"Water and effect of chemical agents in ultra low concentrations".

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Ample experimental data accumulated to date provide evidence for the effect of various classes of biologically active compounds (BAC) at ultra low concentrations (< 10^{-13}M) (ULC) at different organizational levels of biological systems – from macromolecules, cell membranes, organs and tissues to animals, plants and even populations. There are similarities in the effect of all compounds at ultra low concentrations; the most important of them is nonlinear polymodal concentration-effect dependence.

A number of our studies showed that the introduction of different BAC (antioxidants, phorbol esters, peptides) in ULC in model system containing membrane suspension was always accompanied by changes in lipid peroxidation process and structural characteristics of lipid bilayer of membranes (microviscosity and order parameter). We have found that there were three areas of concentrations for all of the investigated BAC:1) the area of physiological concentrations (10^{-3}-10^{-8}M); 2) the area of BAC interaction with specific sites on cell membranes (10^{-9}-10^{-15}M); 3) the area of apparent concentrations (10^{-16}-10^{-25} M).

Our experiments indicate that effect of BAC in concentrations 10^{-16}-10^{-25} M was observed only in polar solvents (water, alcohol-water mixture), but in non-polar solvent (petrolatum oil) it disappeared. To reveal the contribution of water dynamic parameters to the mechanism of BAC action at ULC, the effect of some of them in a wide range of concentrations on the fluctuations of transmission indexes, measured using Fourier transform infrared spectroscopy in 9 narrow infrared-bands (4000-500cm^{-1}) for the corresponded water dilutions taken as a standard, was studied. As a characteristic of water structure modifications in the presence of different BAC doses the Mahalonobis criterion was used. It allows considering the correlation between infrared indexes of the sample and standard and is very sensitive to its dispersions. As a result, significant changes in the structural dynamic state of water have been observed under the effect of BAC at the 10^{-9}-10^{-25} M concentration range which has induced statistically reliable modifications of membrane structure. The same kind of experiments carried out with peptides in near range of infrared area (5200-14000 cm^{-1}) have shown the big changes in these specters of water under the effect of several doses BAC. The greatest deviations have been observed at the wave 9500 cm^{-1}. High concentrations of BAC (10^{-4}-10^{-7}M) had the strongest impact on the absorbtion (decreasing up to 10%) but there was a statistically reliable maximum (increasing up to 6%) at the concentration 10^{-15} M also. Taking together these results indicate that BAC change a structure of water system, probably, inducing the formation of new types of water microdomains which can influence on absorbtion parameters in a great scale. So, the biological effect of BAC at 10^{-15}-10^{-25} M can be explained on the basis of this data.