UNF

Coastal and Marine Biology Flagship Program

Coastal and Marine Biology Flagship Program

- Established as the Coastal Biology Flagship Program in 2006
- Coastal Biology Director
- Increased infrastructure for coastal research
- Establishment of new student support programs (travel grant, summer research)
- NSF-funded UNF REU Program since 2013
- CUREs (Shark Ecology, Dolphin Behavior, Coastal Field Research)
- Member of Florida Institute of Oceanography, Southern Association of Marine Laboratories


❑ Phytoplankton Ecology

❑ Wetlands Ecology

❑ Restoration Ecology

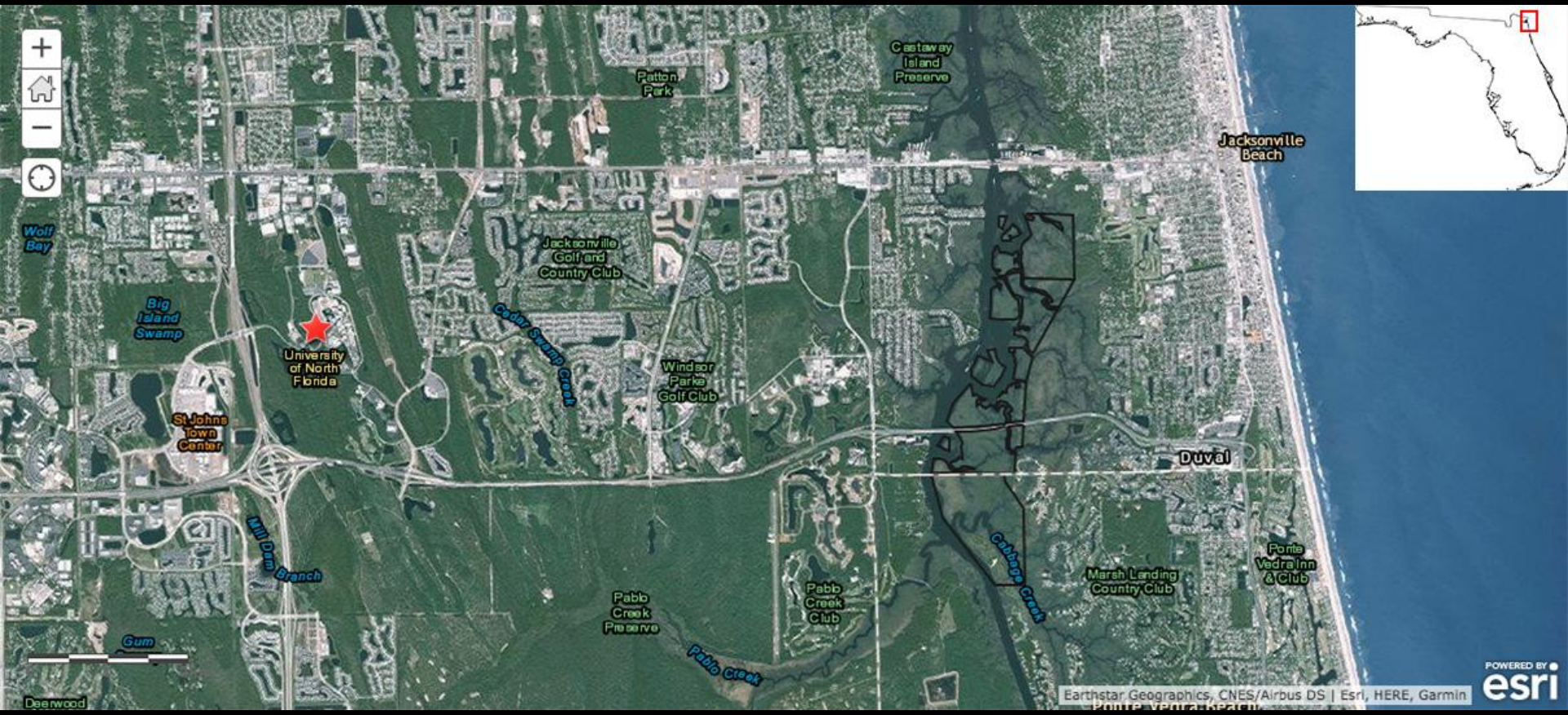
❑ Fisheries Ecology

❑ Dolphin Behavior

- Shark Ecology

❑GTM NERR

❑ Webb Research Station



Coastal One Health and Zoonoses.

Welcome to the COHZ lab

Our group is dedicated to understanding the ecology and epidemiology of zoonotic diseases and to the well-being of our coastal communities. We utilize a One Health approach to solving complex challenges to human, animal, and environmental health, particularly surrounding the intersections of water, sanitation, hygiene, and disease transmission.

UNF UNIVERSITY of NORTH FLORIDA

SOARING HIGHER TOGETHER

STRATEGIC PLAN 2023-2028

Institutional Aspirations

- The University of North Florida will become a Top 100 Public University as ranked in *US News & World Report* by 2028.

- The University of North Florida will strategically grow to an enrollment of 25,000 students by 2028.

Strategic Priorities

- ❑ Student Success

Ensure Student Success from Enrollment to Employment and Beyond

- ❑ Research & Innovation

Inspire Relevant Research and Impactful Innovation

- ❑ Community Partnerships

Expand Mutually Beneficial Partnerships with the Community

- ❑ Faculty & Staff Success

Accelerate the Success of Faculty and Staff

Areas of Focus

- Advanced Manufacturing
- Coastal Resilience
- Data Science, Cybersecurity, and Information Technologies
- Health Care and Health Sciences
- Transportation and Logistics

Water Research, Education and Outreach at Florida Poly

FLORIDA POLY

FIPR INSTITUTE
FLORIDA POLYTECHNIC UNIVERSITY

OverFLoW Seminar Series

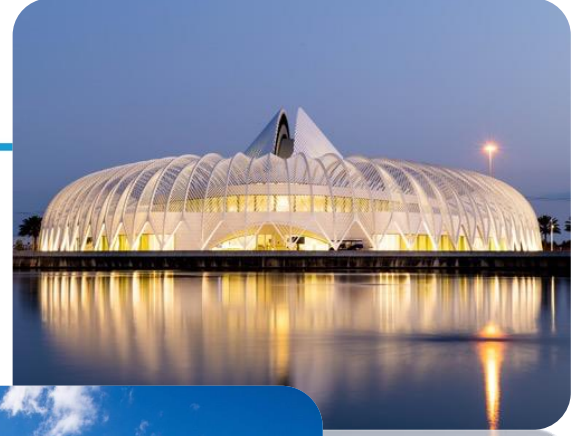
March 25, 2025

Content

1. Introduction and water quality research, Dr. Jun Kim
2. Biochar research, Drs. Yudi Wu and Xiaofan Xu
3. Machine learning-assisted spillway research, Dr. Sanjeeta Ghimire
4. Microplastics & sensor research, Dr. Ajeet Kaushik

Water Research Facilities

- Florida Industrial & Phosphate Research (FIPR)
  - ICP-OES (PerkinElmer Optima 8300)
  - ICP-MS (PerkinElmer NexION 350X)
- Barnett Applied Research Center (BARC)
  - HACH HQ 3900 (TOC, TN, TP, THMs, DBPs)
  - Column test apparatus, adsorption isotherm
  - HP Electrochemical Analyzer
  - Ion Chromatograph (Metrohm)
  - Thermogravimetric Analyzer (TGA)
- Gary C. Wendt Engineering (GWE)
  - GC-MS (planned)
- Innovation, Science, and Technology (IST)
  - SEM/EDS, XRD, XPS (under maintenance)



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Advanced Water Treatment Processes

Jun Kim, Ph.D.

