



# FAMU-FSU Engineering

**FAMU - FSU COLLEGE OF ENGINEERING**  
**DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING**

## **Technical Awareness Group (TAG) Meeting No. 2**

**Thursday, August 12, 2021 2:00 – 3:20 pm Eastern Time**

**Meeting location: Zoom**

**Project Title:** Non-Thermal Plasma Degradation of Per- and Polyfluoroalkyl Substances (PFAS) from Landfill Leachate

**TAG Members:** Bruce Marvin (Geosyntec Consultants), Chao Zhou (Geosyntec Consultants), Claudia Mack (Geosyntec Consultants), Kevin Warner (Geosyntec Consultants), Stephanie Sanchez (Geosyntec Consultants), Terry Johnson (Waste Management Inc.), Sterling Carroll (Florida Rural Water Association), Joseph Dertien (Florida Department of Environmental Protection), Kerry Tate (Florida Department of Environmental Protection), Lauren J. Coleman (Florida Department of Environmental Protection), Owete S. Owete (Florida Department of Environmental Protection), Ryan Barker (Florida Department of Environmental Protection), Shanin Speas-Frost (Florida Department of Environmental Protection), Walsta Jean-Baptiste (Florida Department of Environmental Protection)

**Principle Investigators:** Youneng Tang, Tarek Abichou, Bruce R. Locke, Huan Chen

**In Attendance:** Amita Jain, Ana Dae Pak, Bruce Locke, Bruce Marvin, Chao Zhou, Huan Chen, Joseph Dertien, John Schert, Karam Eeso, Kerry Tate, Kevin Warner, Mojtaba Nouri Goukeh, Owete S. Owete, Rachel Gallen, Radha Bulusu, Shanin Speas-Frost, Tarek Abichou, Walsta Jean-Babtiste, Youneng Tang.

### **Project Overview and Introduction**

The meeting was called to order by Dr. Tang at 2:00 PM. Dr. Tang began by introducing the gas-liquid flowing film reactor. A real-world landfill leachate was treated by the reactor and 30 PFASs were measured by FDEP. Then, Dr. Tang classified these PFASs into 4 categories. The removal percentage of PFASs was shown, and the degradation percentage of PFASs depended on chain length. In addition, the role of leachate components (acetate and surfactants) was discussed. Eventually, he described the impacts of PFAS treatment on acute toxicity of the leachate and offered explanation.

### **Project Tasks and Team**

Dr. Tang presented four tasks to address four questions, respectively, including: 1) does the reactor work for other PFAS at low concentrations (partially complete), 2) what types of leachate can be treated by non-thermal plasma (partially complete), 3) what intermediates are produced (partially complete), 4) what is the toxicity of the intermediates (partially complete).

The research team mainly consists of Dr. Youneng Tang (PI), Dr. Bruce R. Locke (co-PI), Dr. Tarek Abichou (co-PI), Dr. Huan Chen (co-PI), Mojtaba Nouri Goukeh (graduate student), Rachel Gallen (graduate student), and Karam Eeso (undergraduate student).

## Results

- The results showed the high efficiency of the reactor for removing the majority of the measured PFASs. For example, the removal percentages of perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) were 76% and 83%, respectively.
- The degradation percentages of perfluorosulfonates acids (PFSAs), perfluorinated carboxylic acids (PFCAs), and other PFASs decreased with decreasing chain length.
- A higher concentration of acetate led to increased fluoride production, but energy efficiency decreased when the acetate concentration increased.
- Sodium dodecyl sulfate (SDS) as an anionic surfactant increased fluoride production and energy efficiency. However, a cationic surfactant (hexadecyl trimethyl ammonium bromide [CTAB]), and a nonionic surfactant (octyl phenol ethoxylate [Triton-X100]) did not affect fluoride production.
- The acute toxicity of the landfill leachates increased after the plasma treatment. The increase of the toxicity could have been caused by the oxidant and reductive species generated in the reactor such as hydrogen peroxide. They may not be caused by the PFASs intermediates.

## Group Discussion

Major comments and suggestions from the TAG:

- Treating one more landfill leachate sample to confirm that the degradation percentage decreases with decreasing chain length.
- Using a non-polar solvent instead of water can help to understand the degradation mechanisms. This is out of the scope of this project. It will be researched if funding is available in the future.
- Determining the mechanisms of PFAS degradation in the reactor will be useful. A TAG member (Bruce Marvin) will send articles that can provide insights into PFAS degradation mechanisms.

The meeting was adjourned at 3:20 PM, minutes taken and submitted by Mojtaba Nouri Goukeh.