2024 Research at SERL

Department of Biological Systems Engineering

My 2024 selfie

2024 Highlights:

- $1.31 Million Funding
- 7 Awards
- Ph.D. & M.S. graduated
- 4 New Members
- 11 New Projects
- 10 Journal Papers
- 1 Patent
- Another New Field Lab

2nd field lab provided by AlexRenew Enterprise

Our 2024 new funding agency

Dear Friends,

2024 marked a year of growth and achievement for our lab. We secured $1.31 million in new grants, bringing total funding to $6.36 million since 2016. These awards supported innovative projects in continuous biomanufacturing, PFAS degradation, and advanced plastic recycling, bridging the gap between fundamental research and large-scale applications. Notably, another field lab was also established in collaboration with AlexRenew Enterprise, a wastewater treatment plant in Northern Virginia, further advancing our real-world research initiatives. This is the 2nd field lab in addition to the one provided by Arlington Water Pollution Control Plant back in 2023

Our team's academic contributions included 10 peer-reviewed journal papers, 20 conference presentations, and a groundbreaking patent for producing polyhydroxyalkanoates from biomass. We celebrated the successful graduation of one Ph.D. and one M.S. student while welcoming three new Ph.D. candidates and a lab technician. Recognitions this year included five prestigious awards, such as second place at the AWWA Student Water Challenge and wins at the CAPEES Virtual Poster Competition, affirming our team's excellence in environmental engineering research. Media outlets such as *National Geographic* and *Virginia Tech News* featured our work on bioplastics derived from food waste, amplifying the impact of our research.

We made significant investments in cutting-edge equipment, totaling $273,000, to expand our research capabilities. These tools enhance bioplastics production, wastewater treatment, and biogas analysis. With state-of-the-art equipment upgrades and impactful industry collaborations, our lab remains at the forefront of environmental sustainability.

Beyond research, 2024 brought memorable moments that strengthened our team's camaraderie. From seafood gatherings in Virginia Beach to trivia nights and even a wedding, our shared experiences reflect the vibrant spirit of our group. These personal milestones inspire us as much as our professional successes.

As we look forward, we remain committed to pioneering sustainable solutions through innovation, collaboration, and dedication. Thank you for your invaluable support in making our work possible!

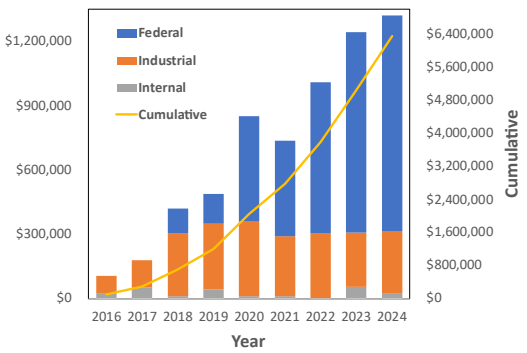
Warm regards,

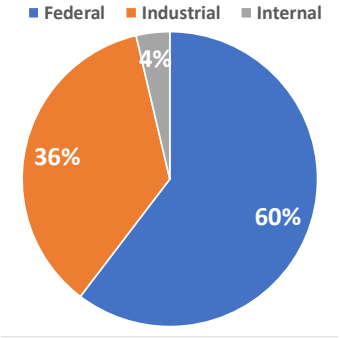
Zhiwu (Drew) Wang

The pilot lab is fully equipped and functional now!

2024 New Research Grants

In 2024, Wang's team reached their highest annual funding total yet, $1.31 million, bringing the cumulative support to $6.36 million since 2016. This achievement reflects both the scale and diversity of his lab's new awards, which range from a $500,000 BioMade grant (with Dr. Andrew Magyar of Capra Biosciences) for continuous biomanufacturing of high-value products from food waste to USDA collaborations targeting bioengineered solutions for food waste valorization ($150,000 share) and plastic recycling ($277,914 share). His team also secured an NSF Convergence Accelerator grant ($78,446 share) for pioneering PFAS degradation methods, complemented by a Water Research Foundation (WRF) award focused on PFAS treatment, namely the $50,000 study "Breaking the Forever PFAS Cycle" with WSSC Water. Another $40,000 WRF award will investigate electrochemical-driven partial denitrification anammox (ePdNA) for treating reverse osmosis concentrate, which is an extension of the DOE funded anammox research funded last year. These WRF collaborations underscore Dr. Wang's commitment to bridging fundamental research with large-scale applications in water and wastewater treatment. Dr. Wang's partnerships with utility and industry sponsors also expanded in 2024, exemplified by several CAWRI-led projects ($50,000 each) that facilitate full-scale pilots with Washington Suburban Sanitary Commission, Arlington County, Prince William County Service Authority, and AlexRenew Enterprise. These pilots investigate real-world sludge densification, biosolids biodegradability, and advanced PFAS destruction methods. Such industry collaborations further underscore Dr. Wang's commitment to bridging fundamental research with practical engineering solutions for resource recovery and environmental sustainability. By engaging industry sponsors, federal agencies, and academic partners, Dr. Wang's group continues to expand the practical reach of pollutant removal and resource recovery, aligning with his overarching mission to transform waste streams into valuable products while protecting public and ecological health.





