

QUARTERLY PROGRESS REPORT

December 1, 2017 to February 25, 2018

PROJECT TITLE: Removal of Heavy Metals from Landfill Leachate using Polyelectrolyte Complex Membranes

PRINCIPAL INVESTIGATOR(S):

Principal Investigator: *Dr. Anwar Sadmani*

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Co-Principal Investigator: *Dr. Lei Zhai*

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COMPLETION DATE: November 30, 2018

PROJECT WEB SITE: <http://www.cece.ucf.edu/sadmani/>

Work accomplished during this reporting period:

Task 1: Fabrication of nanofiber membranes via electrospinning

Nanofiber membranes were fabricated from polyelectrolyte complex solutions via electrospinning, aimed at removing heavy metals from landfill leachate. Homogeneous polyacrylic acid (PAA)/polyallylamine hydrochloride (PAH) complex solutions were produced by dissolving PAH into 25% PAA aqueous solutions at different molar ratios.

The impacts of voltage, pump flowrate, and distance between the needle and collecting pad (i.e., the working distance) on fabrication of the polyelectrolyte fibers were examined to determine the optimal PAA: PAH ratio and fiber size. A multi-needle syringe was procured to accelerate fiber fabrication process. Two sets of NMs, free standing NMs and NMs on polyethersulfone (PES) flat-sheet ultrafiltration (UF) membranes were produced during this period. A PES UF membrane with molecular weight cutoffs (MWCO) of 1 kDa and 10 kDa was used as a substrate to deposit NMs on.

We started evaluating the efficiency of the fibers to remove heavy metals using DI water spiked with copper (Cu). The concentration of Cu ion was measured before and after the addition of fabricated nanofibers into the solutions. Up to approximately 76% Cu ion removal from DI water was observed when using fibers with PAA:PAH ratio of 4:1; however, PAA/PAH ratios did not appear to impact Cu removal efficiency from the tested solutions.

Task 2: Characterization of fabricated NMs (ongoing)

The nanofiber membranes were examined under scanning electron microscopy (SEM) to investigate fiber size, integrity, and stability at different PAA:PAH ratios.

TAG Meetings:

The first TAG meeting was held on January 30th, 2018 at UCF Department of Civil, Environmental, and Construction Engineering. The video of the presentation and the meeting can be found on the project website.

Date of meeting: January 30, 2018

Name/title/emails of participants:

TAG members:

Bob Mackey, Consulting Engineer, S2Li (email: bmackey@s2li.com)

James Flynt, Chief Engineer, Orange County (email: James.Flynt@ocfl.net)

John D Schert, Director, Hinkley Center for Solid and Hazardous Waste Management (email: jschert@ufl.edu)

Kevin Torrens, Vice President, Brown and Caldwell (email: KTorrens@Brwncauld.com)

Sam Levin, Consulting Engineer, S2Li (email: Slevin@S2Li.com)

Wester Henderson, Research Coordinator, Hinkley Center for Solid and Hazardous Waste Management, (email: wester.henderson@essie.ufl.edu)

UCF participants:

Anwar Sadmani, Assistant Professor (email: sadmani@ucf.edu)

Lei Zhai, Professor (email: lzhai@ucf.edu)

Amirsalar Esfahani, Graduate Student (email: aesfahani@Knights.ucf.edu)

Kunal Olimattel, Graduate Student (email: kunalolimattel@Knights.ucf.edu)

Hadi Toure, Graduate Student (email: htoure@Knights.ucf.edu)

Zeyan Zhang, Graduate Student (email: zeyangzhang@Knights.ucf.edu)

Johnci Tanelus, Ungraduated Student (email: Johnci@Knights.ucf.edu)

Angel Villarruel-Moore, Undergraduate Student (email: angelvillarruel1256@Knights.ucf.edu)

James Moulton, Undergraduate Student (email: jamesmoulton@Knights.ucf.edu)

Members who were unable to attend:

Hala Sfeir

Johnny Edwards

Ramana Kari

Sara Arabi

Simeon Komisar

Tim Madhanagopal

Link to the video recording of the meeting: <http://www.cece.ucf.edu/sadmani/>

Metrics:

1. List research publications resulting from THIS Hinkley Center project.
None.
2. List research presentations resulting from (or about) THIS Hinkley Center project.
None.
3. List who has referenced or cited your publications from this project.
None.
4. How have the research results from THIS Hinkley Center project been leveraged to secure additional research funding? What additional sources of funding are you seeking or have you sought?

