

Biomedical Nanoparticle Interfaces Optical Sensing

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INTRODUCTION: Proteins, nucleoproteids, lipoproteids, liposomes, viruses, virosomes, lipid emulsions, blood substitutes and other nanoparticle systems can be considered as biomedical 3D disperse systems (DS) with nanoparticles as disperse phase in dispersive medium [1]. The experience [2-4] suggests that the set of optical parameters of so called "second class" is unique for each 3D DS. In another words each 3D DS can be characterized by n-dimensional vector in n-dimensional space of optical parameters. Such presentation can serve as sensing platform and can provide further progress in biomedical 3D DS characterization and "on-line" or "in-situ" control in nanobiotechnology.

METHODS: Multiparametric optical analysis of 3D DS includes: a) simultaneous measurements of 3D DS 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 technologies of data interpretation by information-statistical theory. For this purpose it is necessary to collect information about optical properties of different 3D DS.

RESULTS: Fig. 1 demonstrates the aggregated nanoparticles of rotavirus. One of the main problem for sensing biomedical 3D DS is the polymodality of particle size distributions. It is possible to find in dispersion the mixture of the original particles, their aggregates and fragments (debris), and different impurities. The analysis of experimental data for biomedical 3D DS by compatible optical methods allows draw the conclusion that there are three classes of parameters. The first class parameters are measured optical values, for example, intensity values of fluorescence or light scattering under certain conditions (installation conditions, conditions of object treatment, etc.). The second class parameters can be calculated from experimental optical data without any "a priori" information about the nature, form and size distribution of particles. The third class parameters can be obtained after solution of inverse optical problem for experimental data.

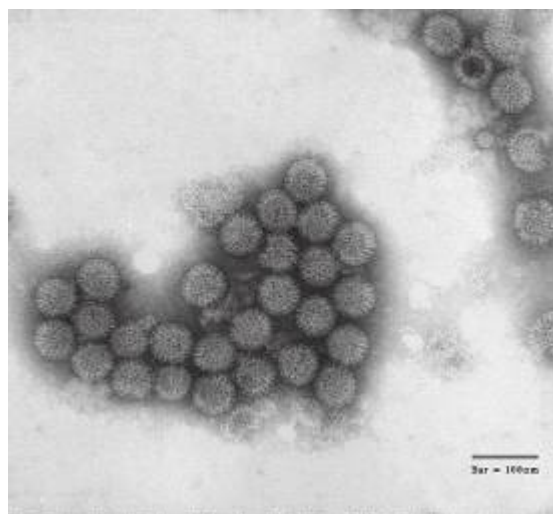


Fig. 1: Electron microscope photograph of Rotavirus nanoparticle aggregate.

DISCUSSION & CONCLUSIONS: 3D DS can be characterised and compared with another 3D DS by means of the second class optical parameters which set can reflect the most changes in the state of mixtures. Due to the fusion of various optical data it is possible to solve by information statistical theory the inverse physical problem on the presence of the component of interest in mixtures and in this case the polymodality of particle size distribution is not the obstacle.

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