New Grants in 2024 ($1,311,360)

1. Zhiwu Wang (PI) 02/2025 – 01/2027 $500,000 Continuous biomanufacturing of high value products from food waste, funded by BioMade, along with Andrew Magyar (PI) from Capra Biosciences, $1,500,000 in total
2. Zhiwu Wang (Co-PI) 01/25-12/25 Breaking the Forever PFAS Cycle: Recycle Stream Treatment to Reduce PFAS Loading to WRRF influent and Biosolids, funded by Water Research Foundation, along with Malcom Taylor (PI) from WSSC Water. $150,000 in total
3. Zhiwu Wang (Co-PI) 01/25-12/25 $40,000 Electrochemical-Driven Partial Denitrification Anammox (ePdNA) Process for Reverse Osmosis Concentrate (ROC) Treatment, funded by Water Research Foundation, along with Yewei Sun (PI) from Hazen & Sawyer and Huiyuan Zhu from University of Virginia. $100,000 in total
4. Zhiwu Wang (Co-PI) 3/24 – 2/27 $150,000 Bioprocessing and bioengineering PARTNERSHIP: Sustainable processing of food waste to high value energy storage material, funded by United States Department of Agriculture, along with Sandeep Kumar (PI) from Old Dominion University, Yi Zheng from Kansas State University, and Rajesh V Shende from South Dakota School of Mines & Technology, $800,000 in total
5. Zhiwu Wang (Co-PI) $277,914 7/24 – 6/27 Recycle plastic waste using engineered yeasts displaying plastic-degrading enzymes as a whole-cell biocatalyst, funded by United States Department of Agriculture, along with Juhong Chen (PI) from University of California, Riverside, Haibo Huang and Clay Wright from Virginia Tech, $650,000 in total
6. Zhiwu Wang (Co-PI) $78,446 1/24 – 1/25 Convergence Accelerator Track M: Bioinspired and Biocatalytic Degradation of Forever Chemicals, funded by National Science Foundation, along with Chao Zhou (PI) and Dimin Fan from Geosyntec Consultants, Inc., Yujie Men from University of California, Riverside, and Dongye Zhao from San Diego State University, $749,961 in total
7. Zhiwu Wang (PI) $25,000 6/24 – 6/25 Acquisition of a microfiltration system for enhancing pilot-scale animal nutrition research, funded by Pratt Endowment Fund
8. CAWRI (PI) $50,000 01/2024-12/2024, Full-scale Recalcitrant Nitrogen Control with Ferric Chloride Addition 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 01/2024-12/2024, Seasonal effect on biosolid biodegradability, funded by Arlington County
10. CAWRI (PI) $50,000 01/2024-12/2024, 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 01/2024-12/2024, High temperature biosolids treatment technology for PFAS destruction, funded by AlexRenew Enterprise

2024 New Awards

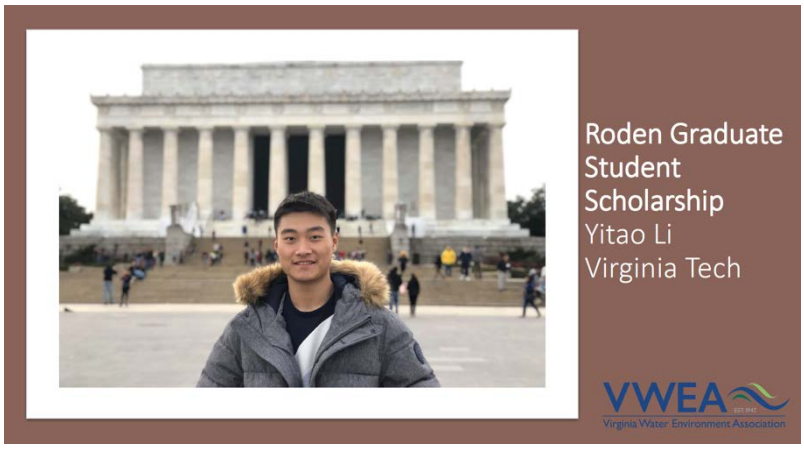
Dr. Wang's team receiving AWWA Student Water Challenge (2nd place)

