Understanding bionanoparticle behavior through physical characterization

Dr. Suvajyoti Guha, Food and Drug Administration (FDA), Silver Spring, Maryland, U. S. A.

Bionanoparticle (e.g. nanoparticles, viruses, proteins, nanoparticle-protein conjugates) research, aided by the expanding multibillion dollar bio-pharma industry, has seen an exponential growth in the last decade. This talk will be an attempt to integrate the fundamentals of mechanical, chemical and bio-engineering to understand bionanoparticle behavior in liquid and aerosol phases. The first part of this talk will focus on research efforts undertaken at National Institute of Standards and Technology (NIST), Gaithersburg, using a state-of-the-art gas-phase ion mobility technique known as electrospray-differential mobility analysis (ES-DMA). An ES-DMA first aerosolizes nanoparticles (typically in the size range of 2.7 nm to 400 nm) from liquid phase and then characterizes them based on the balance of drag and electrical forces. At first, ES-DMA will be used to understand the complex phenomenon of protein adsorption and desorption from surfaces. Then it will be used to characterize proteins aggregates and through different examples it is going to be demonstrated that ES-DMA can complement or at times outperform other industrial gold-standard liquid-phase techniques (e.g., size exclusion chromatography and analytical ultracentrifugation). This talk will also demonstrate ES-DMA's capabilities upon integration with aerosol particle mass analyzers (which differentiates particles by the balance of electrical and centrifugal forces) to quantify ligand adsorption to nanoparticles accurately. The second part of the talk will focus on FDA's efforts to understand the harmful effects of bionanoparticles in aerosolized form to human beings and how protective devices such as respirators or masks can reduce exposure to nanoparticles. We are currently developing computational models validated by experimental results for understanding aerosol transport through protective devices such as masks/respirators which concomitantly would aid in our understanding of risks posed by exposure to bionanoparticles. Some of our initial results are going to be shared.

About the Speaker

Suvajyoti Guha received his PhD in Mechanical Engineering from University of Maryland, College Park in March, 2012 prior to which he had received his master's degree in Mechanical Engineering from Indian Institute of Technology - Delhi, New Delhi in May, 2007 and bachelor's degree in Mechanical Engineering from Jadavpur University, Kolkata in May, 2005. While pursuing his PhD, Suvajyoti was stationed at NIST, Gaithersburg for more than four years (Dec, 2007 - Mar, 2012) and his tasks there included collaborating with multiple organizations encompassing the bio-pharma industry and the academia for accomplishing characterization of a wide range of bionanoparticles such as protein-protein aggregates, viruses and nanoparticle-ligand conjugates and to understand their behavior. During his PhD, besides receiving teaching and research assistantships from his department, he had also received the prestigious Arthur James Clarke fellowship from the graduate school for a maximum possible three years (2007 - 2010). He was also a finalist for the Dean's Doctoral Research Award for best PhD dissertation in 2011-2012. He is presently a postdoctoral fellow at Division of Solid and Fluid Mechanics, Center for Devices and Radiological Health, FDA at Silver Spring by virtue of a Oak Ridge Institute of Science and Education fellowship and his current research focuses on understanding the effect of exposure of human beings to different pathogenic aerosols and the effectiveness of protective devices such as masks and respirators in this context.