Continuation/Research Progression Projects Form (7)

Required for projects that are a continuation/progression in the same field of study as a previous project.
This form must be accompanied by the previous year's abstract and Research Plan/Project Summary.

Student's Name(s) Katherine Zhang

To be completed by Student Researcher: List all components of the current project that make it new and different from previous research. The information must be on the form; use an additional form for previous year and earlier projects.

Components	Current Research Project	Previous Research Project: Year: 2018-19
1. Title	Dialdehyde Cellulose Nanocrystal Hydrogel Synthesis for Antibiotic Remediation	Superabsorbent Polymer Mediated Leachate Control
2. Change in goal/ purpose/objective	To synthesize a dialdehyde cellulose nanocrystal (DCNC)-sodium alginate (SA) hydrogel to effectively remediate Doxycycline Hydrochloride (Doxy): I. Prepare periodate oxidation of cellulose nanocrystals (CNC) into DCNC; II. Synthesize DCNC-SA hydrogel with optimal DCNC:SA ratio;III. Elucidate adsorption mechanisms and performance of DCNC-SA; IV. Explore DCNC-SA hydrogel reusability properties	To determine the efficacy of superabsorbent polymers (SAPs) for leachate control: I. Elucidate the most efficient method to measure SAP absorption freeload; II. Determine maximum freeload absorption capacities of each SAP; III. Analyze the effect of chemical composition on SAP absorption; IV. Determine the effect of pressure & morphology on absorption; V. Determine the desorption properties of SAPs & effect of particle size on desorption.
3. Changes in methodology	Prepared DCNC; synthesized DCNC-SA. Fourier Transform Infrared (FTIR) Spectroscopy, X-Ray Diffraction (XRD) analysis,Scanning Electron Microscopy (SEM) and zeta potential used to characterize DCNC-SA DCNC-SA adsorption efficacy of Doxy measured using UV-vis spectrophotometer. Effect of pH and dosage on Doxy adsorption measured using UV-vis spectrophometer. Reusability properties of DCNC-SA through 2 adsorption-desorption cycles in Doxy.	Leachate was filtered using a vacuum pump. SAP absorption measured as swelling ratio. Elucidated most efficient method to measure absorption: tea-bag method, pyramidal tea-bag method, sieve method, and vacuum method. FTIR and SEM was used to characterize the SAPs. An absorption underload (AUL) apparatus was engineered to apply different pressures to SAP samples. Desorption, SAPs' inability to retain leachate, measured using a sieve.
4. Variable studied	Elucidated synthesis of DCNC-SA for the adsorption properties of Doxy. DCNC was successfully prepared via periodate oxidation of CNC. DCNC: SA ratio for optimal Doxy adsorption was found. Effect of Doxy concentrations and adsorption kinetics of DCNC-SA was measured at different time intervals. The effect of pH from 3 to 11 on DCNC-SA adsorption was measured.The effect of DCNC-SA dosage on Doy adsorption was measured. Reusability of DCNC-SA for Doxy remediation was studied.	Elucidated the efficacy of commercial superabsorbent polymers: sodium polyacrylate (SP), AquaKeep, A200, S400, potassium polyacrylate for leachate absorption. Analysis of the 5 SAPs swelling kinetics was explored using freeload swelling capacities via the vacuum method. Additional SAP analyses included absorption underload at 0.3 and 0.6 psi, which confirmed SAP applications underload for leachate remediation. SP exhibited the highest AUL.
5. Additional changes	Study showed successful synthesis of DCNC-SA and addressed previous limitation in literature of unrecoverable adsorbents used for antibiotic remediation. Application of in-lab synthesized hydrogel: adsorb and remediate Doxy from water. Design of DCNC-SA incorporated into wastewater systems was created for future investigation of DCNC-SA efficacy in targeting antibiotics in municipal wastewater.	Study showed SAPs as a cheap material that can be used to prevent leachate leaks. Application of commercial superabsorbent polymers: absorb and mitigate leachate leaks at waste facilities. Design of a SP SAP pit at current global waste transfer stations was created to capture excess leachate and prevent leakage into water systems.

Attached are:
✓ Abstract and Research Plan/Project Summary, Year 2018-19

I hereby certify that the above information is correct and that the current year Abstract & Certification and project display board properly reflect work done only in the current year.

Katherine Zhang
Student's Printed Name(s)

Katherine Zhang
Signature

Digitally signed by Katherine Zhang
Date: 09-01-2019 11:22 AM

09/01/19
Date of Signature (mm/dd/yy)