Nanochemistry and biotechnology

New hybrid nanocomposites for antitumor therapy

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Currently, cancer research is focused on nanotechnology, which involves the design characterization, production, and application of nanoscale drug delivery systems. Macromolecules of soluble polymers, due to their biocompatibility with living cells and tissues and their possible load dosage forms, can be used as nanocontainers or nanotechnology- based drug delivery systems.

The goal of this study was to create hybrid nanocarriers based on the branched pH-sensitive biocompatible copolymers with controlled internal molecular structure for photodynamoc and drug anticancer therapy. It was shown that these nanocarriers were captured by phagocytic cells, and that were not cytotoxic.

Polymer was loaded with Au nanoparticles and sensitizer (chlorin e6) and tested for photodynamic antitumor therapy. In vitro experiments on malignant cell line MT-4, the nanocomposite photosensitizer demonstrated twofold increase of photodynamic efficacy compared to the free photosensitizer. Significant antitumor photodynamic activity of the nanocomposite photosensitizer was confirmed in experiments on photodynamic therapy of Lewis lung carcinoma, transplanted into laboratory mice, that warrants the photosensitizer prospective preclinical studies.

Also, the polymer were loaded with antitumor drug cisplatin at different concentrations. They revealed dose-dependent decrease in viability of chronic myelogenous leukemia and histiocytic lymphoma cells. When the copolymers were conjugated to both nanosilver and cisplatin, such a nanosystem displayed less cytotoxic effect compared to Polymer/ cisplatin system.

Taking into account that our nanosystems will act mainly on malignant phagocytic cells and do not affect healthy cells, they can thus potentially be used for the therapeutic treatment of tumor cells having phagocytic activity.