2023 Research at SERL

Department of Biological Systems Engineering

My 2023 selfie

2023 Highlights:

- $1,244,109 grants
- 5 Awards
- 1 Ph.D. Graduation
- 4 New Members
- 15 New Projects
- 35 Publications
- New Field Lab
- Wonderful Moments

Field lab provided by Arlington Water Pollution Control Plant

Accomplished NSF I-Corps training

New CAWRI member in 2023

Dear Friends,

2023 is the year of 'growth' for Wang's team. Soon after moving into the 3,227 square feet pilot lab, the level of federal funding support for Wang's team rapidly outgrew that of the industrial funding, leading to an unprecedented level of $1,244,109 in total. With such a strong external funding support, Wang's lab was able to secure a cascade of fermenters (2, 10, 50, and 100 liters) for upscaling biotechnology from bench- to full-scale application. To match the throughput of pilot scale fermentation, a whole set of upstream and downstream processing equipment was also procured and installed in the pilot lab. By the end of 2023, the capacity of Wang's pilot lab has reached Bioindustrial manufacturing readiness level 5 (BioMRL5), i.e., sufficient quantities of end-product can be delivered to downstream stakeholders for testing and evaluation.

Along with the rapid funding and lab growth, Wang's team members also grew to its record high. For the first time, Wang's team has a dedicated lab manager, Mr. Nicolas Poe, overseeing the entire pilot lab operation. Another three new graduate students (2 Ph.D. and 1 M.S.) also joined Wang's team to work on 2023 newly funded research projects.

In order for Wang's team to produce useful data from real samples that are only available onsite, Arlington Water Pollution Control Plant built an environment-controlled field lab equipped with a set of pilot CAMBI thermal hydrolysis system, anaerobic digesters, and sludge dewaterability research equipment. This field lab is serving the research needs of six Northern Virginia utility members in the Center for Applied Water Research and Innovation (CAWRI) led by Dr. Wang. In 2023, a new utility member joined CAWRI, namely the H.L. Mooney Advanced Water Reclamation Facility. This 24 MGD plant is managed by the Prince William County Service Authority. All CAWRI members are looking forward to performing more applied research in collaboration with the Monney plant.

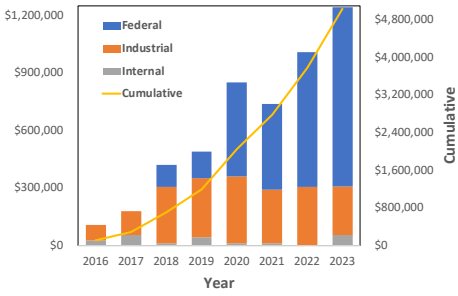
Talking about the applied research, I cannot help but mention that our two most senior graduate students, Ms. Xueyao Zhang and Mr. Jiefu Wang, took part in the 2023 cohort of National Science Foundation (NSF) I-Corps Training as the two Entrepreneurial Leads. They managed to interview 110 industrial partners within six weeks to understand what it takes to commercialize our technologies. This intense training program is in line with the theme of Wang's lab, i.e., "develop useful technologies to improve the quality of human life".

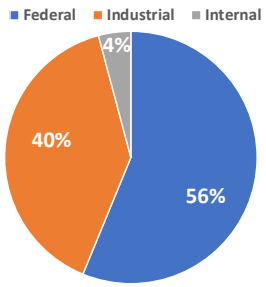
Regards,

Zhiwu (Drew) Wang

2023 New Research Grants

The 2023 research funding awarded to Dr. Wang's team has far exceeded the already record high of 2022 and reached $1,244,109, maintaining an ever-increasing trend continued in the past eight years. The fraction of federal funding increased to 56% from 50% in 2022. This substantial increase of the federal grants has to do with the new lab spaces provided by BSE in the main campus of Virginia Tech. Since last year's relocation into these well-equipped lab spaces, several large projects have been selected for funding by federal agencies. National Science Foundation (NSF) has provided funding to support a pilot-scale demonstration of an advanced biotechnology for treating toxic wastewater produced in the biofuel industry. This technology was developed in collaboration with Dr. Yi Zheng from Kansas State University and Dr. Sandeep Kumar from Old Dominion University. Likewise, building on previous year's success in partial denitrification anammox research (PDNA), United States Department of Agriculture (USDA) funded a collaborative proposal submitted by Dr. Wang and Dr. David Kuhn from Food Science & Technology for pilot demonstrating a PDNA-based fishery wastewater nitrogen removal technology. Down the same line, Department of Energy (DOE) funded another collaborative proposal between Wang's lab and researchers from Quasar Energy Group, University of Missouri, National Renewable Energy Laboratory, and Hazen & Sawyer for reducing the greenhouse gas emission in water resource recovery facilities. In this proposal, PDNA again played a pivot role. Besides these federal grants, Wang's lab continued to receive industrial funding support. Prince William County Service Authority's H.L. Mooney Advanced Water Reclamation Facility joined CAWRI to further on the full-scale demonstration of sludge densification by hydro cyclones. Again, other industrial partners such as Upper Occoquan Service Authority (UOSA), Washington Suburban Sanitary Commission, Arlington County, and AlexRenew Enterprise provided continued support of the research down the directions from last year. It is noteworthy that the Virginia Tech's College of Agriculture and Life Sciences also contributed strong funding support for Wang's lab to build an interdisciplinary team for environmental sustainability. Again, we are so blessed with these diversified funding sources in support of our outstanding graduate students' research and education. Their success is all our efforts about!