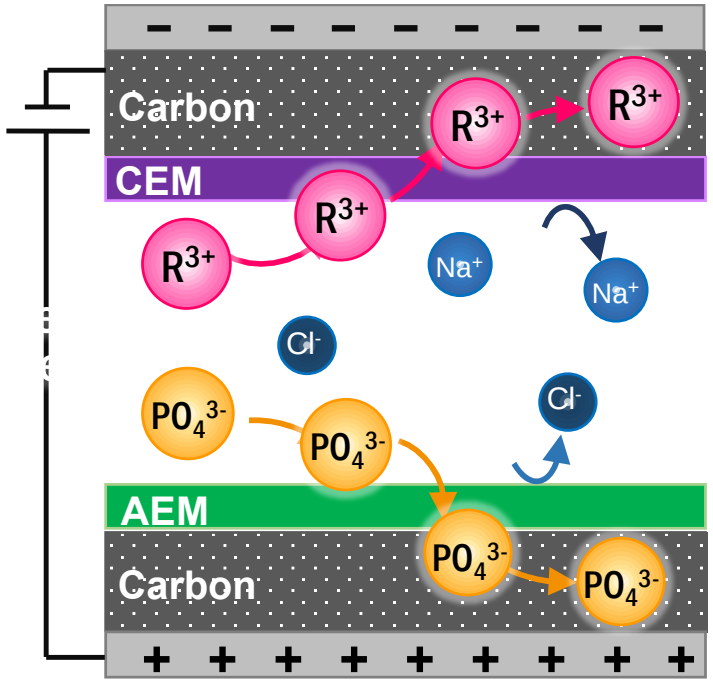
WATER Lab

Environmental Engineering Department

Email: junkim@floridapoly.edu

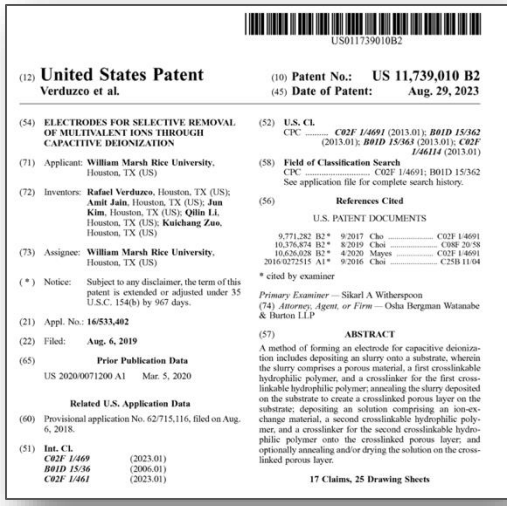
Industry Process Water Treatment

NY Times, 2021, Phosphogypsum Stack Pond



REEs, HMs selective
cation exchange

Oxyanion, P selective
anion exchange



US011739010B2

(12) **United States Patent**
Verduzco et al.

(10) Patent No.: US 11,739,010 B2
(45) Date of Patent: Aug. 29, 2023

(54) **ELECTRODES FOR SELECTIVE REMOVAL OF MULTIVALENT IONS THROUGH CAPACITIVE DEIONIZATION**

(71) Applicant: **William Marsh Rice University**, Houston, TX (US)

(72) Inventors: **Rafael Verduzco**, Houston, TX (US); **Amit Jain**, Houston, TX (US); **Jun Kim**, Houston, TX (US); **Qilin Li**, Houston, TX (US); **Kuichang Zuo**, Houston, TX (US)

(73) Assignee: **William Marsh Rice University**, Houston, TX (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 967 days.

(21) Appl. No.: **16/533,402**

(22) Filed: **Aug. 6, 2019**

(65) **Prior Publication Data**

US 2020/0071200 A1 Mar. 5, 2020

Related U.S. Application Data

(60) Provisional application No. 62/715,116, filed on Aug. 6, 2018.

(51) **Int. Cl.**
C02F 1/469 (2023.01)
B01D 15/36 (2006.01)
C02F 1/461 (2023.01)

(52) **U.S. Cl.**
CPC ***C02F 1/4691*** (2013.01); ***B01D 15/362*** (2013.01); ***B01D 15/363*** (2013.01); ***C02F 1/46114*** (2013.01)

(58) **Field of Classification Search**
CPC C02F 1/4691; B01D 15/362
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

9,771,282 B2 * 9/2017 Cho C02F 1/4691
10,376,874 B2 * 8/2019 Choi C08F 20/58
10,626,028 B2 * 4/2020 Mayes C02F 1/4691
2016/0272515 A1 * 9/2016 Choi C25B 11/04

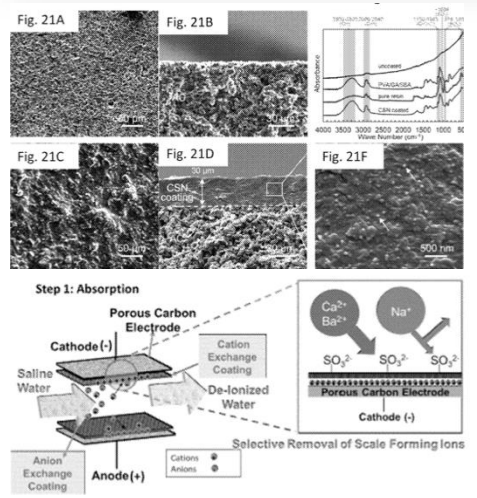
* cited by examiner

Primary Examiner — Sikarl A Witherspoon
(74) *Attorney, Agent, or Firm* — Osha Bergman Watanabe & Burton LLP

(57) **ABSTRACT**

A method of forming an electrode for capacitive deionization includes depositing an slurry onto a substrate, wherein the slurry comprises a porous material, a first crosslinkable hydrophilic polymer, and a crosslinker for the first crosslinkable hydrophilic polymer; annealing the slurry deposited on the substrate to create a crosslinked porous layer on the substrate; depositing an solution comprising an ion-exchange material, a second crosslinkable hydrophilic polymer, and a crosslinker for the second crosslinkable hydrophilic polymer onto the crosslinked porous layer; and optionally annealing and/or drying the solution on the crosslinked porous layer.

17 Claims, 25 Drawing Sheets



Kim et al., US Patent 16/533,402 (2023)
Zuo et al., Environ. Sci. Technol. (2020)
Kim, Rice University (2019)
Kim et al., Water Research (2019)
Jain et al., MSDE (2019)
Zuo et al., Environ. Sci. Technol. (2018)
Jain et al., Environ. Sci. Technol. (2018)

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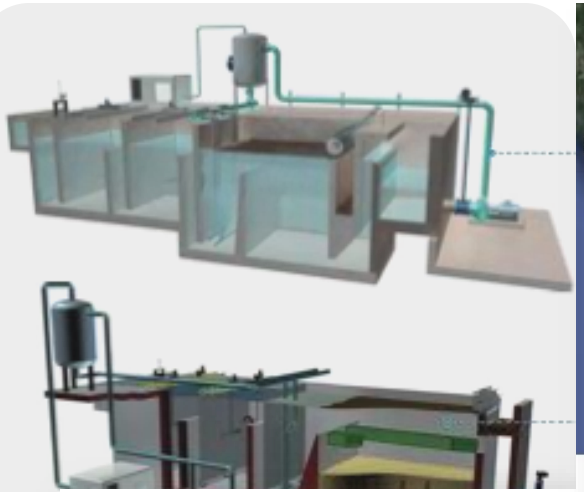
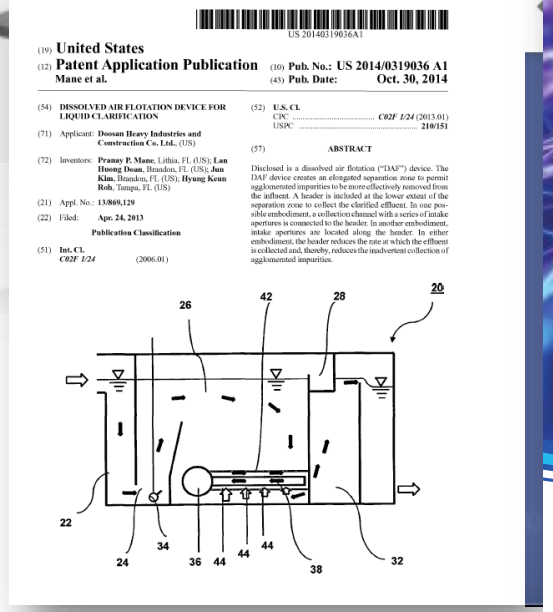
Inland Desalination (Palm Coast, FL)





US 20140319036A1

(19) United States
(12) Patent Application Publication
Mane et al.