Dr. Wang's research team at Virginia Tech earned multiple distinctions in 2024, underscoring their strong expertise in environmental engineering and science. At the WaterJAM conference, team members Yitao Li, Pranta Roy, Zhangtong Liao, Cyrus Li, and Mingxi Wang claimed second place in the AWWA Student Water Challenge. They also excelled in the "Fresh Ideas" Poster Contests, securing both second- and third-place finishes in water and wastewater categories. In recognition of his outstanding academic and professional contributions, Yitao Li received the VWEA Sonny Roden Memorial Graduate Student Scholarship. Additionally, Yitao Li and Xueyao Zhang both took first-place honors in the CAPEES Virtual Student Poster Competition, awarded by the Chinese-American Professors in Environmental Engineering and Science. These accomplishments highlight the group's dedication to advancing innovative research and practical solutions in water and wastewater treatment. Overall, the team continues to build its reputation for impactful scholarship and meaningful contributions to the field.

The following awards have been received by Dr. Wang's team members in 2024

- Li, Y., Roy, P., Li, C., Liao, Z., & Wang, M. 2024 AWWA Student Water Challenge (2nd place). Awarded by the Virginia Section of the American Water Works Association.
- Li, Y. 2024 WaterJAM YP/Student "Fresh Ideas" Poster Contest (Wastewater 2nd place winner). Awarded by the Virginia Water Environment Association and Virginia Section of the American Water Works Association.
- Roy, P. 2024 WaterJAM YP/Student "Fresh Ideas" Poster Contest (Water 3rd place winner). Awarded Virginia Water Environment Association and Virginia Section of the American Water Works Association.
- Li, C. 2024 WaterJAM YP/Student "Fresh Ideas" Poster Contest (Wastewater 3rd place winner). Virginia Water Environment Association and Virginia Section of the American Water Works Association.
- Li, Y. 2024 VWEA Sonny Roden Memorial Graduate Student Scholarship. Awarded by the Virginia Water Environment Association.
- Li, Y. (2024). 2024 CAPEES Virtual Student Poster Competition (winner). Awarded by the Chinese-American Professors in Environmental Engineering and Science.
- Zhang, X. (2024). 2024 CAPEES Virtual Student Poster Competition (winner). Awarded by the Chinese-American Professors in Environmental Engineering and Science.

Mr. Yitao Li receiving the wastewater 2nd place award from 2024 WaterJAM YP/Student "Fresh Ideas" Poster Contest.



Mr. Yitao Li was announced to be the recipient of VWEA Sonny Roden Graduate Student Scholarship during the VWEA Annual Award Luncheon.

2024 New Graduation and New Enrollment

In 2024, Wang's lab celebrated the successful graduation of one Ph.D. student and one M.S. student, reflecting its commitment to innovative research and student education. At the same time, the lab grew its research team by welcoming three new Ph.D. students and a dedicated lab technician. This expansion further enhances the lab's collaborative spirit and research capabilities, paving the way for continued breakthroughs in the years ahead.

Dr. Jiefu Wang earned his Ph.D. in Spring 2024 with a dissertation titled "*Carbon-Efficient Wastewater Treatment Through Resource Recovery, Process Intensification, and Partial Denitrification Anammox*". He has published six first-author research papers in top-tier journals, including *Water Research* and *Chemical Engineering Journal*, and co-authored an additional five journal papers. Following this prolific research output, Jiefu has joined Hazen and Sawyer's Atlanta office as a Research Scientist, contributing to the firm's expertise in advanced wastewater treatment technologies.

Mr. Pranta Roy graduated with an M.S. degree in Fall 2024. His thesis, titled *"Gravity Selector-Enabled Kenaf Recirculation and Reuse as a Renewable Ballasting Agent for Sludge Settleability Enhancement in a Municipal Wastewater Secondary Process: A Real Wastewater Pilot-Scale Study,"* is ready for submission to a peer-reviewed journal. Based on his onsite research, he also submitted a technical report to the Upper Occoquan Service Authority, entitled *"Kenaf Addition for Intensification in a Municipal Wastewater Secondary Process."* During his M.S. studies, Mr. Roy received multiple awards and presented his research orally in professional conferences. We wish him every success in his future career endeavors.

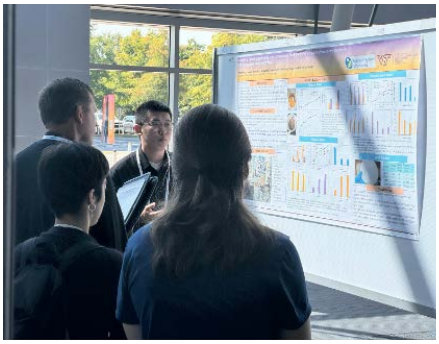
Ms. Zhangtong Liao started her Ph.D. study in in spring 2024. Before that, she received her M.S. in Environmental Engineering from National University of Singapore in 2023 and B.E. in Water Science and Engineering from Chongqing University in 2022. Zhangtong is researching low carbon nitrogen removal technologies that can be applied for municipal and aquaculture wastewater treatment.

