AEROSOL THIOL-ENE PHOTOPOLYMERIZATION FOR SYNTHESIS OF NANOMATERIALS

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Aerosol photopolymerization is a simple and effective tool for synthesis of polymer nanoparticles. In present research aerosol photopolymerization is used in combination with thiol-ene chemistry to produce various polymer nanomaterials: spherical polymer nanoparticles, silver-polymer, and gold-polymer nanoparticle hybrids. Thiol-ene photopolymerization provides rapid, self-initiated step-growth reactions with low shrinkage and oxygen inhibition. Aerosol photopolymerization offers environment-friendly, cost-effective, continuous flow through method for synthesis of nanoparticles without heating. The nanoparticles synthesized via aerosol thiol-ene photopolymerization can be used for applications in various fields of biomedicine. Aerosol photopolymerization setup requires nitrogen stream, aerosol generator, irradiation source (UV-fluorescence tubes), reaction chamber (fluorinated ethylene propylene (FEP) tubes) and a collector (membrane filters incorporated inside the filter housing). Spray solution with thiol and ene monomers, organic solvent (typically, ethanol) and photoinitiator is placed inside the aerosol generator and under the stream of nitrogen a droplet aerosol is formed. The droplets pass through FEP tubes and polymerize under the UV-irradiation. The formed polymer nanoparticles are collected on membrane filters. The shape and size of nanoparticles are observed via Scanning Electron Microscopy (SEM). Different shapes of nanoparticles can be obtained via aerosol photopolymerization. This study was focused on producing spherical individual nanoparticles of narrow size distribution. Size and shape of nanoparticles depends on the initial parameters set for the atomization process, e. g. ratio of monomers, choice of solvent, ratio of solvent, pressure of nitrogen etc. The silver and gold inside the nanoparticle hybrids are observed via Transmission Electron Microscopy (TEM).

The obtained nanoparticles possess -SH groups available for binding of biological molecules, such as maleimide. A number of biomolecules can be bound to nanoparticles for various biomedical applications. Fluorescence-labeled molecules are used in this research to determine the availability of binding sites. Biofunctionalized hybrid nanoparticles synthesized in this study have great potential for cancer diagnostics and therapy.