(10) Pub. No.: US 2014/0319036 A1
(43) Pub. Date: Oct. 30, 2014

(54) DISSOLVED AIR FLOTATION DEVICE FOR LIQUID CLARIFICATION

(71) Applicant: Doosan Heavy Industries and Construction Co, Ltd., (US)

(72) Inventors: Pranay P. Mane, Lithia, FL (US); Lan Huong Doan, Brandon, FL (US); Jun Kim, Brandon, FL (US); Hyung Keun Roh, Tampa, FL (US)

(21) Appl. No.: 13/869,129

(22) Filed: Apr. 24, 2013

Publication Classification

(51) Int. Cl.
C02F 1/24 (2006.01)

(52) U.S. Cl.
CPC C02F 1/24 (2013.01)
USPC 210/151

(57) ABSTRACT

Disclosed is a dissolved air flotation ("DAF") device. The DAF device creates an elongated separation zone to permit agglomerated impurities to be more effectively removed from the influent. A header is included at the lower extent of the separation zone to collect the clarified effluent. In one possible embodiment, a collection channel with a series of intake apertures is connected to the header. In another embodiment, intake apertures are located along the header. In either embodiment, the header reduces the rate at which the effluent is collected and, thereby, reduces the inadvertent collection of agglomerated impurities.

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Manual of Water Supply Practices

M69

Inland Desalination and Concentrate Management

American Water Works Association

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The Palm Beach Post

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WEST PALM BEACH

City of West Palm Beach wins approval for new way to provide drinking water to 130,000 people

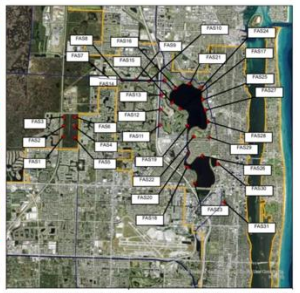
Using the stable but saltier groundwater from the aquifer means building an expensive reverse osmosis plant and 31 wells that can cost up to $5 million each.

Kimberly Miller
Palm Beach Post

Published 5:05 a.m. ET Aug. 2, 2024

Photos: West Palm Beach's water supply is vulnerable to contaminants that are tested daily

Clear Lake is the main source of water for West Palm Beach, Palm Beach and South Palm Beach.



But Florida Polytechnic University Assistant Professor Jun Kim said groundwater is the source for about 92% of water users in Florida. A 2020 presentation to the state's Blue-Green Algae Task Force pegged it as high as 98%.

Water woes: City finds cyanobacterium is stubborn foe that can take days to find

"Many cities near the coastline can blend source waters including surface water," Kim said, noting that the Tampa Bay Water utility uses 55% groundwater, 40% surface water and 5% seawater.

He said there are pros and cons to both water sources. Harmful algae blooms and drought can plague surface water supplies. Groundwater is naturally filtered by soil that removes contaminants but can take a longer time to recharge.

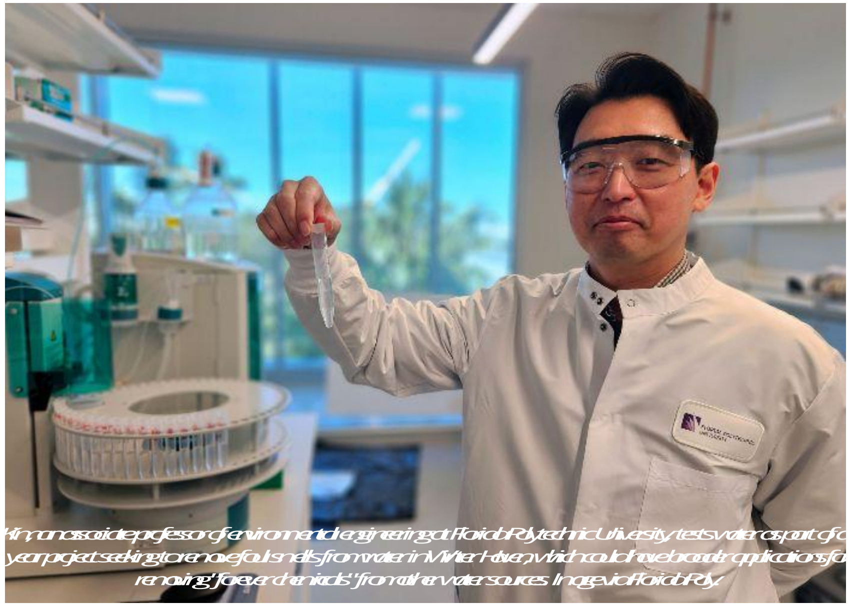
"Surface water needs to be properly monitored and managed due to potential risks," Kim said.

THE TAMPA BAY 100
Building the Tampa Bay community 100 words at a time

EDUCATION

That stinks, but Florida Poly researchers say water in Winter Haven doesn't have to

March 13, 2025



Jun Kim, an associate professor of environmental engineering at Florida Polytechnic University tests water as part of a year project seeking to remove foul smells from water in Winter Haven, which could have broader applications for removing 'forever chemicals' from other water sources. Image via Florida Poly.

As residents in Winter Haven face a smelly water problem, researchers at nearby Florida Polytechnic University are working to rid the community of its funk.

Jun Kim, an assistant professor of environmental engineering, is leading a two-year research project seeking to eliminate foul smelling water from the city's water supply, using advanced treatment processes.

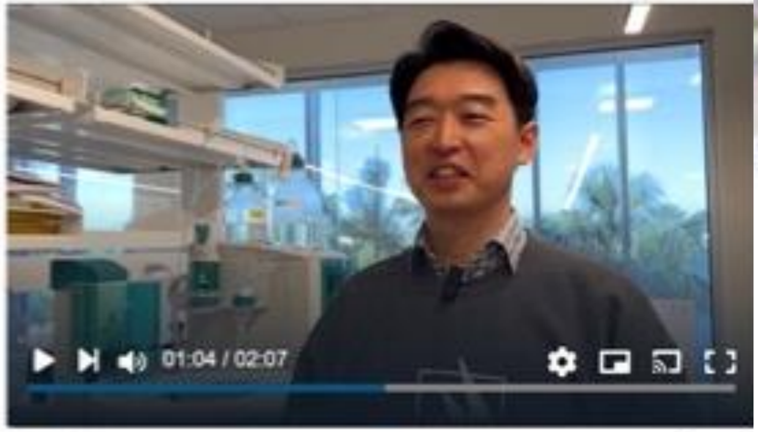
The project could lead to solutions for removing harmful "forever chemicals" from water in Winter Haven and beyond.

"We're working to identify how we can remove the hydrogen sulfide producing the rotten egg smell," Kim said, adding, no one wants to smell stinky water when showering.

- Janelle Irwin, Florida Politics

abc ACTION NEWS WFTS TAMPA BAY

Florida Poly researchers solving Winter Haven's smelly water issue



Researchers look to improve Winter Haven water quality

By: Rebecca Petit

Posted 1 hour and 13 minutes ago

WINTER HAVEN, Fla. — Winter Haven resident Jacqueline Johnson said the water that comes out of her faucets has a foul odor. "It's a stinky odor, more or less like

SPECTRUM NEWS BN 9

ENVIRONMENT

Florida Polytechnic University researchers tackle smelly water in Winter Haven

BY FALLON SILCOX | TAMPA
UPDATED 4:24 PM ET MAR. 19, 2025

LAKELAND, Fla. — Florida Polytechnic University is taking on a research project, working with the city of Winter Haven, to solve a smelly issue that has plagued Central Florida for decades: stinky tap water.

What You Need To Know

- Florida Polytechnic University is taking on a research project, working with the city of Winter Haven, to find a better water treatment process to remove a rotten egg smell from tap water
- Researchers say the water is safe, and meets all EPA regulations, but occasionally has a foul smell due to hydrogen sulfide
- Right now, samples are being collected from the city's water treatment plants weekly

"They are doing an analysis using the samples from the plant," said Dr. Jun Kim, who is the assistant professor of environmental engineering at Florida Polytechnic University. Kim is leading a research team of four undergraduate research assistants who are tasked with getting to the bottom of a stinky problem.

"What we heard so far is that during short periods of time at higher temperatures with higher moisture, it's basically aggravating the condition so that some of the limited area will still get a rotten egg smell from their tap water," he said.