Mr. Cyrus Li started his Ph.D. study in fall 2024. He received his B.E. in Biological Systems Engineering from Virginia Tech in May 2024. Cyrus is investigating novel methods for hydrothermal liquefaction wastewater treatment.

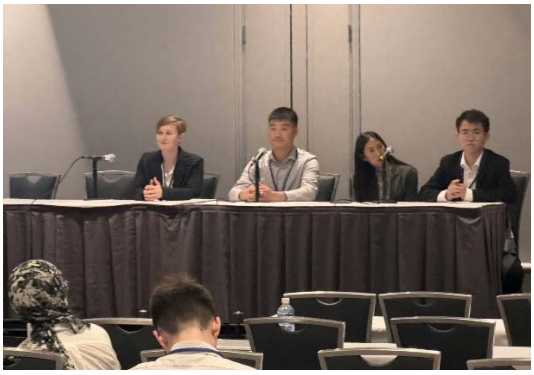
Mr. Mingxi Wang started his Ph.D. study in May 2024. Before that, he received his B.S. in Chemical Engineering from Guangdong Technion-Israel Institute of Technology in 2023. His primary research areas include the production of PHA bioplastics and dark fermentation. He is researching food waste conversion to bioplastics.

Mr. Kai Han started his lab technician role in Fall 2024. His research focus is on food waste characterization and project management. Before that he received his B.E in Food Science and Technology and Business Administration from Shanghai Jiao Tong University in 2003.

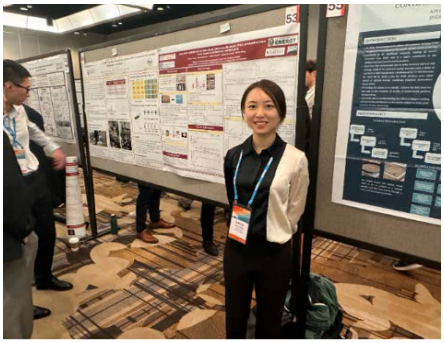
2024 Research Highlights



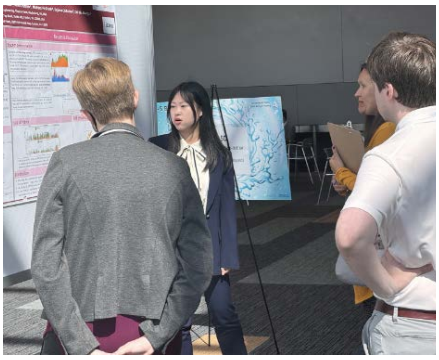
Pilot-scale bioplastic production: Mr. Mingxi Wang was showcasing how to produce bioplastics from various substrates in pilot-scale. His research provided the basis for the life cycle analysis and technoeconomic analysis required for full-scale application.



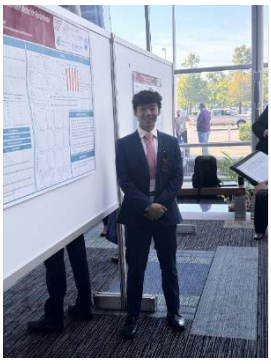
Panel discussion with industry experts: Dr. Jiefu Wang and Mr. Yitao Li were invited to the Thermal Hydrolysis Process Panel Discussion at WEF Innovation in Treatment Technology Conference to share their new research findings in downstream treatment of sludge thermal hydrolysis and hydrothermal liquefaction wastewater.



Long-term bioplastic production from food waste: Ms. Xueyao Zhang developed an innovative biotechnology that enables stable long-term production of bioplastics from food waste, effectively addressing two critical environmental challenges, namely food waste management and plastic pollution.

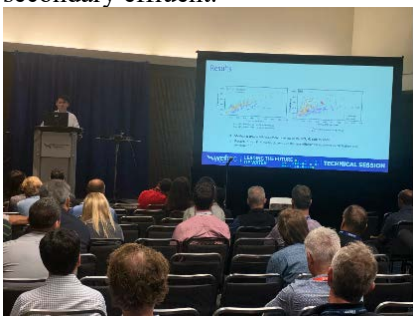


Partial denitrification anammox in MBBR: Ms. Zhangtong Liao was presenting kinetic mechanism of methanol-fed partial denitrification anammox in tertiary moving bed biofilm reactors fed with real secondary effluent.



Toxic wastewater remediation: Mr. Cyrus Li was presenting on novel methods to treat toxic compounds in hydrothermal liquefaction wastewater with the aim to upscale the technology from bench to pilot scale.

Rapid THP-digester startup: Mr. Yitao Li pushed the feed rate of THP-digesters beyond the industry "limits" to accelerate the startup phase, which potentially allow utilities to save costs and reach full processing capacity faster.



