



UNIVERSITY OF CENTRAL FLORIDA

NANOSCIENCE TECHNOLOGY CENTER
ADVANCED MATERIALS PROCESSING & ANALYSIS CENTER

GRADUATE RESEARCH SEMINAR SERIES

Application of Conducting Polymer Nanoparticles in Photodynamic Therapy

Mona Mathew (12:00 PM – 12:30 PM)
Dr. Andre Gesquiere's Group



Abstract: Conducting polymer nanoparticles as a next generation of photosensitizers were developed for applications in Photodynamic Therapy (PDT). Due to their large extinction coefficients ($> 10^7 \text{ L mol}^{-1} \text{ cm}^{-1}$), ability to undergo intersystem crossing to the triplet state, and having triplet energies that are close to that of oxygen, conducting polymer nanoparticles were a promising choice for PDT. It was therefore hypothesized that such polymers could be effective at generating ROS due to the large excitation rate that can be generated. Conducting polymer nanoparticles (CPNPs) composed of the conducting polymer poly[2-methoxy-5-(2-ethylhexyl-oxy)-p-phenylenevinylene] (MEH-PPV) were fabricated and studied in-vitro for their potential in PDT application. Though the nanoparticles were not functionalized for selectivity, a strong bias to the cancer cells was observed. The formation of ROS was proven *in vitro* by staining of the cells with CellROX Green Reagent, and the cell viability after PDT was quantified by MTT assays. Cell mortality was observed to scale with nanoparticle dosage and light dosage. Based on these results the MEH-PPV nanoparticles were developed further to allow for surface functionalization, for targeting these NPs to cancer cell lines. Cancers that overexpress folate receptors (FR) were considered for targeting by nanoparticles functionalized with folic acid. The functionalized nanoparticles (FNPs) were studied in OVCAR3 (ovarian cancer cell line) as FR+, A549 (lung cancer cell line) having marginal FR expression, MIA PaCa2 (pancreatic cell line) as FR-, and TE 71 as normal control cell line. Complete selectivity of the FNPs towards the FR+ cell line was found. Quantification of PDT results by MTS assays and flow cytometry show that PDT treatment was fully selective to the FR+ cell line (OVCAR3). No cell death was observed for the other cell lines studied here within experimental error.

Friday
November 7, 2014

12:00 PM – 1:00 PM

Research Pavilion
NSTC
Conference Room 475

Pizza and drinks
will be provided

Copper (Cu)–Silica Nanocomposite Containing Valence-Engineered Cu: A New Strategy for Improving the Antimicrobial Efficacy of Cu Biocides

Mikaeel Young (12:30 PM–1:00 PM)
Dr. Swadeshmukul Santra's Group



Abstract: Copper (Cu) compounds are widely used as antibacterial/antifungal agents for protecting food crops. Prolonged use of Cu biocides would lead to undesirable Cu levels in agricultural soil. In the absence of a suitable alternative, prudent use of Cu biocides is required. I will report on a composite material of sol-gel silica host matrix loaded with mixed valence Cu as an alternative to conventional biocides. In this composite material, Cu is present in different oxidation states. The hydrophilic silica matrix serves as a water-dispersible delivery vehicle for antimicrobial Cu. It is hypothesized that a mixed-valence Cu system, specifically enriched with Cu(0) and Cu(I), will exhibit enhanced antimicrobial efficacy over traditional Cu(II) compounds. Materials were characterized by high-resolution transmission electron microscopy and X-ray photoelectron spectroscopy for the determination of particle size, morphology, crystallinity, and Cu oxidation states. Antimicrobial studies against *Xanthomonas alfalfae* and *Escherichia coli* (minimum inhibitory concentration) showed improved efficacy in MV-CuSiNG treatment compared to CuSiNG and other controls. Phytotoxicity studies performed (in *Vinca sp.* and *Hamlin orange*) under greenhouse conditions showed that the newly prepared nanocomposite is safe for plants, demonstrating potential usefulness of the material in agricultural biocides.