New Grants in 2023 ($1,244,109)

1. Zhiwu Wang (PI) $184,998 3/2023 – 4/2025 Pilot-scale demonstration of an advanced biotechnology for treating toxic wastewater produced in the biofuel industry, funded by National Science Foundation, along with Haibo Huang from Virginia Tech, Yi Zheng from Kansas State University, and Sandeep Kumar from Old Dominion University, $249,998 in total
2. Zhiwu Wang (Co-PI) $252,011 7/2023 – 6/2026, Partnership: Leveraging anaerobic ammonium oxidation for sustainable aquaculture, along with David Kuhn (PI), Stephen Smith, and Ann M Stevens from Virginia Tech and Bethany Klemetsrud from University of North Dakota, $799,999 in total
3. Zhiwu Wang (PI) $25,000 04/2023- 06/2024, Building an interdisciplinary team to achieve cost-effective conversion of food waste to bioplastics, funded by 2023 CALS Strategic Plan Advancement – Integrated Internal Competitive Seed Grants Program, along with Haibo Huang, Young Kim, and Erin Ling from Virginia Tech, $75,000 in total
4. Zhiwu Wang (Co-PI) $10,000 $25,000 04/2023- 06/2024, Convert brewer's spent grain into high-value protein and dietary fiber to support the Virginia bioeconomy, funded by 2023 CALS Strategic Plan Advancement – Integrated Internal Competitive Seed Grants Program, along with Haibo Huang (PI), Yiming Feng, Jactone Ogejo, and Xueqian Su from Virginia Tech, $47,000 in total
5. Zhiwu Wang (PI) $83,338 02/2023- 01/2024, Continuous Flow Aerobic Granulation Study Phase V, funded by Upper Occoquan Service Authority
6. Zhiwu Wang (PI) $1,500 1/2023-12/2024, Mentoring Network Connection with Regional Campuses, funded by Office of the Executive Vice President and Provost
7. Zhiwu Wang (Co-PI) $10,000 7/2023 – 6/2024 Hyperspectral imaging for the real-time detection of microplastic particles in seafoods, funded by 4-VA Competitive Research Grants, along with Yiming Feng (PI), Sandeep Kumar at Old Dominion University, and Benoit Van Aken at George Mason University. $40,000 in total
8. CAWRI (PI) $50,000 01/2023-12/2023, Recalcitrant nitrogen control with aluminum and ferric dosing prior to belt filter press dewatering of thermal hydrolysis pretreatment-enhanced anaerobic digester effluent, funded by Washington Suburban Sanitary Commission
9. CAWRI (PI) $50,000 01/2023-12/2023, Pilot scale understanding of the dewaterability of sludge produce from thermal hydrolysis-ehanced anaerobic digestion, funded by Arlington County
10. CAWRI (PI) $50,000 01/2023-12/2023, Full-scale demonstration of sludge densification by hydrocyclones in H.L. Mooney Advanced Water Reclamation Facility, funded by Prince William County Service Authority
11. CAWRI (PI) $50,000 01/2023-12/2023, Partial denitrification anammox in the secondary treatment system, funded by AlexRenew Enterprise
12. Zhiwu Wang (Co-PI) $5,000 07/2023-06/2024, The role of the air-water interface in breakthrough of PFAS and phthalate esters during wastewater treatment, funded by 4-VA Competitive Research Grants, along with Kirin E. Furst (PI) at George Mason University. $24,985 in total
13. Zhiwu Wang (Co-PI) $5,000 07/2023-06/2024, Protection of RNA by Association with Macromolecules: Implications for Wastewater Based Epidemiology, funded by 4-VA Competitive Research Grants, along with Benoit Van Aken (PI) at George Mason University. $24,989 in total
14. Zhiwu Wang (PI) $37,100 7/13/23-7/12/24, Franklin's Southeastern Wastewater Capacity Project, funded by Hazen & Sawyer
15. Zhiwu Wang (Co-PI) $500,000 10/2023 – 9/2026, Integrating reverse A2O and anammox with arrested anaerobic digestion to reduce greenhouse emission from water resource recovery facilities, along with Yebo Li: (PI) and Xumeng Ge from Quasar Energy Group, Zhiqiang Hu and Sanjeev Khanna from University of Missouri, Violeta Sanchez i Nogue from National Renewable Energy Laboratory, and Yewei Sun from Hazen & Sawyer. $2,500,000 in total

2023 Awards, Enrollment, and Graduation

Virginia Tech team successfully defended their champion in 2023 AWWA Student Water Challenge

In 2023 WaterJam conference, Dr. Wang's students **Mr. Yitao Li** and **Mr. Pranta Roy** successfully defended Virginia Tech's Champion in 2023 AWWA Student Water Challenge competition, along with other team members. Besides, **Mr. Yitao Li** and **Mr. Pranta Roy** also won 2nd place awards in wastewater and water sectors in 2023 WaterJAM YP/Student "Fresh Ideas" Poster Contests. In addition, **Mr. Md Sazzadul Haque** and **Mr. Collins Ugwu** were also awarded Pratt Fellowship, respectively