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Resource Recovery from Solid Waste and Its Potential in Addressing Emerging Contaminants

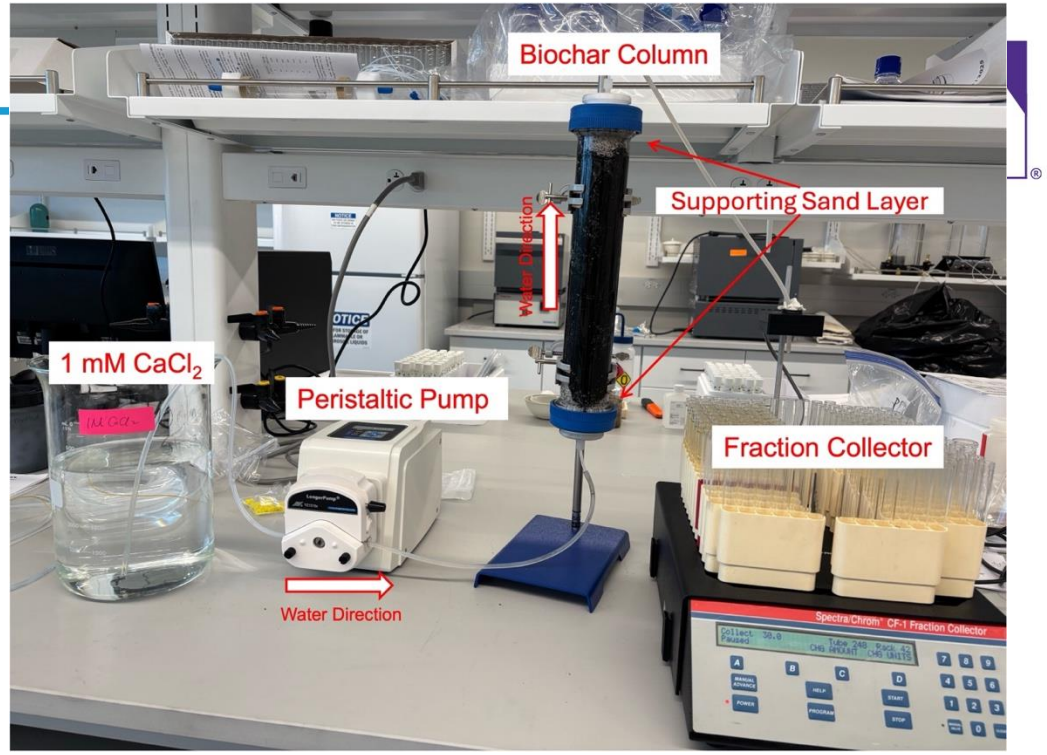
Yudi Wu, Ph.D.

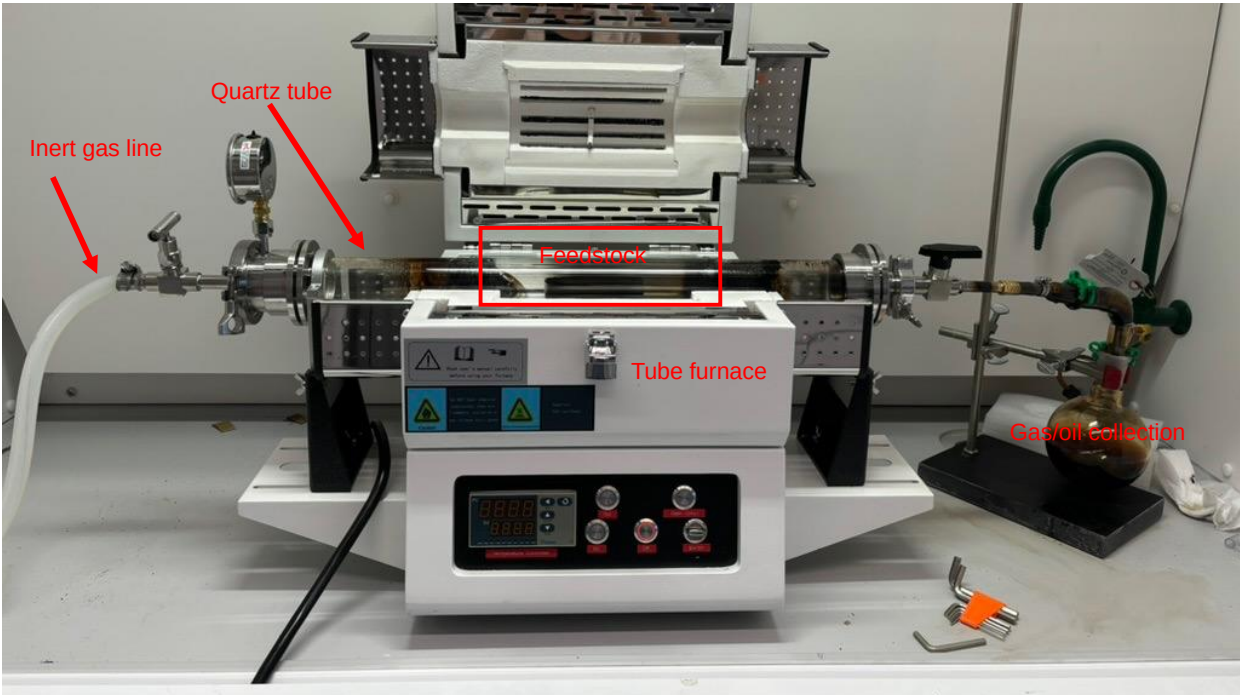
Zero-waste Engineering Lab

Environmental Engineering Department

Email: ywu@floridapoly.edu

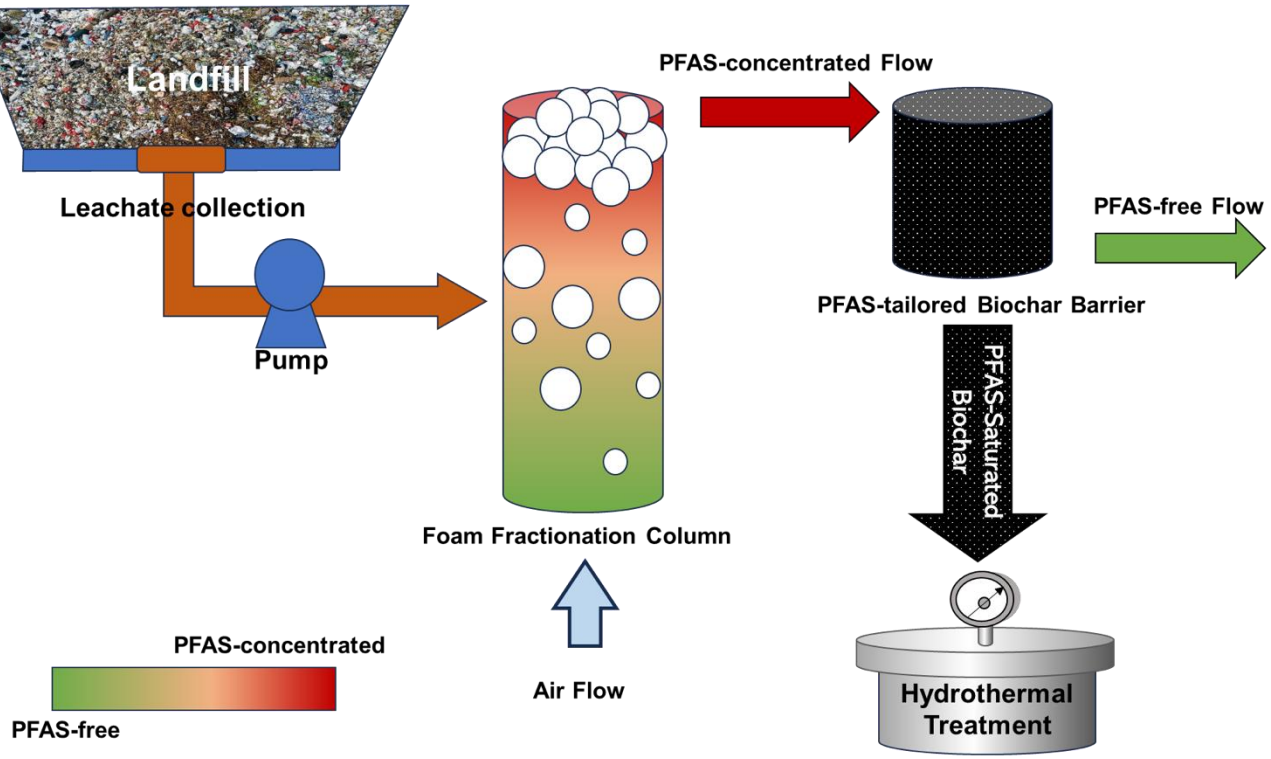
Using Biochar from Landfill to Landfill:





EPA Method 1413: Leaching Environmental Assessment Framework

Recycling biosolid to treat landfill leachate: opportunities and challenges



PFAS Type	Concentration (ng/g)	Method
Biosolid		
Perfluoropentanoic acid (PFPeA)	0.71	1633
Perfluorooctanoic acid (PFOA)	2.7	1633
Perfluorodecanoic acid (PFDA)	6.5	1633
Perfluorooctanesulfonic acid (PFOS)	15	1633
N-Methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	4.0	1633
3-Perfluoropentylpropanoic acid (5:3 FTCA)	95	1633
3-Perfluoroheptylpropanoic acid (7:3 FTCA)	42	1633
Extractable Organic Fluorine (EOF)	**ND**	**ELLE SOP**
Biosolid Compost		
Perfluorobutanoic acid (PFBA)	0.71	1633
Perfluorohexanoic acid (PFHxA)	5.7	1633
Perfluoroheptanoic acid (PFHpA)	0.35	1633
Perfluorononanoic acid (PFNA)	0.39	1633
Perfluorobutanesulfonic acid (PFBS)	0.54	1633
Extractable Organic Fluorine (EOF)	**480**	**ELLE SOP**

unpublished data

Sponsors

FIPR INSTITUTE, FLORIDA POLYTECHNIC UNIVERSITY

EREF Environmental Research & Education Foundation — Lighting the way towards a more circular economy

Hinkley Center for Solid and Hazardous Waste Management

Polk County

City of Winter Haven Water Department

Hazen all things water

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Application of Biochar in Water Quality Control

Xiaofan Xu, Ph.D.