We are seeking additional funding from the Hinkley Center for an additional year based on the existing project's accomplishment and proposing the investigation of additional landfill leachate contaminants. We are also planning to seek funding from the Water Environment and Reuse Foundation and Environmental Research and Education Foundation.

5. What new collaborations were initiated based on THIS Hinkley Center project?
No change.

6. How have the results from THIS Hinkley Center funded project been used (not will be used) by the FDEP or other stakeholders?
None to date.

Pictures:

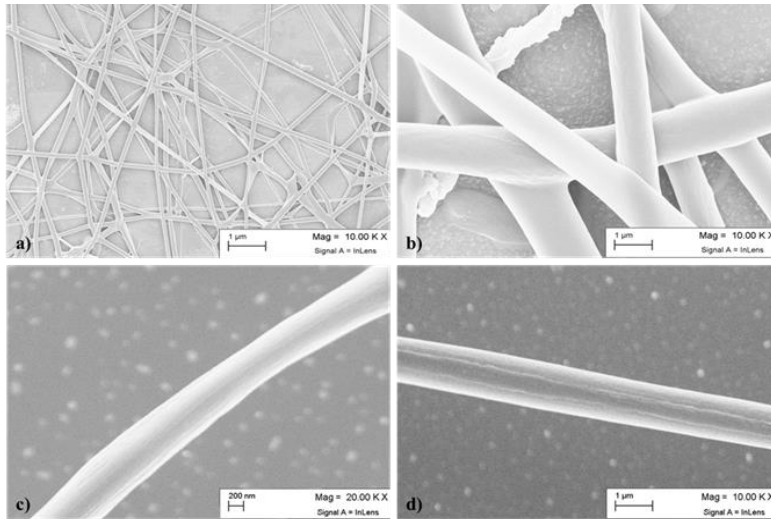
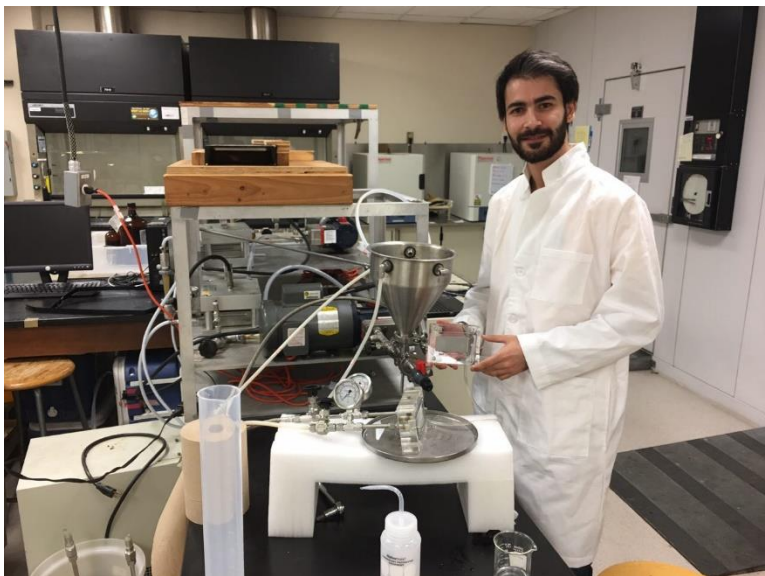


Figure 1. SEM images of a) electrospun nanofiber membranes from PAA and PAH laminated on the UF membrane; b) generated fiber with PAA/PAH ratio of 2:1; c) generated fiber with PAA/PAH ratio of 4:1; d) generated fiber with PAA/PAH ratio of 8:1.



Amirsalar Esfahani working in lab.