Mainstream anammox: Dr. Jiefu Wang was presenting the partial nitrification and dentrificaiton anammox (PANDA) technology that allows anammox to be applied in mainstream wastewater treatment.

Kenaf carrier: Mr. Pranta Roy focuses on sludge densification using kenaf carrier to provide an alternative to aerobic granular sludge for biomass retention and settleability improvement in Upper Occoquan Service Authority.

Catalytic destruction of PFAS at low temperatures: Mr. Yitao Li utilized a transition metal oxide-based catalyst to destruct PFAS compounds in municipal wastewater, which potentially is a game-changing technology for energy-efficient PFAS defluorination.

2024 New Equipment

In 2024, our lab significantly expanded its capabilities by investing a total of $273,202 in new equipment. This includes a 20-channel respirometer (Columbus Instruments) for measuring CO_2, O_2, CH_4, and N_2O kinetic data; a GC-MS and an HPLC for detailed analysis of microbial sample composition; a 7'×12' refrigerated trailer that can maintain feedstock samples between –18 °C and 10 °C during transport; a Sartorius SARTOFLOW tangential flow filtration system capable of processing 50 liters of sample in under an hour; a portable biogas analyzer for on-site quantification of H_2S, H_2, CH_4, CO_2, and O_2 gas composition; and a large incubator shaker with space for 20 one-liter flasks. Collectively, these acquisitions empower us to conduct more comprehensive and efficient research in biological waste valorization technology development and applications.

20-Channel Columbus Instruments Micro-Oxymax respirometer equipped with CO_2, O_2, CH_4, and N_2O sensors

Shimadzu GCMS-QP2010 SE System

Shimadzu LC-20 HPLC System

7'x12' refrigerated trailer (-18 ºC ~ 10 ºC)

Sartorius SARTOFLOW® Study Membrane Filtration System

Biogas 5000 Portable Analyzer with H_2S, H_2, CH_4, CO_2, O_2, temperature, and pressure probes

Thermo Scientific IntelliStack Incubator Shaker with a front down swing door and 690 x 1005 x 347 mm internal space

2024 Publications

Journal papers

1. Wang J.F., Sun Y.W., Khunjar W., Pace G., McGrath M., Chitrakar S., Taylor R.L., Carroll J.R., Zhang X.Y., Wang Z.W. (2024) Mechanistic understanding of the performance difference between methanol- and glycerol-fed partial denitrification anammox in tertiary moving bed biofilm reactors treating real secondary effluent. Water Research, 122893
DOI: https://doi.org/10.1016/j.watres.2024.122893
2. Zhang X.Y., An Z.H., Wang J.F., Lansing S., Amradi N.K., Haque M.S., Wang Z.W. (2024) Long-term effects of cycle time and volume exchange ratio on poly(3-hydroxybutyrate-co-3-hydroxyvalerate) production from food waste digestate by Haloferax mediterranei cultivated in sequencing batch reactors for 450 days. Bioresource Technology, 416, 131771
DOI: https://doi.org/10.1016/j.biortech.2024.131771
3. Liu M.C., Wang J.F., Umeda I., Wang Z.W., Kumar S., Zheng Y., (2024) Harnessing filamentous fungi and fungal-bacterial co-culture for biological treatment and valorization of hydrothermal liquefaction aqueous phase from corn stover. Bioresource Technology, 409, 131240
DOI: https://doi.org/10.1016/j.biortech.2024.131240
4. Wang, J., Sun, Y., Zhang, X., Khunjar, W., Bo, L., Winkler, M.K., Goel, R. and Wang, Z.W., (2024) Carbon-Efficient Nutrients Removal from Real Municipal Wastewater Under Conditions of Highly Variable Influent Quality and Low Temperature. Chemical Engineering Journal, 155268
DOI: https://doi.org/10.1016/j.cej.2024.155268
5. Zhao F., Wang Z.W., Huang H. (2024) Physical Cell Disruption Technologies for Intracellular Compound Extraction from Microorganisms. Processes, 12(10), 2059 https://doi.org/10.3390/pr12102059
6. Zhang X.Y., Wang J.F., Zhang Y.X., Qing W.H., Lansing S., Shi J., Zhang W., Wang Z.W. (2024) Anhydrous volatile fatty acid extraction through omniphobic membranes by hydrophobic deep eutectic solvents: mechanistic understanding and future perspective. Water Research, 257, 15, 121654
DOI: https://doi.org/10.1016/j.watres.2024.121654
7. Guo C.C., Ma Y.F., Li Y.T., Wang Z.W., Lin S.P., Dong R.J., Liu S. (2024) Effects of Hydrothermal Pretreatment and Anaerobic Digestion of Pig Manure on the Antibiotic Removal and Methane Production, Applied Biochemistry and Biotechnology.
DOI: https://doi.org/10.1007/s12010-024-04900-y
8. Lin S.P., Li Y.T., Guo C.C., Yang L.C., Ma Y.F., Dong R.J., Liu S. (2024) Effects of hydrothermal pretreatment on sulfadiazine degradation during two-stage anaerobic digestion of pig manure, Chemosphere.
DOI:
https://doi.org/10.1016/j.chemosphere.2024.143475
9. Aka R.J.N., Hossain M.M., Nasir A., Zhan Y.H., Zhang X.Y., Zhu J., Wang Z.W., Wu S. (2024) Enhanced Nutrient Recovery from Anaerobically Digested Poultry Wastewater through Struvite Precipitation by Organic Acid Pre-treatment and Seeding in a Bubble Column Electrolytic Reactor, Water Research, 252, 121239.
DOI: https://doi.org/10.1016/j.watres.2024.121239
10. Luo H., Zhang X.Y., Nguyen C., Taylor M., Wang Z.W. (2024) Effects of Carbon Diversion to Primary Sludge Production on Thermal Hydrolysis Pretreatment-Enhanced Anaerobic Digestion, Environmental Science: Water Research and Technology, 10, 677 – 687.
DOI: https://doi.org/10.1039/D3EW00695F

