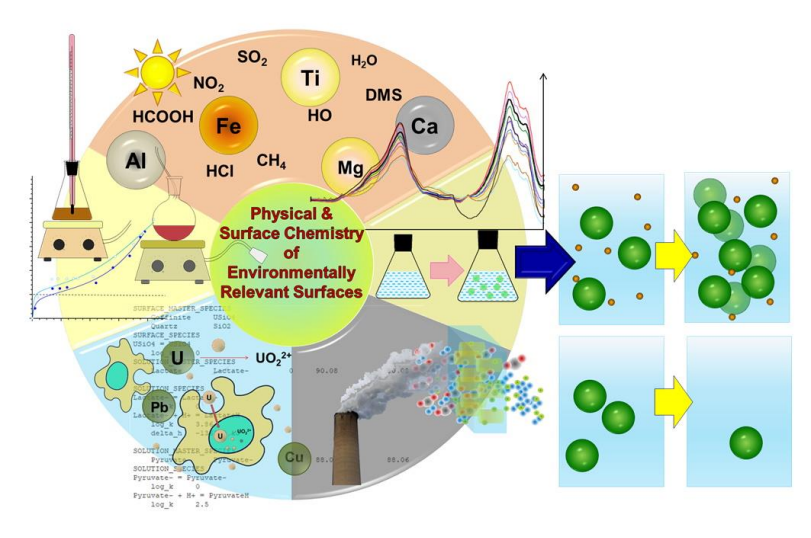
Chemistry Ph.D. Dissertation Defense

Study of Heterogeneous Chemistry & Photochemistry of Atmospheric Aerosols: Impact of Mineralogy on Ocean Fertilization, Human Health, and the Greenhouse Gas Mitigation

By Eshani Hettiarachchi



The earth's atmosphere is a complex mixture of a variety of components such as gasses, and particulate matter (PM). These components, of both natural and anthropogenic origin, are continuously interacting with each other, introducing a large array of heterogeneous chemical and photochemical reactions to the atmosphere. Atmospheric processing of mineral dust aerosols due to these processes has been identified as a major contributor to bioavailable iron (Fe) in oceans. Numerous studies have focused on bioavailable Fe production from mineral dust aerosols by the single component Fe-bearing minerals such as hematite. However, the impact of non-Fe bearing minerals on Fe dissolution and marine phytoplankton productivity remains largely unknown. This study focuses on mineralogy driven enhanced Fe solubility of mineral dust aerosols in atmosphere, in the presence of elevated levels of titanium (Ti). These Ti represents either internally mixed phases such as ilmenite ($FeTiO_3$), or externally mixed phases such as titania (TiO_2). The Fe dissolution in the daytime increases when mixed with TiO_2 due to $HO^{\bullet}$ mediated mechanisms. In the dark, TiO_2 and nitrate increase Fe dissolution via redox coupling reaction under reduced conditions. Additionally, the growth studies conducted with a marine centric surface diatom *Cyclotella meneghiniana* shows their growth responses are significantly higher when fed with hematite mixed with TiO_2 than hematite alone, or having ilmenite ($FeTiO_3$) suggesting that not only the atmospheric processing of mineral dust aerosol, but also the marine diatom growth is mineralogy dependent.

Date & Time: April 1st, Noon – 1.00 PM

Venue: https://zoom.us/j/754908712