SYNTHESIS AND ANALYTICAL CHARACTERIZATION OF GOLD NANOPARTCLES FOR ANTICANCER DRUG DELIVERY APPLICATION

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For many years research has been carried out to form selective drug carriers. Gold nanoparticles (AuNP) are of particular interest. New perspectives of these nanoparticles as drug carries include: the use of drugs which are poorly soluble in water, targeted delivery of drugs, transport by barrier membranes, the possibility of macromolecular drug release, "combined" treatment - two or more drugs, securing faster mechanisms of action and improved efficiency of drugs [1].

Drug-modified gold nanoparticles (R-AuNP) have been synthesized in a single-phase system based on the reduction of hydrogen tetrachloroaurate (III) using the stabilizing ligand. The color change from yellow to deep ruby red indicated the formation of gold nanoparticles. The formation of stabilized gold nanoparticles was confirmed by the observation of the surface plasmon resonance band. Varying drug concentrations and kinds of solvents were used for the reduction of tetrachloroaurate to determine the effect of drug/ligand concentration and solvent type on the formation of AuNPs. The stability of newly synthesized R-AuNPs was characterized using UV-Vis spectroscopy. The conjugated particles (the resulting AuNPs) were characterized by several techniques, including transmission electron microscopy (TEM), UV-Vis spectroscopy, infrared spectroscopy (IR), Raman spectroscopy, nuclear magnetic resonance spectroscopy (NMR), capillary electrophoresis, electrochemical techniques and zeta potential measurement.

In any application of the AuNPs, it is important first to determine their basic physico-chemical characteristics, such as, e.g. size, shape, mono- or polydispersity, UV–Vis spectra, electrokinetic potential as well as other special parameters and analytical methods employed in the characterization of the AuNPs. TEM is a powerful and straightforward method for the determination of size (including size distribution) and shape of the AuNPs. UV–Vis absorption spectrophotometry allows for an in situ direct analysis of colloidal solutions. The position of the observed band maxima (typically in the range 500 – 600 nm) is usually related to particle size. However, the position of the surface-plasmon resonance (SPR) maximum cannot be directly related to the particle size of the NPs and other factors have to be considered [2]. The capillary electrophoresis is the method applied to confirm the formation of nanoparticles as well as to determine the drug residuals in the leachate during the purification of the conjugates. By means of infrared and Raman spectroscopy it is possible to study the molecular species deposited on the AuNPs. The NMR spectroscopy and electrochemical techniques are used to confirm the attached drugs. Complete structural characterization of the organic molecules attached to the AuNPs surface was carried out.

References:

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