Environmental Engineering Department

Email: xxu@floridapoly.edu

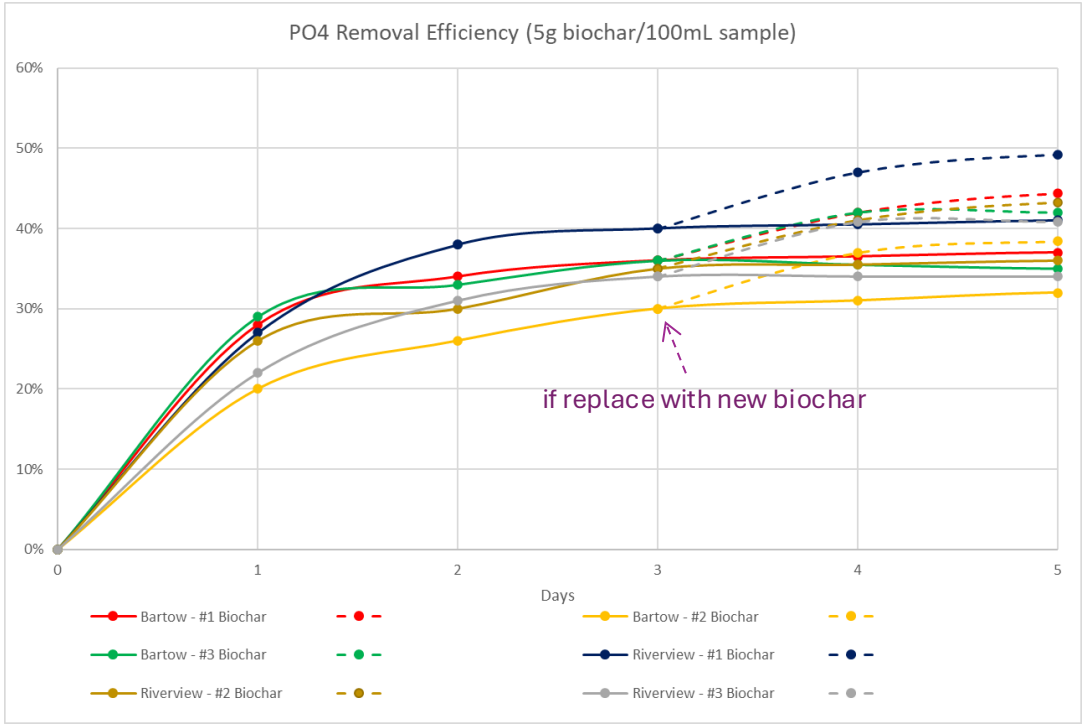
Application of Biochar in Process Water Treatment

- Fine pore structure & large specific surface area
- Good adsorbent in wastewater treatment
- Rich sources & low cost
- Possible environ-friendly disposal
- Commercialization possibility in downstream treatment

P removal efficiency of three biochar products for process water samples

- **Effective** but **not efficient:** avg 36% removal rate
- **2 days:** optimal mixing time
- **Environmental concerns:** contains fluoride & produces harmful gases
- **Low pH:** possible limiting factor

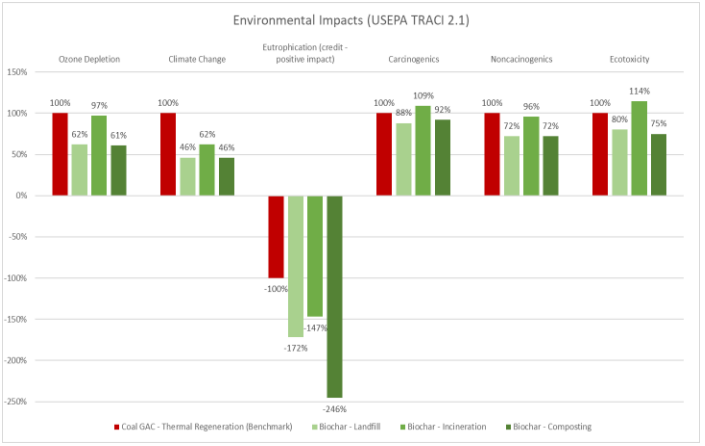
Possible solution: Algae-based biochar that can work under low pH



Environmental impacts of biochar with different EOL strategies

- **Most sustainable EOL – Composting:** the lowest global warming, human toxicity and eutrophication

Research need: Chemical hazard inspection of used biochar to ensure the safety of direct composting



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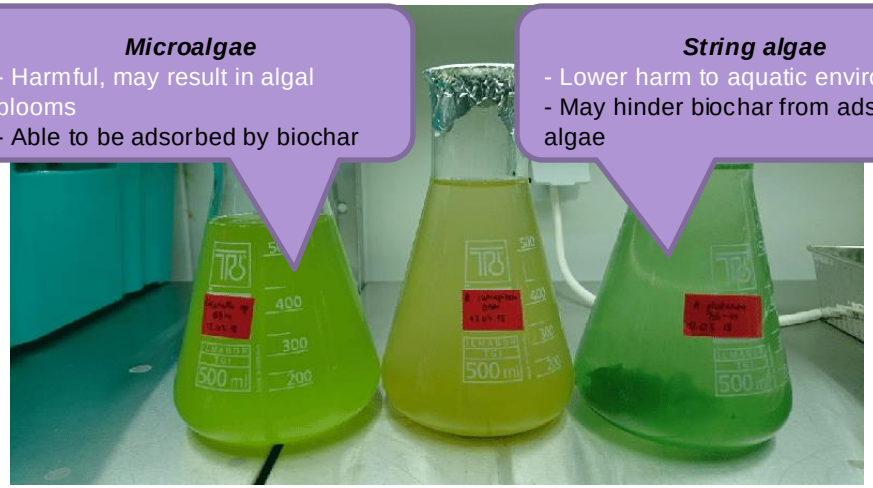
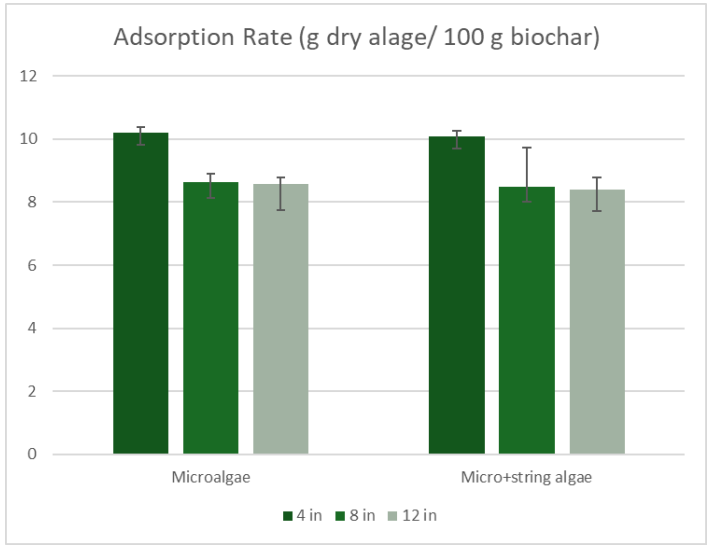
Application of Biochar in Algae Control and PFAS Removal

Microalgae
- Harmful, may result in algal blooms
- Able to be adsorbed by biochar

String algae
- Lower harm to aquatic environment
- May hinder biochar from adsorbing algae



