Ministry of Science and Higher Education of the Russian Federation
Ivanovo State University of Chemistry and Technology
G.A. Krestov Institute of Solution Chemistry of the Russian Academy of Sciences
Institute of Macroheterocycle compounds ISUCT
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Abstract

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Maiorova L.A.[1], Koifman O.I.[1,2]

THE CONCEPT OF NANOSTRUCTURING OF MACROHETEROCYCLIC COMPOUNDS AT THE GAS–LIQUID INTERFACE

[1]Institute of Macroheterocyclic Compounds,
Ivanovo State University of Chemistry and Technology, Ivanovo, Russia
[2]Institute of Solution Chemistry, RAS, Ivanovo, Russia
e-mail: Maiorova.Larissa@gmail.com

In the talk a concept of nanostructuring of organic compounds at the gas-liquid interface, according to which the structural units of a floating layer can be as single molecules (Langmuir approach) and their nanoaggregates (the so-called M-nanoaggregates), will be presented [1–4]. The method developed for determining the quantitative parameters of the structure and properties of such layers [1], and applied to phthalocyanines and porphyrins [2] will be also presented. Using the developed approach, under conditions of confined spaces, nanostructures of a number of different kind of organic compounds were formed at air-water interface, in Langmuir-Schaefer (LS) films and in polymeric capsules [3,4].

The influence of nature of the compound and the formation conditions on the structure and properties of the ensembles has been established. Nanostructured layers of μ-nitrido dimer of iron octapropylporphyrazine (μ-[(OPTAP)Fe]$_2$N) highly sensitive to aromatics were formed. Conditions of formation of T-shaped structures of μ-[(OPTAP)Fe]$_2$N in LS-films were determined. The reactions of complexation of 5-(4′-N-*tert*-butyloxycarbonyl-D-leucylamidophenyl)-10,15,20-triphenylporphine ((D-LeuPh)TPP) with zinc and axial coordination of cobalt tetraphenylporphine with imidazole were carried out in the layers at air-water interface at the room temperature. LS-films consisting of Zn complex of (D-LeuPh)TPP and cobalt tetra-(p-methoxyphenyl)porphyrin nanostructures, absorbing in near IR (768, 856 nm and 695, 916 nm, respectively) were formed. The formation of nanostructures of chlorin e$_6$ (absorbing at 676 and 710 nm), *methylpheophorbide a* (absorbing at 426 and 697 nm), and tetraphenylporphine (transparent for visible light and week absorbing at 720 nm) is established. By a non-covalent self-assembly at the water-air interface, the first porphyrin supermolecules were obtained. They were formed from magnesium porphine (the ancestor of all porphyrins and the functional element of chlorophyll). It was shown that their photophysical properties fundamentally differ from properties of initial molecules. In particular, in contrast to the pink color of the monomer solution, solutions of supermolecules are transparent for visible light and absorb in the ultraviolet and near-infrared regions. Structural study of the films was carried out using synchrotron radiation. The formation and properties of described nanoparticles determined by strong exciton coupling in the ensembles [4].

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