Multicomponent Drug Delivery Systems Based on PLCL Nanofibers and Modified Gold Nanoparticles in Cancer Treatment

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The idea of the project is the design of advanced systems potentially useful in targeted cancer therapy and neurosurgery. In my project I have focused on composites of modified gold nanoparticles, hydrogels and polymers. I used in bioengineering process of polymeric PLCL nanofibers with introduced modified gold nanoparticles and attached, selected for investigations, anticancer drug - doxorubicin. First, I synthetized gold nanoparticles in two-phase reaction process, where the alkyl ligand of carboxyl group was exchanged by 11-meracaptoundecanioic acid. Then, doxorubicin was attached to Au NPs modified by dodecanethiol linkers capped carboxyl groups, by amine - carboxyl group covalent bonding (peptide bond). The bond is sensitive and disrupt after change of pH environment to more acidic (about 5-6). The next step, was the noncovalent introducing of modified Au NPs into nanofibers synthetized from poly-L-lactide-co-e-caprolactone in DMF and chloroform environment. Mixed together, both initial solutions were electrospuned in coaxial electrospinning process. The morphology of Au-PLCL nanofibers were confirmed by TEM and SEM microscopy measurements. I studied the kinetic of release of modified and conductivity gold nanoparticle during biodegradation process of nanofibers.The release of doxorubicin from modified nanocomposites were tested in in vitro experiments with use of cancer cells – HeLa, Insulinoma and Glioma. I investigated the ability to accumulate of doxorubicin in cells and cytotoxic and cytostatic properties during MTT and CyQUANT tests. I presented that application of nanocomposite and drug release is useful for better accumulation of drug in cancer cell. The selectivity of composite drug delivery is important from the point of it toxicity on health cells.

Awards Won:

Fourth Award of $500