Recipients	Awards	Amount
Yitao Li, Pranta Roy, etc.	2023 AWWA Student Water Challenge (1st place)	$1,200 total
Yitao Li	2023 WaterJAM YP/Student "Fresh Ideas" Poster Contest (Wastewater 2nd place winner)	$500
Pranta Roy	2023 WaterJAM YP/Student "Fresh Ideas" Poster Contest (Water 2nd place winner)	$500
Md Sazzadul Haque	Pratt Fellowship	$1,000
Collins Ugwu	Pratt Fellowship	$1,000

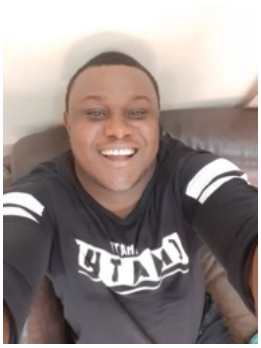
With his completion of multiple applied research projects for Washington Suburban Sanitary Commission, Arlington County Water Pollution Control Plant, and Virginia Department of Agriculture and Consumer Services, **Dr. Hao Luo** successfully defended his Ph.D. dissertation titled "**Wastewater Carbon Diversion and Recovery via Primary Sludge Production, Thermal Hydrolysis, and Anaerobic Digestion**". His dissertation defense committee was impressed by the quality and quantity of research outcomes he has delivered. Dr. Luo has been employed by SZ PM consultants located in Washington DC.

Mr. Yitao Li won wastewater 2nd place award in 2022 WaterJAM YP/Student "Fresh Ideas" Poster Contest

Mr. Pranta Roy won water 2nd place award in 2022 WaterJAM YP/Student "Fresh Ideas" Poster Contest

With an old member's graduation, several new members joined us in 2023. **Mr. Nicholas Poe** joined Dr. Wang's team as a Lab and Research Specialist II in January of 2023. He received his B.S. & M.S. in Food Science and Technology in 2017 and 2019 from Virginia Tech. He will oversee the entire pilot lab's operation and safety. **Mr. Pranta Roy** joined Dr. Wang's team as a M.S. student in Spring 2023. He received his B.S. in Civil Engineering from Khulna University of Engineering & Technology in Bangladesh in 2018. Pranta is researching methods to improve the activated sludge settleability for intensifying secondary wastewater treatment system. **Mr. Md Sazzadul Haque** joined Dr. Wang's research team as a Ph.D. student in Summer 2023. He obtained his B.Sc. in Civil and Environmental Engineering from North South University in Bangladesh in 2020. His research focuses on developing biodegradable plastic materials from food waste products. **Mr. Collins O. Ugwu** joined Dr. Wang's research team as a Ph.D. student in Summer 2023. He acquired his B.Eng and M.Eng in Mechanical Engineering in the University of Nigeria, Nsukka (UNN) in Nigeria. His research involves the identification of critical material attributes of municipal solid wastes for biofuels production through thermal and biological conversion technologies.

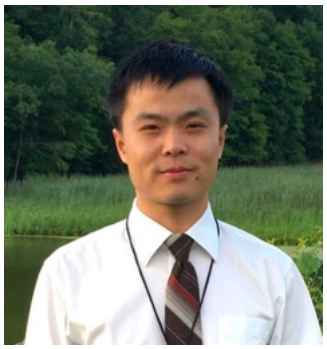
Mr. Nicholas Poe joined Dr. Wang's team in January of 2023. He oversees the pilot lab operation.



Mr. Collins O. Ugwu joined Dr. Wang's research team as a PhD student in Summer 2023.

Mr. Md Sazzadul Haque joined Dr. Wang's research team as a Ph.D. student in Summer 2023.

Mr. Pranta Roy joined Dr. Wang's team as a M.S. student in Spring 2023.

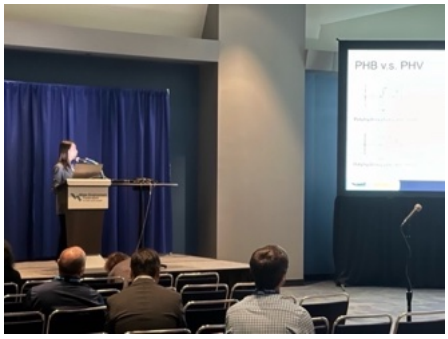


Dr. Hao Luo graduated with a Ph.D. degree in fall 2023. He is working for SZ PM consultants in Washington DC.

2023 Research Highlights

Kenaf carrier: Mr. Pranta Roy is pilot-testing whether kenaf carrier can provide an alternative to aerobic granular sludge for biomass retention and settleability improvement in Upper Occoquan Service Authority.

