1-1-2021

Critical Phenomena in Organic Binary Liquid Mixtures

Surangi Jayawardena

Development of Targeted Chemotherapeutic Delivery Non-Small Carcinoma Lung Cancer Cells

Surangi Jayawardena (Ph.D.), Assistant Professor, Department of Chemistry

MSB 305, 256-824-5445, hj0022@uah.edu

New Proposal Identifier: RCEU21-CH-SJ-01

Previous Proposal Identifier: RCEU20-CH-SJ-03 (submitted for RCEU 2020 and approved)

Project Description

Non–small cell lung cancer (NSCLC) accounts for approximately 85% of all lung cancers and overall cure and survival rates for NSCLC remain low, particularly in metastatic disease. This project proposal is on the development of a chemotherapeutic targeted drug delivery system targeting non-small lung cancer (NSLC) cells. The nanocarrier is a porous silica nanocarrier wrapped in a lipid bilayer. The lipid layer (liposome) is conjugated with an antibody that targets NSLC cells. Silica based nanocarrier will be loaded with a chemotherapeutic agent doxorubicin (Dox).

Student Duties, Contributions and Outcomes

Student Duties: ***a)*** Mesoporous nanoparticle (MSN) synthesis and characterization. (1-2 weeks); ***b).*** Dox loading in MSNs, followed by characterization and quantification of Dox. (1-2 weeks); ***c).*** Liposome encapsulation of dox loaded MSNs followed by characterization. (1-2); ***d)*** Quantification of the chemotherapeutic efficacy of the encapsulated Dox. (1-2 weeks). ***e)*** Fluorescence microscopy to track nanocarrier internalization and localization in NSCL cells.

Tangible Contributions - A successful project would be strongly considered for Material Research presentation done by the tri-campus research program held in January the following year. A positive outcome in the project (e.g. Successfully treatment of delivery of Dox to NSLC), will lead to the student been awarded co-authorship in high-impact factor journal publication.

Specific Outcomes – skill based ***a)*** Synthesis and characterization of MSNs – room temperature template method synthesis using surfactants; characterization via dynamic light scattering (DLS), UV-visible (UV-vis) spectroscopy, porosity measurements ***b)*** quantification of drug loading – thermogravimetric analysis (TGA) ***c)*** liposome encapsulation and antibody conjugation – extrusion method, bioconjugation techniques. **Knowledge based** ***a)*** nanomaterial synthesis and characterization methods ***b)*** bioconjugation techniques

Student Selection Criteria – Students who have taken Organic I (CH331) ***or*** whom that major/minor in Chemistry or Chemical Engineering will be favorably considered. This project is open to students from any academic rank.

Faculty Mentorship – Student will be under the guidance and the overall supervisions of the PI. A graduate student (Ph.D. candidate) will be assigned as an immediate mentor (graduate mentor) and the student will always work along side with their graduate mentor. The graduate mentor will do the initial training MSN preparation and characterization, where the mentee will first observe/shadow and learn the techniques (1-2 weeks), once the training is completed student will work while been observed by the mentor. The student will train under the supervision of the PI and graduate mentor to synthesis of MSN to several hundred nanometers of liposomes. The PI will evaluate the progress of learning, will guide on the critical thinking necessary to formulate these

nanoparticles e.g.: how characterization process dictate the success in the particle synthesis, how different reagents dictate particle size. With the guidance of the PI the student will learn how to modify experiments (e.g.: how to change the concentration of reagents to achieve difference particle size). The training in the synthesis of complex nanoassembly is invaluable for students going in for graduate programs or industry careers in areas of biotechnology, biomedical engineering, chemical engineering and materials chemistry. Individual meeting would be held once/twice a week where the student will present his/her progress or problems of the project. Group meetings will be held twice a week where they will present their work to the entire group.