Model Colloidal Systems

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The coexistence of particles having different surface chemical properties, in aqueous solutions, is an essential problem in natural processes. The adsorption of organic molecules(ligands) on the surface of solid particles in such systems depends on the nature of the solid phase and on the conditions of the liquid medium: ionic strength, pH, adsorbate functionality, steric configuration, molecular weight and concentration(1). The adsorption of various ligands influences the stability of the system which is directly reflected on the transport of particles suspended in natural aquatic systems. Especially sensitive and critical zone in natural aquatic systems, is the salinity transition zone within an estuary, where abrupt changes at the solid/liquid interface strongly influence the geochemical fate of suspended particles(2). Electrokinetic study of mixtures of colloidal particles of different composition and surface properties contribute to the understanding of the properties of such systems (3,4).

In this work, the selected mixtures of inorganic oxides (SiO_2, Al_2O_3), clay minerals and carbonates, and organic particles (PS latices, fatty acids and amino acids), suspended in aqueous solutions, represent the models for the studies of the interactions in natural aquatic systems (5,6). Their *electrophoretic mobilities* were measured and related to the changes in the composition of both the solid phase and the aqueous solution. The pH range of the solutions were defined taking into account the isoelectric points of the members of the mixed system. The concentration of the electrolyte and other constituents (ligands) were determined according to their significance in natural waters, however, within the limitations determined by the technique used (PenKem S3000 microelectrophoresis).

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An Input/Output Flux for Lead in a Coastal Bay off Alexandria Region

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As a consequence of the rapid increase in human population represented as growing industrialization and activities in the adjacent coast of the eastern region of Alexandria coastal belt task of lead pollution has become a serious problem. For a better understanding for the behaviour and impact of lead on the living and non-living resources of the coastal region an overview on the levels and the input and output fluxes of the metal are presented in this paper. The relative importance of the different sources of the metal as well as the environmental capacity of the system are evaluated.
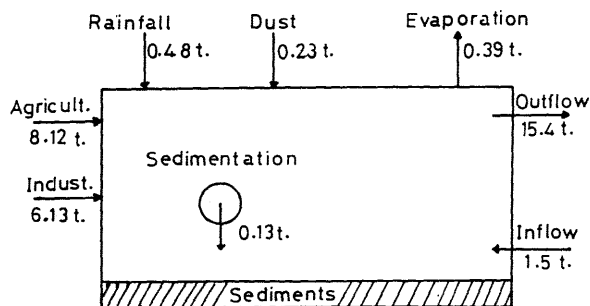
Input/Output flux of Pb in Abu-Kir bay.

Abu-Kir bay is a semicircular bay located 36 Km east of Alexandria city. The area is about 360 Km^2 with an average depth of 12 m. The bay receives $1400 \times 10^6 m^3$ of brackish agricultural water/year, in addition to $2 \times 10^6 m^3$/day of industrial wastes including textile, paper, dye and weaving, food processing and paper industries. Integrated over the bay area the annual rainfall and evaporation were $82 \times 10^6 m^3$/y and $540 \times 10^6 m^3$/y, respectively. Assuming the mixing of the bay (of constant volume) the whole year round as well as constancy of the residence time of water, the annual bottom input of the Mediterranean neritic waters to the bay is $19.43 \times 10^9 m^3$/y opposed by an outflowing surface water from the bay amounting to $21.1 \times 10^9 m^3$/y. The mean water residence time is 2.5 months.

Samples from 10 stations were collected to cover the bay area for determination of dissolved (dithizone/chloroform extraction) and particulate (Tessier et al., 1979) lead, followed by measurements using GFAAS. Mean blanks were 10 ± 1 ng/Kg, triplicates yield a precision of $\pm 12\%$ while extraction efficiency exceeded 92%. Analysis of NBS (standard River Material) shows 8% deviation while replicates were within 10%. Rain water and airborne dust were collected on 2 gas platforms (near and offshore) away from sea spray as possible.

The mean concentration of Pb in the bay was 658 ng/l of which 73% are in the particulate form. Both the concentrations of dissolved (range 47-630 ng/l) and particulate (range 208-916 ng/l) showed elevations at the nearshore area. The standing stock of lead in the bay water was 2.84 tons. The in/output fluxes of Pb to and from Abu-Kir bay are represented in the box diagram.

The main features of the lead balance are 1) Despite the increase in the concentration of industrial derived Pb ($8.4 \mu g/l$), its magnitude is less significant than agricultural derived lead. 2) 40% of industrial lead is derived from raw textile wastes resulting from dyes used in finishing processes, 13% via electric power plant, 8% from paper industry, 5% through fertilizers industry, the rest distributed among waste water and organic chemicals. 3) Normalized to Pb/Al in crustal material lead is enriched ($EF=19.2 \times 10^5$) in rain water. 4) The average airborne lead concentrations ($1.8 \mu g/m^2$/day) is 6 times higher than those reported over central Alexandria city. 5) Atmospheric input accounts for 5% of the total lead input to the bay, the magnitude of which is masked by huge land-runoff derived lead. 6) The bulk sedimentation rate of Pb (using sedimentation traps) was 95 Kg/y yielding high sediment concentrations (>64 $\mu g/g$) in the nearshore zone. 7) About 0.6 tons of Pb are accumulated in the water system 30% of which were observed in phyto-and zooplankton. 8) The residence time for Pb was 0.17 years. 9) Quantification of Pb derived from scrap metal during ships dismantling, expore to $(CH_3)_4 Pb$ and $(C_2H_5)_4 Pb$ used as petrol ingradients and the use of Pb as an anticorrosive primer paint for ships, are hardly difficult.

Assuming linear relation between loading and Pb concentration in the bay, the assimilative capacity of the bay amounted to 25 ton y^{-1}/μg l^{-1}. 10% annual reduction in the present day load of Pb to the bay for about 11.2 years, leading to a reduction of 2.5 tons, will pass by Pb to a safe concentration limit of 100 ng/l.

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