Washington University in St. Louis
School of Engineering & Applied Science

Energy, Environmental & Chemical Engineering

EECE Department Seminar

Friday, January 27, 2017

11:00am

Brauer Hall, Room 12

Nanoscale chemical engineering for sustainable agriculture and environment

ABSTRACT

In 19th century chemical engineers helped to advance agricultural by inventing process to synthesize macro nutrients. With the time, challenges become bigger, and now world agricultural zones are facing a wide spectrum of challenges such as stagnation in crop yields, low nutrient use efficiency, declining soil organic matter, multi-nutrient deficiency, shrinking arable land, water availability and shortage of labor due to exodus of people from farming. Data compiled by the UN's Food and Agriculture Organization represent that depletion and degradation of land and water pose serious challenges to producing enough food and other agricultural products to sustain livelihoods, and meet the needs of the world's ever increasing population. Recent report of the UN suggests that by 2050, global population will reach to 9.5 billion. Nanotechnology – designing ultra-small particles – is now emerging as a promising way to promote plant growth and development. This idea is part of the evolving science of precision agriculture, in which farmers use technology to efficiently use water, fertilizer and other inputs. Precision farming makes agriculture more sustainable because it reduces waste. To meet the food demand, farmers use more chemical fertilizer that eventually affects soil health and reduces natural resources, not to mention potential environmental and ecological impacts. Some crops can be grown under artificial conditions using hydroponic techniques, but the cost (in energy and dollar) is approximately 10 times that of conventional agriculture. Such systems are neither affordable nor sustainable for the future. Therefore, it is an urgent requirement to develop sustainable strategies that results in more nutritious and enhanced crop production by minimizing the use of resources and fertilizers. In contrast to conventional fertilizer use, which involves many tons of inputs, nanotechnology focuses on use of smaller quantities that are more efficiently used. Nanoscale particles (between 1 and 100 nanometers in at least one dimension) have unique physical, chemical and structural features, which can be controlled to obtain desired functionalities. However, environmental health and safety aspects should also be considered, and it is critical to determine the toxicity/biocompatibility. In this presentation, I will discuss how better we can use nanotechnology to produce enough nutritious food for growing world population while ensuring soil and environmental health challenges to realize sustainable and precision agriculture.

Ramesh Raliya, Research Scientist

Department of Energy, Environmental & Chemical Engineering,
Washington University in St. Louis

Dr. Ramesh Raliya is a Research Scientist at Department of Energy, Environmental and Chemical Engineering, Washington University in St. Louis, USA. Prior to this, he was Research Associate at National Agriculture Innovation Project of Nanotechnology at Central Arid Zone Research Institute, Jodhpur (An institute of Indian Council of Agriculture Research, Government of India). At Washington University, Dr. Raliya associated with Nano Research Facility, and Aerosol and Air Quality Research Laboratory of School of Engineering & Applied Science, and Center for Multiple Myeloma Nanotherapy of Washington University School of Medicine. Dr. Raliya's research is in the area of nanoparticle technology and having expertise in advanced functional nanomaterial synthesis using biological, chemical and aerosol route, and their application in biomedical, plant science, toxicity, energy and environmental technologies. He has published more than 30 peer reviewed publications, and holds five patents for his nano-biointerface research. He is a co-founder of BIRANO LLC, and recently won Leadership in Entrepreneurial Acceleration Program (LEAP) Inventor Challenge Award by the Washington University for his research on nanofertilizer. Dr. Raliya has interdisciplinary academic and research background. He earned his bachelor degree in Bioscience and Masters in Biotechnology from Jai Narain Vyas University, Jodhpur. He earned his Ph.D. in 2012 from the Central Arid Zone Research Institute, India.

For more information contact Kara Dix at kdix@wustl.edu