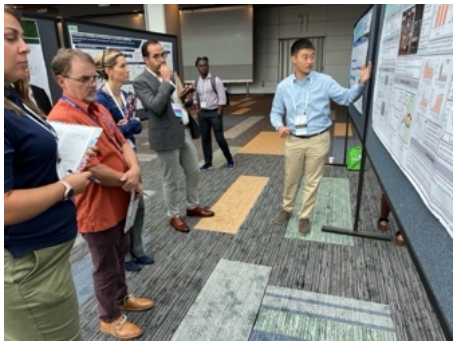
Endogenous denitrification: Mr. Jiefu Wang was able to take advantage of endogenous dentification for eliminating the energy consumption for mixed liquor recirculation without external carbon addition.



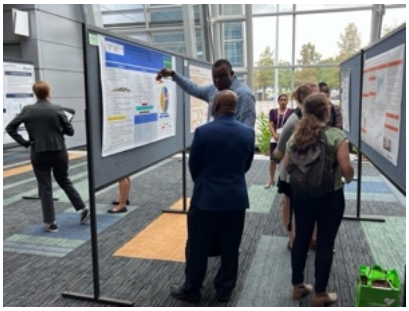
Bioplastic production from food waste: Ms. Xueyao Zhang developed a biotechnology to produce bioplastic from food waste, which simultaneously resolves two environmental problems.

Dewaterability Prediction: Mr. Yitao Li calibrated his dewaterability measurement method using different types of biosolids produced from various processes. His bench-scale results matched full-scale data very well.

Bioplastic recovery: Ms. Xueyao Zhang figured out a simple, low energy way to extract bioplastics from microorganisms that utilize food waste as a substrate. She is collaborating with other researchers on how to further purify the extracted bioplastics.

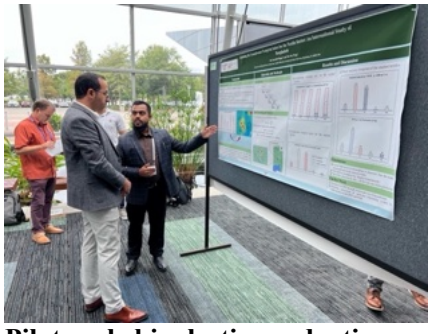


Friability test of dried biosolids: Mr. Yitao Li for the first time developed a methodology capable of predicting the friability of thermally-dried biosolids, which is important for designing the biosolid processing system.



Smart management of municipal solid waste: Mr. Collins O. Ugwu has been collecting large quantity of municipal solid waste composition data to extrapolate their best management practice by using artificial intelligence methods.

Hydrothermal liquification wastewater treatment: Mr. Jiefu Wang discovered a microbial consortia that can destroy >90% organic carbon contained in the toxic hydrothermal liquification wastewater regardless whether it is made from corn stover or biosolids.

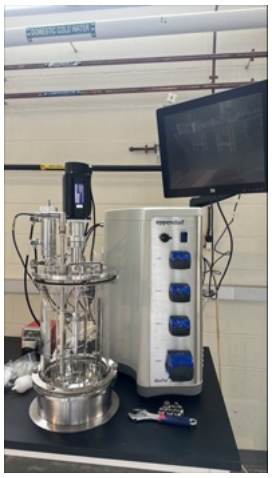


Pilot-scale bioplastic production: Mr. Md Sazzadul Haque focuses on the upscaled bioplastic production from food waste. His research will provide basis for the life cycle analysis and technoeconomic analysis required for full-scale application of the technology.

2023 New Equipment

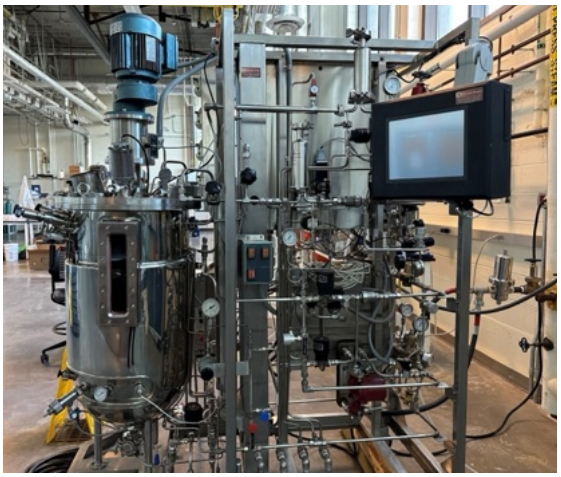
The 3,227 square feet high-bay pilot lab was empty when Dr. Wang team moved in back in 2022 fall. It took about a year to equip the space with pilot-scale experiment capacity. For example, a suite of 2, 10, 50, and 130-liter fermenters are in place for upscaling technologies. A 100 L anaerobic digester is in place for upstream processing the highly variable raw feedstock. A suite of pilot-scale disk centrifuge, evaporator, and extruder are also in place for downstream processing of bioproducts. By the end of 2023, the pilot lab is fully equipment with enough capacity for large-scale bioprocess validation & demonstration.

