

ADSORPTION OF ACRYLIC AND POLYACRYLIC ACIDS ON DIFFERENT MODEL SURFACES IN SEAWATER

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In the past few decades considerable attention was paid to polyelectrolytes, substances of high molecular mass which are simultaneously electrolytes (LEEUWEN *et al.*, 1989).

In natural waters and soils the transport and bioavailability of many trace substances are influenced by the presence of not well characterized fraction of organic matter-humic substances which have many binding sites per molecule (mainly of carboxylic or phenolic type) and may be considered as polyelectrolytes.

Acrylic acid is by itself important for natural waters as it is known that some phytoplankton species especially the dinoflagellates along with the prymnesiophytes (KELLER *et al.*, 1989) are producers of - dymethylpropiothetin (DMPT) the osmotic pressure regulator. DMPT is enzymatically cleaved in seawater (or with alkaline solution to dimethyl sulfide (DMS) and acrylic acid. DMS was firstly identified by Hass (HASS, 1935) in the gaseous emissions of the marine red alga *Polysiphonia lanosa* and further on studied by many authors particularly after being recognized as a volatile sulfur compound important for the mass balance of atmospheric sulfur (LOVELOCK *et al.*, 1972). Acrylic acid is pointed out as a compound with antibiotic properties while the guts of penguins which consumed the algae (*Phaeocystis Pouchetii*) were found sterile because of the acrylic acid (SIEBURTH, 1960). It was found that acrylate is metabolised by a variety of bacteria. Polymerization of these material can not be excluded as it is known that acrylic acid polymerases to polyacrylic acid on standing.

In our work special attention is paid to the adsorption properties of these compounds with regard to their different molecular weights, in wide pH range and at different ionic strenghts, in the concentration range relevant for natural water systems aimed at elucidating the behaviour of these substances on the hydrophobic/hydrophilic interfaces in natural water systems.

The adsorption of acrylic acid, glutaric acid as well as polyacrylic acids (molecular weights (MW) = 2000, 5000 and 90 000) on the mercury surface by phase selective a.c. voltammetry at the potential of -0.6 V vs. Ag/AgCl reference electrode was investigated (Fig. 1.). The adsorption of these compounds were determined in the pH range 2 to 8 which is important because by changing the pH values the degree of the polyacrylic acids neutralization changes and influences adsorption. The adsorption of polyacrylic acids is pronounced at low pH values (pH = 2.0) while at higher pH values (pH = 7.0) they are not adsorbed at all regardless of the degree of polymerization. No effect of ionic strenght (0.01 M and 0.55 M NaCl) was estimated for adsorption of polyacrylic acid (MW = 2000 and MW = 5000) under experimental conditions. This indicates (MARINSKY, 1987) that these macromolecules are impermeable to salt (hydrophobic) which on the other hand determines its interaction with the hydrophobic surfaces.

The study of adsorption of acrylic acid and glutaric acid as possible monomers of polyacrylic acids at the mercury electrode have shown that even at low pH value glutaric acid is poorly adsorbed while acrylic acid is adsorbed more strongly than predicted by its hydrophobic properties defined through octanol/water distribution coefficient (REKKER, 1977).

The adsorption of polyacrylic acids on hydrophilic (mineral) surfaces was examined as well. The adsorption of polyacrylic acids and their monomers on hydrophobic and hydrophilic surfaces will be compared regarding its meaning for natural seawater.

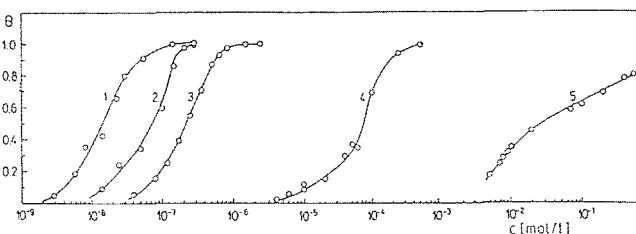


Figure 1. The adsorption isotherms of different polyacrylic acids in 0.55 M NaCl, pH 1.8. (1) PAA MW = 90000, (2) MW = 5000 (3) MW = 2000 and (4) acrylic acid and (5) glutaric acid. Adsorption time $t = 60$ s, potential $E = -0.6$ V vs Ag/AgCl reference electrode. Θ = degree of surface coverage .

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