University of Minnesota
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Department of Chemistry

Seminar

9:45 a.m. Thursday, September 22 • 331 Smith Hall

Assistant Professor

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University of California, Riverside

Analytical Tools for Studying Nanoparticle-Protein Interaction

Research interests: development of novel bio-analytical techniques with unique specificity and sensitivity for high-throughput detection of biomolecules, and investigation of host-pathogen interaction using proteomic approaches, both relying on various techniques like chromatography, mass spectrometry, microscopy imaging, and flow cytometry.
Website: http://chem.ucr.edu/index.php?main=faculty&facsort=profile&faculty=zhong

Abstract

With the rapid advancement of nanotechnology, engineered nanomaterials have found enormous applications in diverse areas including molecular sensing, energy production, biomedical imaging, and drug delivery.[1] On the other hand, the increasing production of NM augments their release to the environment and raises great safety concerns.[2] Both trends calls for more profound understanding of the interaction between nanomaterials and biomolecules, especially proteins, to ensure effective and safe employment of nanomaterials.[3] Our group uses separation and spectroscopy technologies to study the nanoparticle (NP)-protein binding. We developed a capillary electrophoresis (CE)-based method to measure the binding affinity, which offers fast running speed, high resolution power, and non-destructive separation of the nanoparticle-protein complex.[4] We also employed matrix-assisted laser desorption and ionization (MALDI) mass spectrometry to analyze the integrity of the surface molecules coating outside of NPs.[5] Together, we identified the major driven force to be the desolvation effect at the interaction interface. Further, the binding epitope of the Fe_3O_4 NPs on human serum albumin (HSA) was determined using the crosslinking chemistry coupled with MS, and CE confirmed the identification by showing the competition between small molecular ligands and NPs for binding to HSA. In the meanwhile, the protein corona, the biosignature of NPs in biosystems, formed on the surface of NPs when they encounter a biological matrix like human serum has been analyzed. With the analytical tools developed in our group, we can systematically study the dependence of protein affinity, binding consequence, and corona formation on the physicochemical properties of NPs, gaining more knowledge about the interaction driving force and possible consequences. The knowledge will be useful for ensuring the good performance of the nano-protein conjugates and for safely implementing nanomaterials.

References

[1] S. Rana, Y.-C. Yeh, V. M. Rotello, *Curr. Opin. Chem. Biol.* **2010**, 14, 828-834.
[2] T. A. Faunce, *Ex. Opin. Drug Safety* **2008**, 7, 103-106.
[3] P. Asuri, S. S. Bale, S. S. Karajanagi, R. S. Kane, *Curr. Opin. Biotechnol.* **2006**, 17, 562-568.
[4] N. Li, S. Zeng, H. Le, W. Zhong, *Anal. Chem.* **2010**, 82, 7460-7466.
[5] N. Li, S. Zeng, H. Le, W. Zhong, *Anal. Chem. In Press.*

Host: Associate Professor Michael Bowser
Refreshments will be served prior to the seminar.