Equip Solution 2L Jacketed Glass Reactor



Eppendorf 10-liter BioFlo® 320 Fermenter

Equip Solution 50-liter Fermenter



New Brunswick 6000 130-liter Fermenter

TwinLab-F 20/40 Bradender Extruder (1 - 20 kg/hour)

Alfa Laval Clara 20 Clarifier Disk Centrifuge (1,000-liter/hour)

100-liter Anaerobic Digester

BUCHI Rotavapor R-300 Rotary Evaporator with Controller (3-liter capacity)

Two units of 30-liter Buchi MidiPilot glass reactors heated by two units of Julabo presto a30

Thermo Scientific Sorvall LYNX 4000 Superspeed Centrifuge

2023 Publications

Journal papers

1. Xiao R., An Z.H., Wang Z.W., Zheng Y. (2023) Kinetic Modeling of Cell Growth and Value-added Products Accumulation of *Thraustochytrium striatum*, Biomass and Bioenergy, 181: 107033
   DOI: https://doi.org/10.1016/j.biombioe.2023.107033
2. Liu M.C., Mahata C., Wang Z.W., Kumar S., Zheng Y. (2023) Comparative Exploration of Biological Treatment of Hydrothermal Liquefaction Wastewater from Sewage Sludge: Effects of Culture, Fermentation Conditions, and Ammonia Stripping, Journal of Environmental Management, 349:119527
   DOI: https://doi.org/10.1016/j.jenvman.2023.119527
3. Gomeiz A.T., Sun Y., Newborn A, Wang Z.W., Angelotti B., Van Aken B. (2023) Metagenomic Analysis of a Continuous-Flow Aerobic Granulation System for Wastewater Treatment. Microorganisms, 11(9):2328
   DOI: https://doi.org/10.3390/microorganisms11092328
4. Li B., Godfrey B., RedCorn R., Candry P., Wang Z.W., Goel R., Winkler M. (2023) Mainstream Nitrogen Removal from Low Temperature and Low Ammonium Strength Municipal Wastewater using Hydrogel-encapsulated Comammox and Anammox, Water Research, 242, 15,
   DOI: https://doi.org/10.1016/j.watres.2023.120303
5. Wang J.F., An Z.H., Zhang X.Y., Angelotti B., Brooks M., Wang Z.W. (2023) Effects of Nitrate Recycle on the Sludge Densification in Plug-Flow Bioreactors Fed with Real Domestic Wastewater, Processes 2023, 11(7), 1876. DOI: https://doi.org/10.3390/pr11071876
6. An Z.H., Wang J.F., Zhang X.Y., Bott C.B., Angelotti B., Brooks M., Wang Z.W. (2023) Coupling physical selection with biological selection for the startup of a pilot-scale, continuous flow, aerobic granular sludge reactor without treatment interruption, Water Research X, 19, 100186.
   DOI: https://doi.org/10.1016/j.wroa.2023.100186
7. Li B., Godfrey B.J., RedCorn R, Candry P., Wang Z.W., Goel R., Winkler M.K.H., (2023) Simultaneous anaerobic carbon and nitrogenremoval from primary municipal wastewater with hydrogel encapsulated anaerobic digestion sludge and AOA-anammox coated hollow fiber membrane, Science of the Total Environment, 163696.
   DOI: https://doi.org/10.1016/j.scitotenv.2023.163696
8. Hong S., Winkler M., Wang Z.W., Goel R. (2023) Integration of EBPR with mainstream anammox process to treat real municipal wastewater: process performance and microbiology, Water Research, 233, 119758
   DOI: https://doi.org/10.1016/j.watres.2023.119758

Book Chapters

9. Ge X.M., Tanvir R.U., Hu Z.Q., Hassanein A., Lansing S., Yu Z.T., Luo H., Wang Z.W., Wan C.X., Yang L.C., Khanal S.K., Li Y.B. (2023) Rethinking Anaerobic Digestion for Bioenergy and Biopolymers Production: Challenges and Opportunities. In: "Advances in Bioenergy, volume 9", Elsevier Inc., Cambridge, MA.

Dissertations

10. Hao Luo (2023) Wastewater Carbon Diversion and Recovery via Primary Sludge Production, Thermal Hydrolysis, and Anaerobic Digestion
    DOI: http://hdl.handle.net/10919/116659

Conference Oral Presentations

11. Zhang X.Y., Amradi N., Hassanein A., Lansing S., Wang Z.W., (2023) Salty food waste conversion to bioplastics. WEFTEC 2023, Sep.30 – Oct. 4, Chicago, IL
12. Wang J., Sun Y., Khunjar W., Winkler M., Goel R., Wang Z.W. (2023), Combination of endogenous denitrification, EBPR, partial nitrification/denitrification and anammox (PANDA) to achieve cost-effective nutrient removal. Wefec 2023, Sep.30 – Oct. 4, Chicago, IL
13. Li Y.T., Luo H., Strawn M., Racey L., Haile F., Balchunas B., Moline C., Hentz L., Higgins M., Wang Z.W. (2023) To What Extent Can Solids Retention Time Be Reduced Without Deteriorating the Performance of the Thermal Hydrolysis Pretreatment-enhanced Mesophilic Anaerobic Digestion. WEFTEC 2023, Sep.30 – Oct. 4, Chicago, IL
14. Wang J.F., Sun Y., Khunjar W., Winkler M., Goel R., Wang Z.W. (2023) Integration of endogenous denitrification, EBPR, partial nitrification/denitrification and anammox (PANDA) for cost-effective nutrient removal. WaterJAM 2023, September 11-14, Virginia Beach, VA
15. Zhang X.Y., Amradi N., Hassanein A., Lansing S., Wang Z.W., (2023) Bioplastic production from salty food waste. WaterJAM 2023, September 11-14, Virginia Beach, VA
16. Li Y.T., Luo H., Strawn M., Racey L., Haile F., Balchunas B., Moline C., Hentz L., Higgins M., Wang Z.W. (2023) The impact of solids retention time reduction on the thermal hydrolysis pretreatment-enhanced mesophilic anaerobic digestion. WaterJAM 2023, September 11-14, Virginia Beach, VA