Sampling site:
Se7en Wetlands in Lakeland

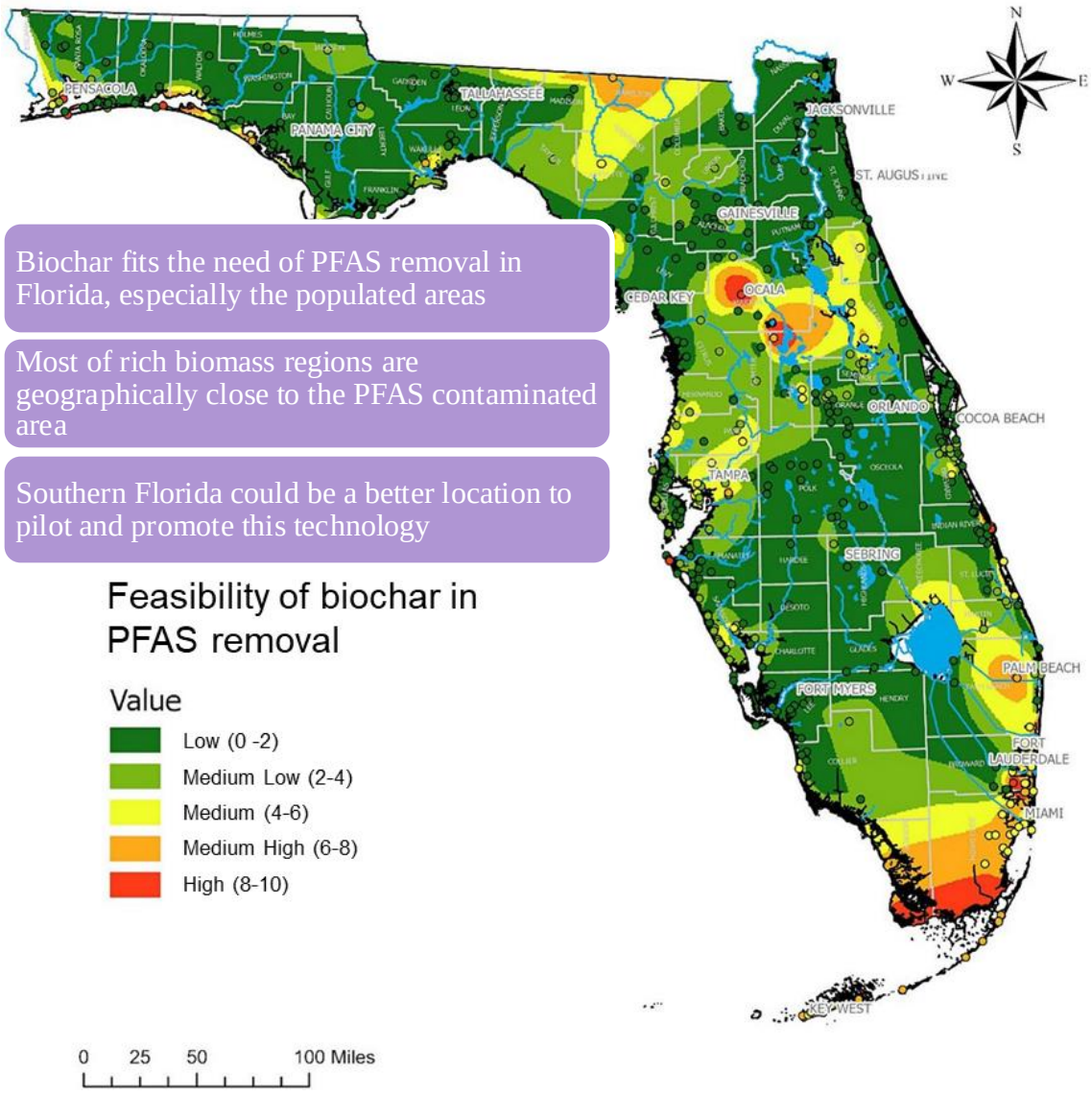


The adsorption rate of algae by biochar in different size of cubes in 24 hours

Biochar fits the need of PFAS removal in Florida, especially the populated areas

Most of rich biomass regions are geographically close to the PFAS contaminated area

Southern Florida could be a better location to pilot and promote this technology



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Extreme Events and Dam Safety: Machine Learning Approach to Predicting Spillway Erosion

Sanjeeta N. Ghimire, Ph.D., M.ASCE

Civil Engineering Department

Email: sghimire@floridapoly.edu

Introduction and Motivation

Embankment Dams and Spillways

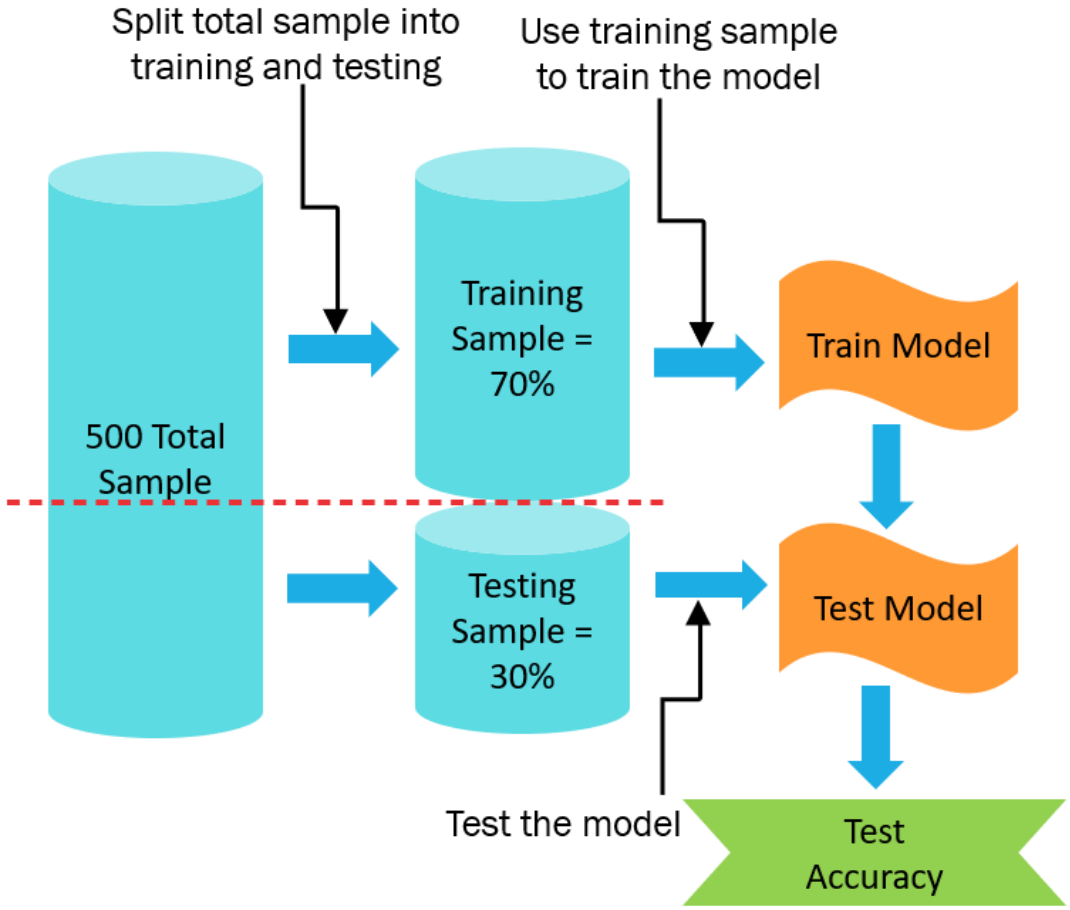
Erosion of Oroville Dam's main and auxiliary spillways in February 2017 led to the evacuation of 200,000 people downstream and almost $1.1 billion property damage for emergency response and reconstruction.

Edenville and Sanford Dams in Michigan experienced cascading failure in May 2020 prompting 10,000 people to evacuate with significant property damage.