Dissertations & Thesis

1. Jiefu Wang (2024) Carbon-efficient Wastewater Treatment Through Resource Recovery, Process Intensification, and Partial Denitrification Anammox, https://hdl.handle.net/10919/119139
2. Pranta Roy (2024) Gravity selector-enabled kenaf recirculation and reuse as a renewable ballasting agent for sludge settleability enhancement in a municipal wastewater secondary process: A real wastewater pilot-scale study, https://hdl.handle.net/10919/124189

Conference Oral Presentations

1. Luo H., Zhang D., Taylor M., Nguyen C., Wang Z.W., Aeration in Sludge Holding Tanks as an Economical Means for Biosolids Odor Control-A Case Study. WEFTEC 2024, Oct 5-9, New Orleans, LA (**Invited Talk**)
2. Li Y.T., Zhang D., Burch R., Novak A., Wang Z.W. (2024) Effect of Thermal Hydrolysis Pretreatment on the Friability of Thermally-Dried Digested Biosolid Pellets. WEFTEC 2024, Oct 5-9, New Orleans, LA
3. Li Y.T., Nguyen C., Taylor M., Novak J., Wang Z.W. (2024) Filtrate rDON and Ortho-P Control through Coagulant Addition during Dewatering of THP-AD Sludge. WEFTEC 2024, Oct 5-9, New Orleans, LA
4. Li Y.T., Nguyen C., Taylor M., Novak J., Wang Z.W. (2024). Filtrate rDON and Ortho-P Control through Coagulant Addition during Dewatering of Thermal Hydrolysis Pretreatment-Enhanced Anaerobic Digestion Sludge. WaterJAM 2024, September 9-12, Virginia Beach, VA
5. Roy P., Angelotti B, Brooks M., Wang Z.W. (2024), Implementation of kenaf for intensification in a municipal wastewater secondary process. WaterJAM 2024, September 9-12, Virginia Beach, VA
6. Zhao F.J.Z., Haque M.S., Wang Z.W., Huang H.B. (2024) Recovery of Polyhydroxyalkanoates from *Haloferax mediterranei* utilizing glycerol waste. ACS 2024, Aug 18-22, Denver, CO

7. Liu M.C., Wang J.F., Umeda I., Wang Z.W., Kumar S., Zheng Y. (2024) Harnessing filamentous fungi and fungal-bacterial co-culture for biological treatment and valorization of hydrothermal liquefaction wastewater. ASABE Annual International Meeting. July 28 – 31, Anaheim, CA, USA
8. Liu M.C., Umeda I., Wang Z.W., Kumar S., Zheng Y. (2024) A comparative study on the biodegradability of aqueous phase from hydrothermal liquefaction of corn stover under varied temperature, residence time, and feedstock loading conditions. ASABE Annual International Meeting. July 28 – 31, Anaheim, CA, USA
9. Zhang X.Y., Hassanein A., Amradi N., Lansing S., Wang Z.W. (2024) Strategy for Haloferax Mediterranei-based PHA production from food waste. 2024 ASABE Annual International Meeting. July 28 – 31, Anaheim, CA, USA
10. Wang J.F., Zheng Y., Liu, M.C., Umeda. I., Kumar S., Wang Z.W. (2024)Biological Treatment of Hydrothermal Liquefaction Wastewater from Sewage Sludge with Municipal Wastewater Activated Sludge. WEF Innovations in Treatment Technology Conference 2024, May 21-24, Virginia Beach, VA
11. Wang J.F., Sun Y.W., Khunjar W., Pace G., McGrath M., Chitrakar S., Wang Z.W. (2024) Mechanistic Understanding of the Kinetic Difference Between the Methanol and Glycerol-Driven Partial Denitrification Anammox in Low Nitrogen Polishing Moving Bed Biofilm Reactors. WEF Innovations in Treatment Technology Conference 2024, May 21-24, Virginia Beach, VA
12. Li Y.T., Nguyen C., Taylor M., Novak J., Wang Z.W. (2024) Filtrate rDON and Ortho-P Control through Coagulant Addition during Dewatering of THP-AD Sludge. WEF Innovations in Treatment Technology Conference 2024, May 21-24, Virginia Beach, VA
13. Li Y.T., Zhang D., Burch R., Novak A., Wang Z.W. (2024) Effect of Thermal Hydrolysis Pretreatment on the Friability of Thermally-Dried Digested Biosolid Pellets. WEF Innovations in Treatment Technology Conference 2024, May 21-24, Virginia Beach, VA