17. Liu M.C., Kumar S., Wang Z.W., Zheng Y., (2023) Comparative Evaluation of Microorganisms for Biological Treatment of Hydrothermal Liquefaction Wastewater from Sewage Sludge. ASABE 2023 Annual International Meeting, July 9-12, Omaha, NE
18. Liu C., Shi J., Zhang X.Y., Qiao Q., Gao X., Ullah A., Wang Z.W., Shao Q., (2023) A Process Intensification Approach to Improve Volatile Fatty Acids Production from Brewer's Spent Grains through Thermophilic Anaerobic Fermentation. ASABE 2023 Annual International Meeting, July 9-12, Omaha, NE
19. Zhan Y.H., Robinson J.N.A., Zhang X.Y., Wu X., Wang Z.W., Xiao Y.T., Zhu J. (2023) Bio-Energy Production and Nutrient Recovery from Poultry Litter with Water Reuse by Integration of Anaerobic Digester, Electrolytic Reactor, and Forward Osmosis. ASABE 2023 Annual International Meeting, July 9-12, Omaha, NE
20. Li Y.T., Luo H., Strawn M., Racey L., Haile F., Balchunas B., Moline C., Hentz L., Wang Z.W. (2023) The impact of solids retention time reduction on the thermal hydrolysis pretreatment-enhanced mesophilic anaerobic digestion. ASABE 2023 Annual International Meeting, July 9-12, Omaha, NE
21. Zhang X.Y., Amradi N., Hassanein A., Lansing S., Wang Z.W. (2023) Bioplastic production from food waste. 2023 ASABE Annual International Meeting. July 9 – 12, Omaha, NE, USA
22. Li Y.T., Luo H., Strawn M., Racey L., Haile F., Balchunas B., Moline C., Hentz L., Wang Z.W. (2023) The impact of solids retention time reduction on the thermal hydrolysis pretreatment-enhanced mesophilic anaerobic digestion. AEESP Research and Education Conference 2023, June 20-23, Boston, MA
23. Wang J., Sun Y., Khunjar W., Winkler M., Goel R., Wang Z.W. (2023) Integration of EBPR, endogenous denitrification, partial nitrification/denitrification and anammox for cost-effective nutrient removal, AEESP Research and Education Conference 2023 , June 20-23, Boston, MA
24. Luo H., Haile F., Strawn M., Racey L, Wang Z.W. (2023) Does adding a secondary hydrolysis improve municipal sludge anaerobic digestion? WEF Residuals & Biosolids Conference 2023, May 16-19, Charlotte, NC
25. Li Y.T., Luo H., Strawn M., Racey L., Haile F., Balchunas B., Moline C., Hentz L., Wang Z.W. (2023) The impact of solids retention time reduction on the thermal hydrolysis pretreatment-enhanced mesophilic anaerobic digestion. WEF/IWA Residuals and Biosolids Conference 2023, May 16-19, Charlotte, NC

