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The nanoparticle protein corona relevance for nanomedicine and toxicology

Roland H. Stauber
University Hospital of Mainz, Germany

In biological fluids, proteins bind to the surface of nanoparticles forming a coating known as the protein corona, potentially influencing success or failure of nanobiomedical applications. Nanomaterials adsorb biomolecules upon contact with all (biological) environments. Therefore, the biomolecules-coated nanomaterials may need to be considered as 'new materials' compared to the pristine nanomaterials during their manufacturing. Particularly, the so called "nanoparticle-protein corona" is expectedto influence not only the success and safety of nanobiomedical applicationsbut alsoto critically impact nanotoxicology and nanoecology. As most biological systems are (highly) dynamic, a time-resolved knowledge of particle-specific protein fingerprints is required to understand the coronas' evolution, enabling improved nanotechnological applications without potential adverse side effects.

Employing label-free liquid chromatography mass spectrometry, we present not only a qualitative but also a quantitative systematic analysis of the human blood protein corona on nanoparticles varying in distinct physico-chemical features. Our results provide novel insights into the complexity and kinetic evolution of particle-specific protein signatures. Collectively, we demonstrate that already the rapid corona formation is (patho) biologically relevant and provide bioinformatic functional predictors. Combined with comprehensive cell-based (high-throughput) assays, the impact of corona evolution as well as its rational exploitation for advanced nanomaterial with improved safety will be discussed.

rstauber@uni-mainz.de

Nanoparticle for colon specific drug delivery system

Sanjay J. Kshirsagar
AISSMS College of Pharmacy, India

Local delivery to bowel tissue through oral administration is a challenging but a desirable goal to treat diseases like inflammatory bowel disease (IBD). Nanoparticles, Liposomes have shown potential to specific accumulation at inflammation site thus reduce toxicity; hence it can be used for effective treatment of IBD.

Nanoparticles of prednisolone were prepared by nanoprecipitation with pH responsive polymer eudragit S100. Effect of formulation variables such as surfactant, oil, and polymer on properties like average size, drug release rate, and drug entrapment of nanoparticles was investigated. The optimized formulations have mean size of 567.87 nm, high encapsulation efficiency of 90.21%. In vitro drug release study was done by changing pH method revealed that drug releases after 4.5 h lag time corresponding to time to reach colonic region. In vivo studies shown drug release after 3 h lag time in rat corresponds to arrival in colon.

Liposomes of budesonide were prepared using thin film hydration method. Statistical design was used for optimization of liposome formulation. Inverted sac method was used as *ex vivo* model for IBD. In *in vivo* study, myeloperoxidase (MPO) activity and histopathology comparative study was carried out. Liposomes were formulated in enteric coated capsules to deliver the liposome specifically in initial segment of colon. Particle size and entrapment efficiency were between 200 and 300 nm and 40 and 60%, respectively. In vivo and *ex vivo* study indicates higher accumulation of liposomes in colonic region as compared to pure drug. Enteric coated capsules delivered the drug after 5 h lag time corresponding to colonic arrival time.

Nanocapsules of budesonide were prepared by nanoprecipitation technique and optimized by Statistical design. Ex vivo and *in vivo* study is in process.

Biography

Sanjay J. Kshirsagar completed Ph.D. from JNTU, Hyderabad in the year 2012. Having experience of about 13 years, currently is working as Associate professor at AISSMS College of Pharmacy, Pune. He has published 38 papers in reputed national and international journals and attended 13 presentations. He has guided 19 Post Graduate students (M.Pharm.). He completed an industrial project for Itros Pharmaceuticals. He has filed two Indian patents and also published a book on Pharmaceutics, awarded as best M.Pharm thesis in 2012-13.

sanjayjk@rediffmail.com