Conference Poster Presentation

1. Li Y.T., Nguyen C., Taylor M., Novak J., Wang Z.W. (2024). Filtrate rDON and Ortho-P Control through Coagulant Addition during Dewatering of Thermal Hydrolysis Pretreatment-Enhanced Anaerobic Digestion Sludge. WaterJAM 2024, September 9-12, Virginia Beach, VA (**2nd Place Award**)
2. Roy P., Wang Z.W. (2024), Water Widget: The Next Gen Drinking Water Quality Assurance using ArcGIS. WaterJAM 2024, September 9-12, Virginia Beach, VA. (**3rd Place Award**)
3. Liao Z.T., Wang J.F., Sun Y.W., Khunjar W., Pace G., Pathak A., McGrath M., Chitrakar S., Wang Z.W.(2024), Kinetic mechanism of methanol-fed partial denitrification anammox in tertiary moving bed biofilm reactors fed with real secondary effluent. WaterJAM 2024, September 9-12, Virginia Beach, VA
4. Wang M.X., Zhao F.J.Z., Haque M.S., Zhang X.Y., Huang H.B., Kim Y.T., Wang Z.W. (2024), Potential of Haloferax mediterranei in conversion of food waste to Poly(3-hydroxybutyrate-co-3-hydroxyvalerate)-based bioplastics. WaterJAM 2024, September 9-12, Virginia Beach, VA
5. Li C., Wang J.F., Liu M., Zheng Y., Kumar S., Umeda I., Wang Z.W. (2024), Municipal Activated Sludge as a Highly Efficient Treatment Method for Hydrothermal Liquefaction Wastewater. WaterJAM 2024, September 9-12, Virginia Beach, VA (**3rd Place Award**)
6. Zhang X.Y., Amradi N., Hassanein A., McCoy E.L., Lansing S., Yates M.D., Wang Z.W. (2024), Enhancement of 3-Hydroxyvalerate fraction in poly(3-hydroxybutyrate-co-3-hydroxyvalerate) produced by Haloferax mediterranei fed with food waste digestate as a substrate. WaterJAM 2024, September 9-12, Virginia Beach, VA
7. Zhang X.Y., Hassanein A., Amradi N., Lansing S., Wang Z.W. (2024) Long-term stability of continuous PHA production from food waste by Haloferax mediterranei. 2024 ASABE Annual International Meeting. July 28 – 31, Anaheim, CA, USA

Technical Reports

1. Li Y. and Wang Z.W. (2024) Effects of coagulant and polymer dosing for recalcitrant dissolved organic nitrogen and orthophosphate control during dewatering of thermal hydrolysis pretreatment-enhanced anaerobic digester sludg. Submitted to Washington Suburban Sanitary Commission, Nov 1, 2024
2. Li Y. and Wang Z.W. (2024) Effects of the maximum feed rates on the startup, steady-state, and dewatering performance of Arlington County pilot-scale thermal hydrolysis pretreatment-enhanced mesophilic anaerobic digesters. Submitted to Arlington Water Pollution Control Bureau, July 1, 2024
3. Roy P. and Wang Z.W. (2024) Kenaf addition for intensification in a municipal wastewater secondary process. Submitted to Upper Occoquan Service Authority, March 31, 2024