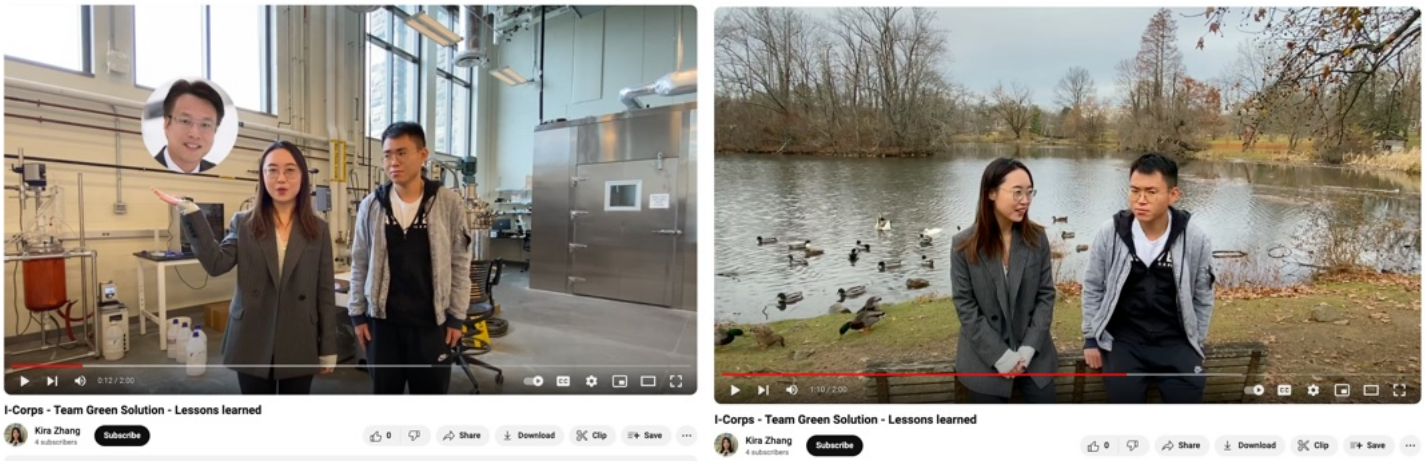
Conference Poster Presentation

26. Ugwu C.O., Olisa E., Ikenna E. and Wang, Z.W. (2023). Characterization and Correlation Studies of the Municipal Solid Waste (MSW) generated in Nigerian Universities. Case Study: University of Nigeria, Nsukka (UNN). WaterJAM 2023, September 11-14, Virginia Beach, VA
27. Roy, P and Wang, Z.W. (2023). Implementation of Blockchain-Based Drinking Water Quality Assurance System. WaterJam 2023, September 11-14, Virginia Beach, VA (**Second Place Award in water sector**)
28. Haque, M.S. and Wang, Z.W. (2023). Assessing the Groundwater Footprint Index for the Textile Sector: An International Study of Bangladesh. WaterJAM 2023, September 11-14, Virginia Beach, VA
29. Wang J.F., An Z., Angelotti B., Brooks M., Wang Z.W., (2023) Effects of NRCY on the startup of physical and biological selection pressure-driven aerobic granulation for biological nitrogen removal in plug-flow bioreactors fed with real domestic wastewater. WaterJAM 2023, September 11-14, Virginia Beach, VA
30. Li Y.T., Luo H., Strawn M., Racey L., Haile F., Balchunas B., Moline C., Hentz L., Wang Z.W., (2023) The impact of solids retention time reduction on the thermal hydrolysis pretreatment-enhanced mesophilic anaerobic digestion. WaterJAM 2023, September 11-14, Virginia Beach, VA (**Second Place Award in wastewater sector**)
31. Zhang X.Y., Amradi N., Hassanein A., Lansing S., Wang Z.W., (2023) Salty Food Waste Conversion to Bioplastics. WaterJAM 2023, September 11-14, Virginia Beach, VA
32. Liu C., Shi J., Zhang X.Y., Qiao Q., Gao X., Ullah A., Wang Z.W., Shao Q., (2023) Extracting VFA with Hydrophobic DESs from Thermophilic Fermentation Effluent. ASABE 2023 Annual International Meeting, July 9-12, Omaha, NE
33. Zhan Y.H., Xiao Y.T., Robinson J.N.A., Wu X., Wang Z.W., Zhu J. (2023) A Comparison Study of Different Strategies for Enhancing Methane Production from Anaerobic Co-Digestion of Poultry Litter with Wheat Straw. ASABE 2023 Annual International Meeting, July 9-12, Omaha, NE
34. Zhang X.Y., Amradi N., Hassanein A., Lansing S., Wang Z.W. (2023) Conversion of salty food waste to bioplastics. AEESP Research and Education Conference 2023, June 20-23, Boston, MA
35. Zhang X.Y., Amradi N., Hassanein A., Lansing S., Wang Z.W. (2023) Bioplastic production from salty food waste. WEF/IWA Residuals and Biosolids Conference 2023, May 16-19, Charlotte, NC

2023 National NSF I-Corps Training

The NSF I-Corps (Innovation Corps) Training is a program designed to assist researchers in transforming their scientific and technical discoveries into commercial ventures. In 2023, Dr. Wang's team was honored to receive this NSF I-Corps funding support to enable his team to learn what it will take to commercialize novel technologies developed in his lab. The most senior and qualified graduate students in Dr. Wang's lab, namely **Ms. Xueyao Zhang** and **Mr. Jiefu Wang**, took initiative to act as the two Entrepreneurial Leads in this intensive National NSF I-Corps Training, i.e., 100 interviews have to be done within 6 weeks. To be honest, I did not believe we can accomplish this intense mission even though I am the Technique Lead of my team. The reality has shown how much potential we have. By the end of 6 weeks, Ms. Xueyao Zhang and Mr. Jiefu Wang exceeded the cohort expectation by interviewing 110 experts from utilities, consulting firms, government, and technology distribution companies. This is an eye-opening experience in that what we learned is quite different from what we thought prior to the training. Doing business is so different from doing research. Only by keeping customers' and decision makers' preferences in mind can we develop useful technologies that have commercialization potential in the market.

We are one of the 24 teams completed NSF I-Corps training during 2023 fall cohort