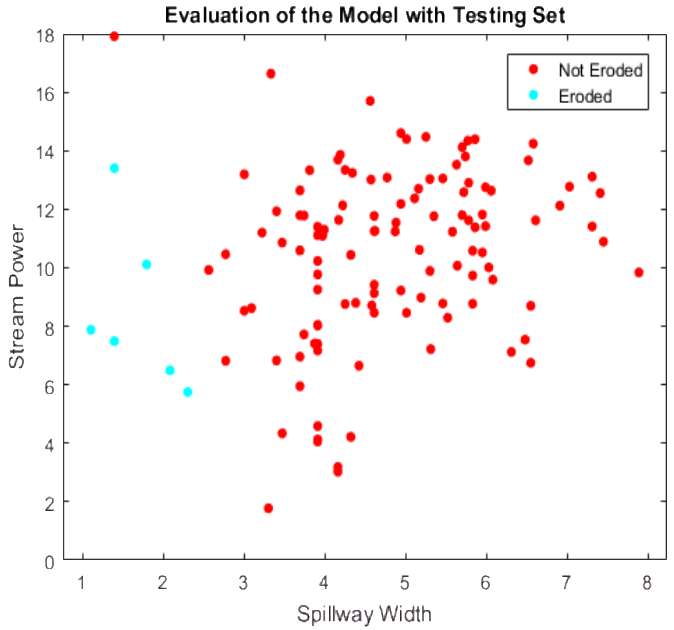
Climate Change Impact: Extreme floods increase the risk of dam failures.
Key Problem: Traditional erosion prediction is costly, slow, and sometimes inaccurate.
Solution: Can machine learning provide a faster and more reliable prediction alternative?

Methodology and Findings

Machine Learning for Erosion Prediction

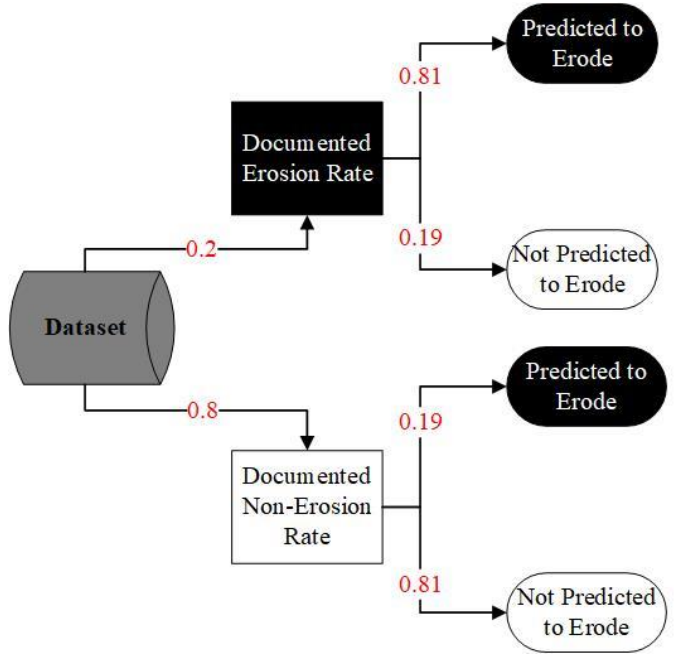


Logistic Regression Model



Testing sample as 80.66% accuracy

Bayesian Probability Results



- The results showed 81% accuracy in the tested sample, indicating that 81% of the dams have a chance of erosion, while Bayesian inference suggested a 52% probability that those dams will indeed erode.
- ASDSO, USDA, USACE, USBR, etc. can apply this technique to prepare for emergency situations.

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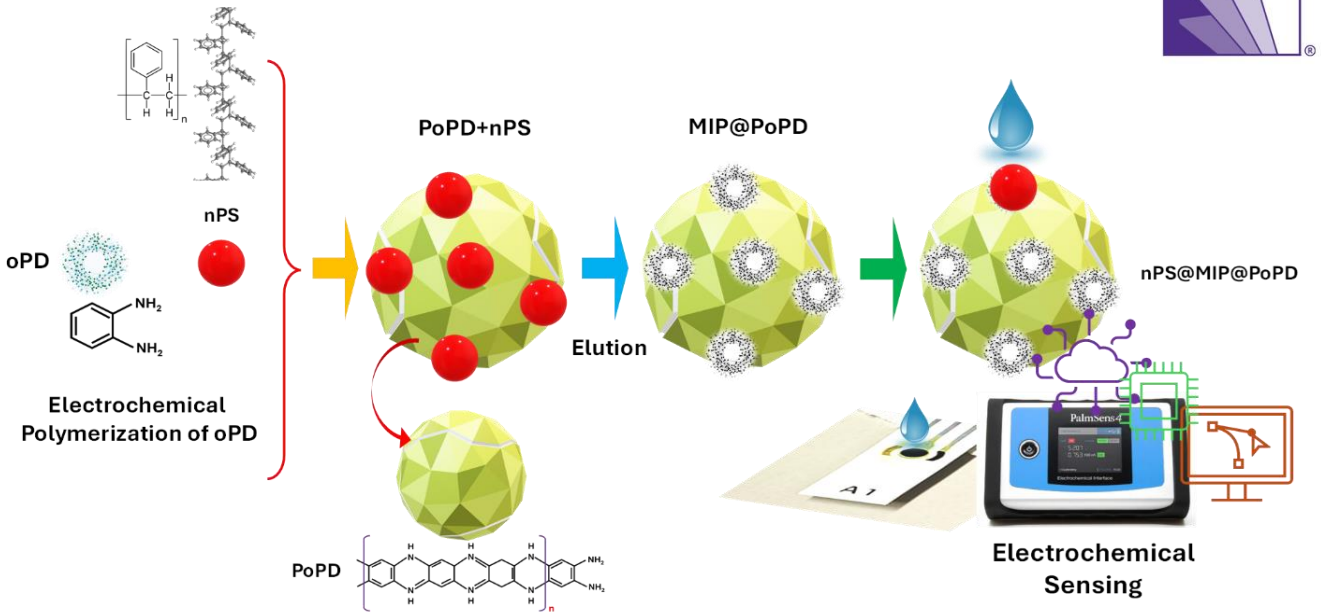
Electrochemical Sensing of Microplastic in point-of-care settings

Ajeet Kaushik, Ph.D.

