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MULTIPARAMETRIC OPTICAL ANALYSIS DEVELOPMENT FOR CONTROL OF BIOLOGICAL MICRO- AND NANO- PARTICLES

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INTRODUCTION: Multiparametric analysis of optical data for biological and other three-dimensional (3D) disperse systems with nano- and micro- particles can provide further progress for characterization and "on-line" or "in-situ" control of such dispersions. Taking into account optical theory [1,2] and results of investigations [3,4] can help to elaborate sensing elements for the control of specific particles.

METHODS: 3D disperse system multiparametric optical characterization includes: a) the simultaneous measurements of dispersion by different compatible non-destructive optical methods such as refractometry, absorbency, fluorescence, light scattering (integral and differential, static and dynamic, unpolarized and polarized); and b) solution of inverse optical problem by different methods including modern technologies of data interpretation by information-statistical theory. For this purpose it is necessary to have information about optical properties of different 3D disperse systems.

RESULTS: Our research has investigated different 3D water dispersions for the Bank of Optical Data for Disperse Systems (BODDS) with nano- and micro-particles: proteins, nucleoproteins, lipoproteids, viruses, lipid emulsions, blood substitutes, latexes, liquid crystals, cells with various form and size (especially E.coli cells), metal powders, clays, kimberlite, zeolites, oils; and mixtures - proteins with nucleic acids, liposomes and viruses, liquid crystals with surfactants, mixtures of clay with cells, samples of natural waters, etc. [3,4]. Fig. 1 demonstrates the nanostructures of rotavirus (which look like influenza virus, coronavirus or virosome artificial structure). Rotavirus and E.coli cells can be considered as test-objects for natural water virus and bacteria contamination.

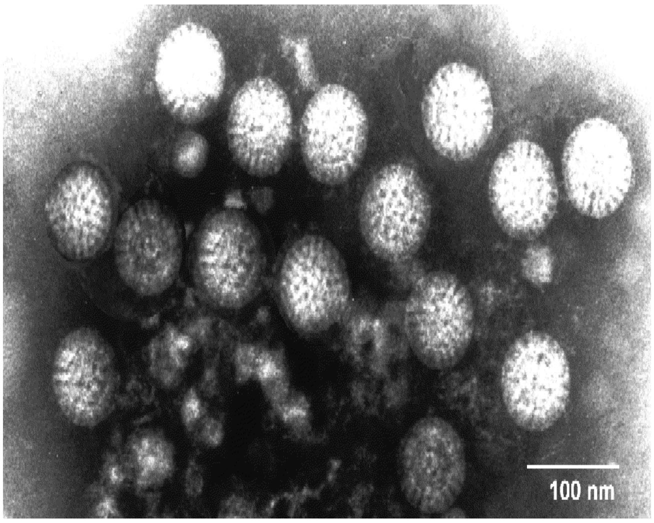

Fig. 1: Electron microscope photograph of Rotavirus.

DISCUSSION & CONCLUSIONS: By optical methods it is possible to estimate mean diameter and number of particles, disperse phase mass and number of particles size distributions, form and inner structure of particles [1,2]. Due to the comparison of data from integral and differential light scattering it is possible to explain light scattering intensity changes at aggregation of such particles as lyposomes, latexes, viruses, etc. Mixtures can be considered as polycomponent and polymodal disperse systems (such as natural waters). Optical data indicate complex interactions between particles of different nature in mixtures. Electrokinetic data are evident in favor of an assumption that there is heteroaggregation in mixed dispersions. Due to the fusion of various optical data it is possible to solve the inverse physical problem by methods of information-statistical theory on the presence of impurities in mixtures (biological cells, viruses, oil, metallic particles, etc.) [4,5]. At this case the polymodality of particle size distributions is not an obstacle.

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