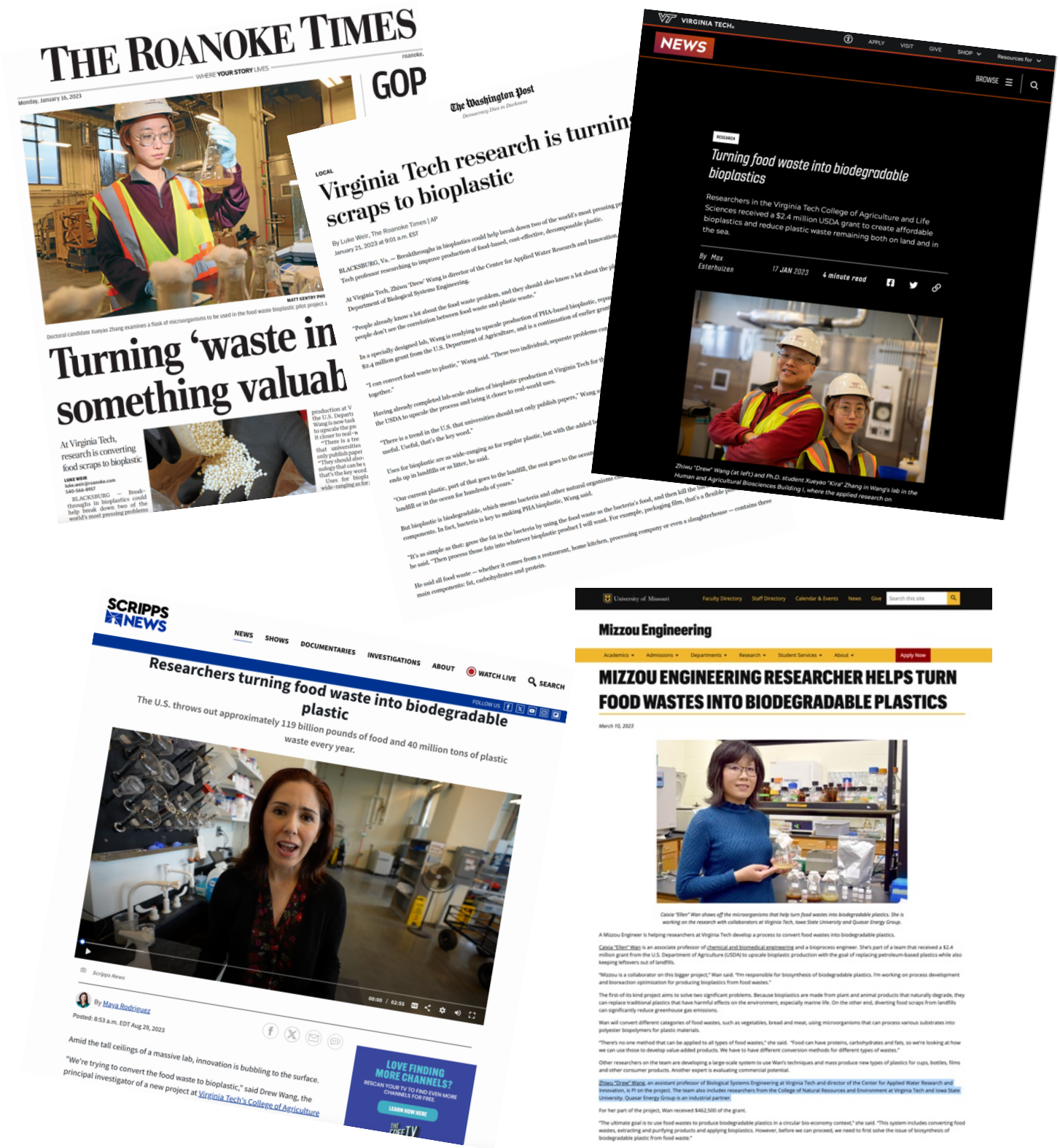


Our entrepreneur leaders **Ms. Xueyao Zhang** and **Mr. Jiefu Wang** summarized the knowledge they learned in this video: **https://youtu.be/ljW9J4pHQG0**

Within just 6 weeks, **Ms. Xueyao Zhang** and **Mr. Jiefu Wang** managed to interview **110 experts** from utilities, consulting firms, government, and technology distribution companies

2023 Media Reports

In 2023, Wang's team garnered widespread recognition and acclaim for the exceptional research achievements, a testament to the team's dedication and expertise. This notable success was highlighted across various media platforms, drawing attention to the team's outstanding research work. As a result of the innovative research and significant contributions to the field, Wang's team established themselves as a leading figure in the field of waste valorization. This high visibility achieved through media exposure not only celebrates our current accomplishments but also sets a solid foundation for future endeavors, enhancing our reputation within the academic and scientific community.



2023 Wonderful Moments

I am with Department Head Dr. Edwards and Dr. Krometis in 2023 Spring commencement

Xueyao was our Halloween Bunny

Touring Novozymes with undergraduate students

Department Holiday Hootenanny

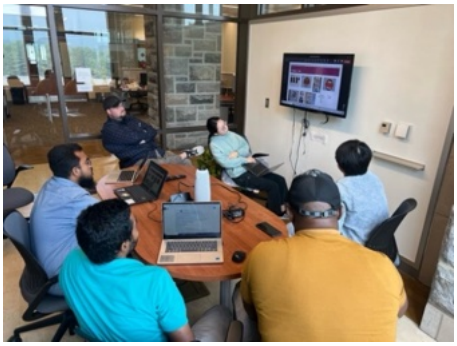
Xueyao presenting her poster

A golf gathering for Wang's team

Wang's team attending a conference reception

A beer gathering with graduate students

10-mile kayaking with students



Dr. Wang's weekly team meeting between Blacksburg and Northern Virginia.

Virginia Water Environment Association Western VA Joint Associations Holiday Party

An "all hands-on deck" landfill sampling