

Nanochemistry and biotechnology

Fullerene water solutions for the treatment of cancer and neurodegenerative diseases

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Nowadays, water soluble forms of fullerenes are of current interest regarding biomedical applications. Thus, C₆₀ fullerene complexation with several antitumor drugs leads to the enhancement of their anticancer activity. It was assumed that the reason for this effect is the membranotropic activity of C₆₀ fullerene which results in the enhanced delivery of fullerene-drug complexes to the cytosol of tumor cells. Also, neuroprotective effect was revealed for fullereneol and hydrated fullerene C₆₀.

The present paper is devoted to the comparison of the efficiency of fullerene C₆₀ water solutions with respect to their application for the treatment of oncological and neurodegenerative diseases. Different methods of preparation of fullerene water solutions were considered. At the initial stage of research, the detailed structure analysis for each solution in water and after fullerene transfer in saline solutions included several methods (small-angle X-ray and neutron scattering, dynamic light scattering, atomic force microscopy, transmission electron microscopy, UV-Vis spectroscopy). At the next stage, cytotoxicity in vitro tests with mammalian fibroblasts of Chinese hamsters, line V-79, revealed good survival at fullerene concentrations up to 5 µg/ml. Subsequent investigations of the complexation of fullerenes with anticancer drugs for potential enhancement of their activity concerned the interaction of C₆₀ with oxyresveratrol (OXY). The detection of complex formation in mixture of C₆₀ with OXY was the first step prior to further biological in vitro and in vivo testing. Finally, the effective inhibition of growth and depolymerization of lysozyme amyloid fibrils by fullerene C₆₀ was revealed, which makes it a promising agent in the treatment of neurodegenerative diseases.