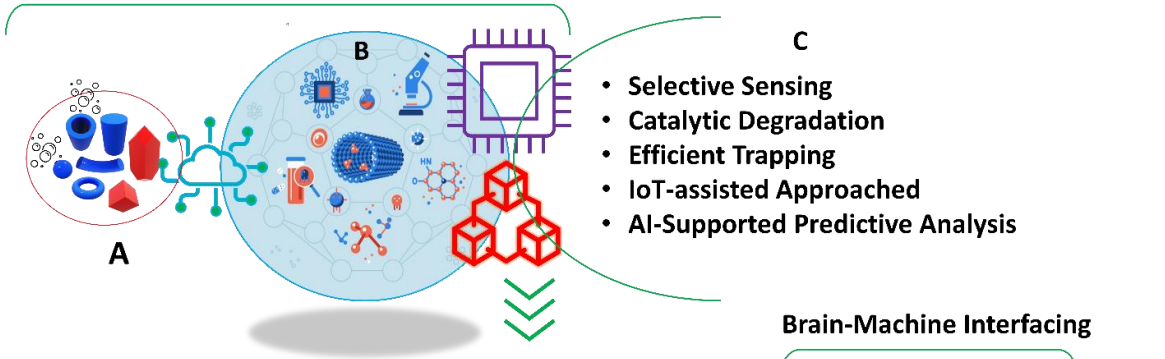
NanoBioTech Laboratory

Environmental Engineering Department

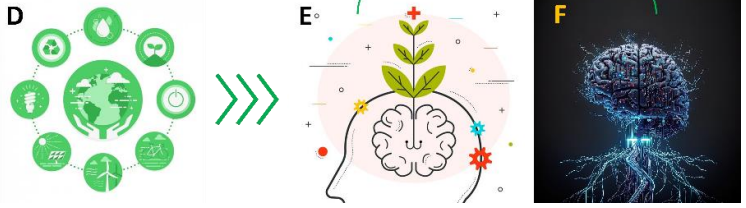
Email: akaushik@floridapoy.edu

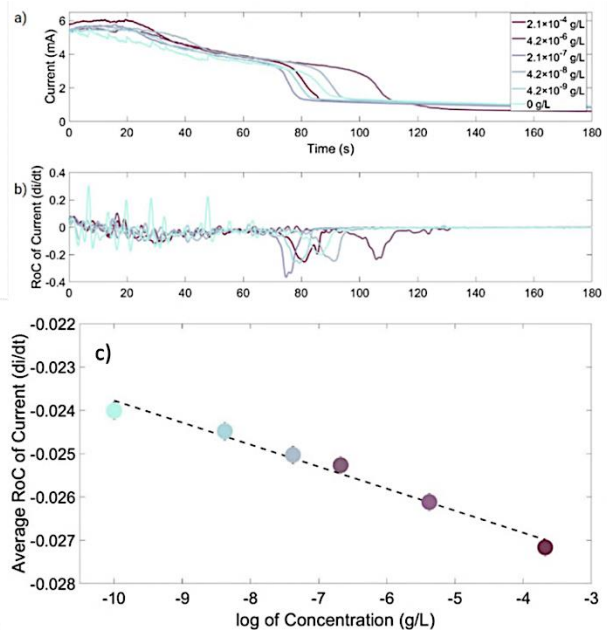


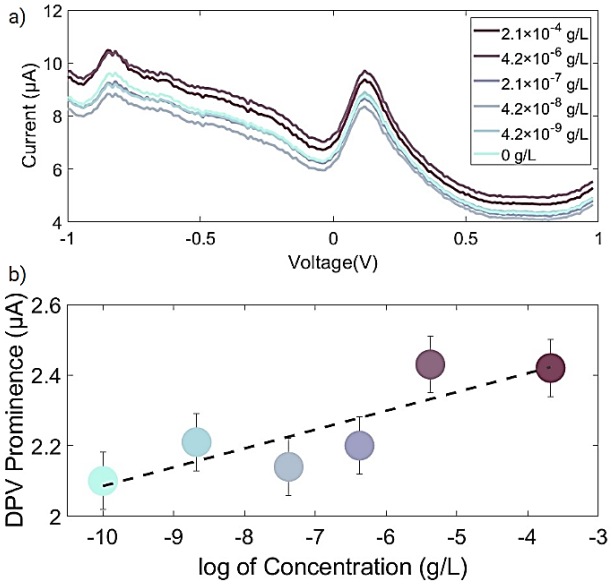
N/M-Ps & Nanotechnology Interfacing



Brain-Machine Interfacing







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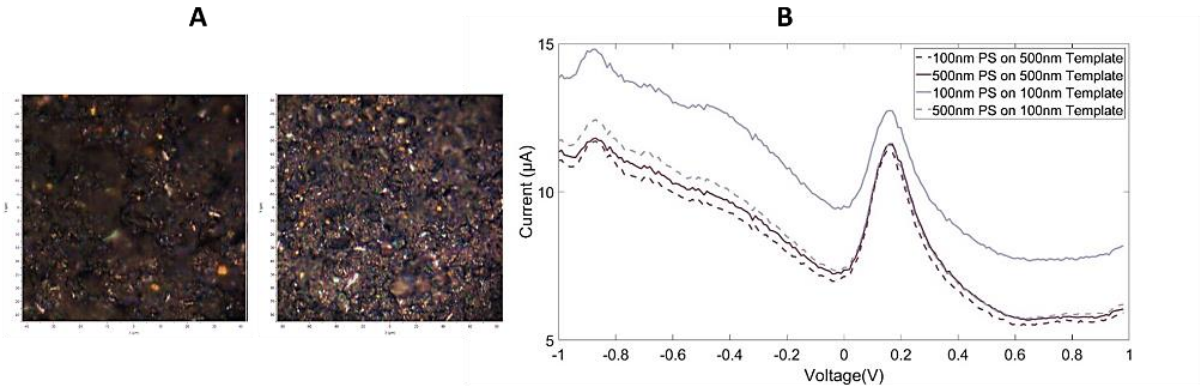

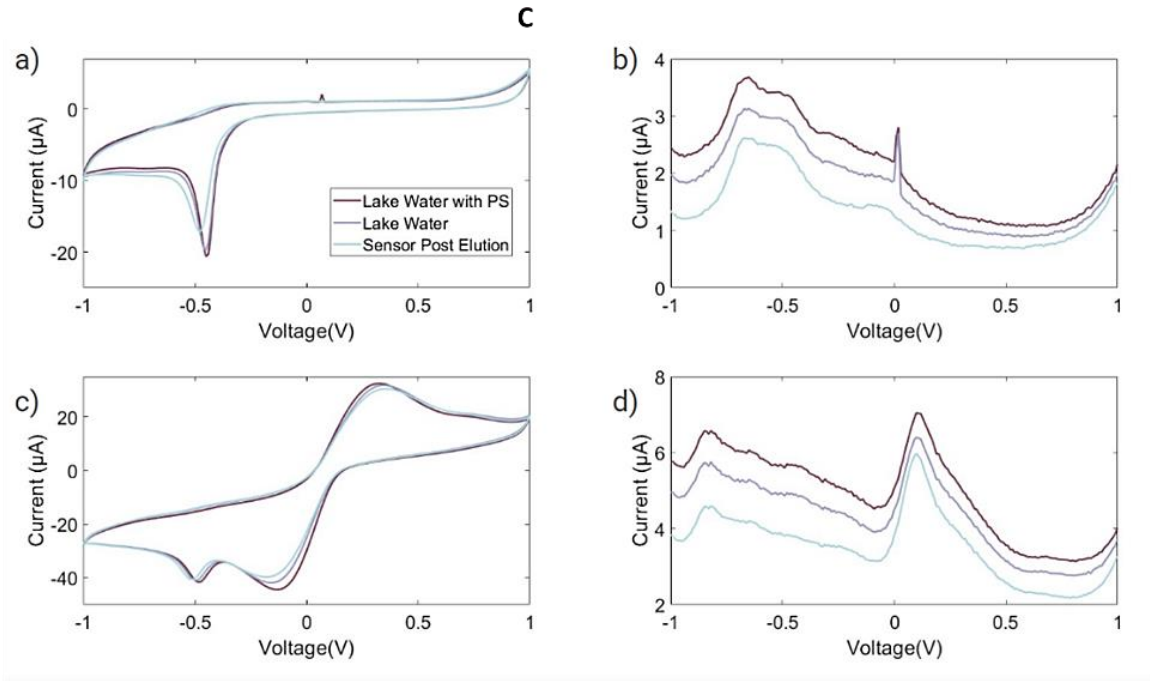

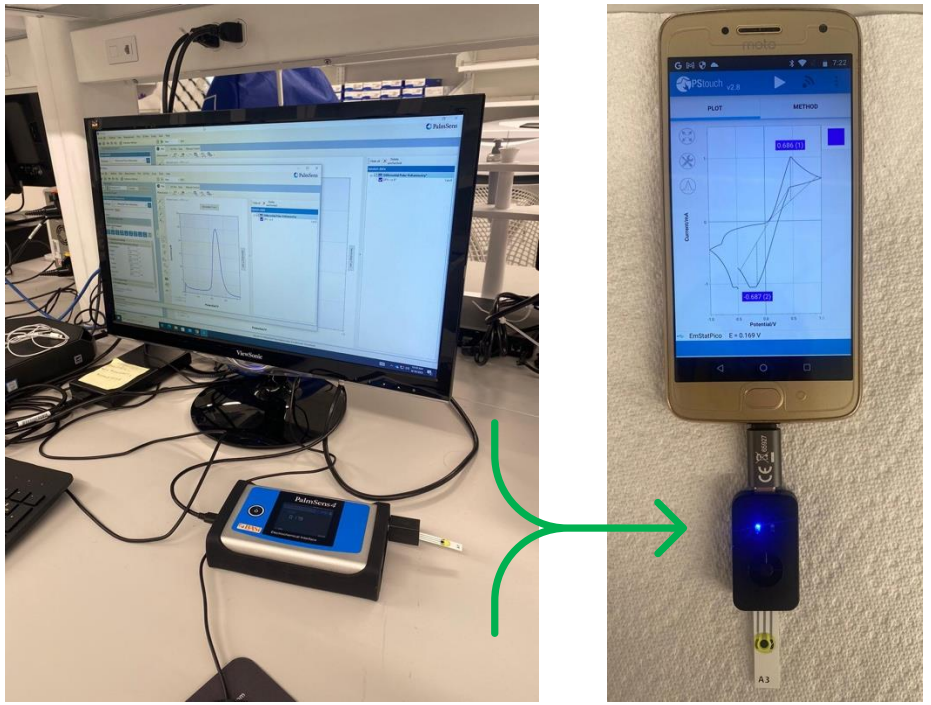

Future Directions

- Sensing of various types of M/N-Ps.
- M/N-Ps detection in various types of water samples, as a control
- M/N-Ps detection in real samples.
- Optimizing POC sensing capability
- Exploring AI for Data Analytics for Decision Making

ALL STEM. ALL IMPACT.

Thank You

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