Regulated Research Institutional/Industrial Setting Form (1C)

This form must be completed AFTER experimentation by the adult supervising the student research conducted in a regulated research institution, industrial setting or any work site other than home, school or field.

Student's Name(s) Isha Brahmbhatt

Title of Project Removal of Rare Earth Metal Ions from Contaminated Water by Sustainable Carboxycellulose Nanofibers Derived from Agave through Nitro Oxidation Proce

To be completed by the Supervising Adult in the Setting (NOT the Student(s)) after experimentation:

(Responses must be on the form as it is required to be displayed at student's project booth; please do not print double-sidec

The student(s) conducted research at my work site:

1. Did you or your proxy (e.g. graduate student, postdoc, employee) mentor or provide substantial guidance to the student researcher? ☑ Yes ☐ No
   a. If no, describe your and/or your institution's role with the student researcher and his/her project (e.g. supervised use of equipment on site without ongoing mentorship and sign below.

   b. If yes, complete questions 2–5.

2. Is the student's research project a subset of your ongoing research or work? ☐ Yes ☑ No
   Use questions 3, 4 and 5 to detail how the student's project was similar and/or different from ongoing research or work at your site.

3. Describe the independence and creativity with which the student:
   a. developed the hypotheses or engineering goals for the research project

   Isha contributed the idea of using agave biomass, as it is an underutilized plant species that is found in abundance along rural area. Additionally, she initiated the process of designing an experiment to evaluate if lanthanide ions can be recovered from the flocculation of ions and carboxycellulose nanofibers. She proposed examining the agave carboxycellulose nanofibers with a mechanical and rheological study. Isha also provided valuable insight in her discussions with me regarding the practical implementation of such a water purification system, which led to our decision to study the removal of rare earth metal ions such as lanthanide ions.

   b. designed the methodology for his/her research project

   Isha made the decision to work with agave biomass by considering the viability of applications. The invasive growth of agave plants makes it an accessible material, and accessibility was her key goal with this project. She also determined the list of characterization tests that constructed our experimental design. Through discussion about past literature, Isha and I determined the procedure for the removal and recovery of the lanthanide ions, including concentrations for lanthanide ions. While completing the oxidation of the agave biomass, she referenced the existing protocol for the nitro oxidation process, calculated new concentrations and amounts for sodium nitrite and nitric acid for the use of this process on agave biomass, and adapted the original times for dialysis and homogenization of agave carboxycellulose nanofibers, which I reviewed prior to starting experimentation.

   c. analyzed and interpreted data

   Isha performed all data analysis independently using Excel for calculations and Origin software to create graphs or tables. She actively drew upon her past research projects or online resources to learn the required graphical and mathematical analysis skills. In addition, Isha referenced past literature to compare the peaks values from characterization data, and construct the appropriate isotherm models through regression analysis. After performing all data analysis, Isha referenced past literature that characterized raw agave and compared it with our data to confirm that the agave biomass we tested had been fully converted to carboxycellulose nanofibers. She then used comparisons on the peaks data to draw conclusions about the properties of agave carboxycellulose nanofibers. Isha created a table for Qmax and adsorption values calculated from the isotherm model to compare the removal of lanthanide ions from solution by agave carboxycellulose nanofibers with existing materials' removal values to draw conclusions about the effectiveness of agave carboxycellulose nanofibers in terms of the original research question.

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Regulated Research Institutional/Industrial Setting Form (1C) Continued

Student's Name(s) Isha Brahmbhatt

4. Detail the student's role in conducting the research (e.g. data collection, specific procedures performed). Differentiate what the student observed and what the student actually did.

Isha performed the procedures for FTIR, Contact Angle, UV Vis, rheological analysis, and the nitro oxidation process. She also recorded all the data and specifications of experimentation tools, including which software and machine mode was used to collect the data in the corresponding machine. She subsequently converted the data to forms that she could work with for further analysis. Isha observed the procedures for TEM, AFM, SEM/EDX, and 13C CPMAS NMR. She was present for the data collection period and sat with the instrument operator. From the data collected, she pinpointed certain groups of data that I needed for further analysis and transferred the data from the machine software to more compatible forms. ICPMS was performed by another faculty member in a university facility. Isha used the raw ICPMS data to perform Langmuir and Freundlich isotherm modeling after reading about various linear and kinetics isotherm models. She referenced previous studies on lanthanide removal mechanisms to find and compare Qmax and adsorption efficiency values from her study with those of other materials in a tabular method. She calculated the efficiency of recovering lanthanide ions from the flocculation formed by lanthanide ions and agave CNF and discussed it with lab members to indicate a future direction of study. She performed all calculations in Excel and created all graphs using Origin software.

5. Did the student(s) work on the project as part of a group? ☐ Yes ☑ No
If yes, how many individuals were in the group and who were they (e.g. high school students, graduate students, faculty, professional researchers)?

I attest that the student has conducted the work as indicated above and that any required review and approval by institutional regulatory board (IRB/IACUC/IBC) has been obtained. Copies are attached if applicable.
I further acknowledge that the student will be presenting this work publicly in competition and I have communicated with the student research regarding any requirements for my review and/or restrictions of what is publicized.

Sunil Sharma	Sunil K. Sharma	Dr.
Supervising Adult's Printed Name	Signature	Title
Stony Brook University		8/15/19
Institution		Date Signed (must be after experimentation) (mm/dd/yy)
John S. Toll Road, Stony Brook, NY, 11794		sunil.k.sharma@stonybrook.edu
Address		Email/Phone