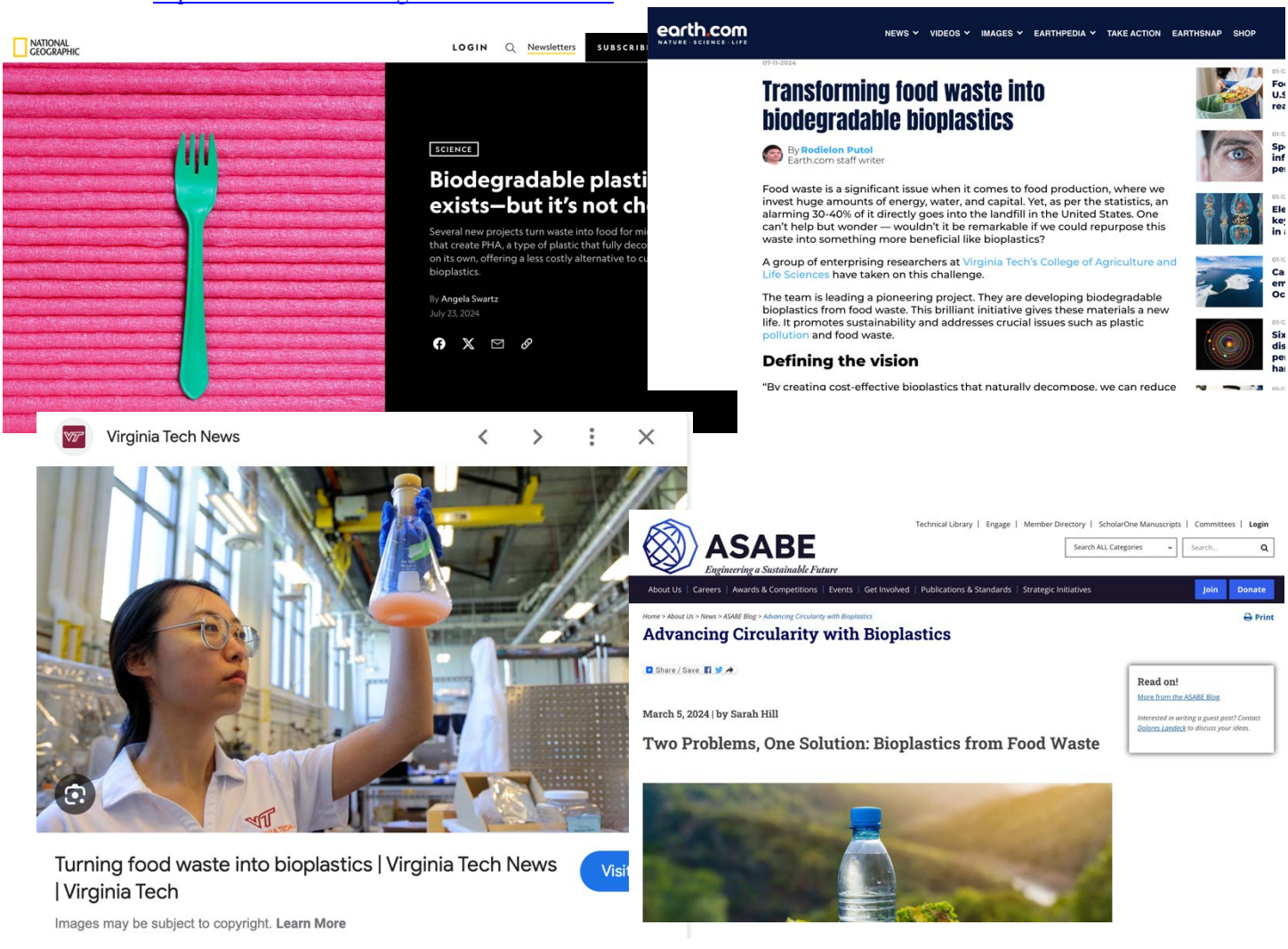
Patents

1. Wang Z.W., Kim Y.T., Huang H.B., Zhang X.Y., Zhao F. (2024) Method for producing polyhydroxyalkanoates from biomass (U.S. Patent No. 103418-001US), U.S. Patent and Trademark Office.

2024 Media Reports

In 2024, Dr. Wang's team received significant recognition for their innovative research in converting food waste into biodegradable bioplastics. Their work was featured in several prominent publications, including National Geographic, which discussed the challenges and advancements in bioplastic production. Virginia Tech News highlighted the team's development of cost-effective, sustainable bioplastics derived from food waste. The American Society of Agricultural and Biological Engineers' blog emphasized the team's role in advancing circularity through bioplastics. Earth.com reported on the environmental benefits of transforming food waste into biodegradable materials. Additionally, Chemistry & Industry magazine featured an article on innovative uses for food waste, including the team's research. This extensive media coverage has solidified Dr. Wang's team as leaders in waste valorization, enhancing their reputation within the scientific community and providing a strong foundation for future endeavors.

- **National Geographic Article:** Swartz, A. (2024, July 23). *Biodegradable plastic exists—but it's not cheap*. *National Geographic*. Retrieved from https://www.nationalgeographic.com/science/article/bioplastic-biodegradable-compostable-plastic-pha
- **Virginia Tech News Article:** Esterhuizen, M. (2024, June 5). *Virginia Tech researchers work to create biodegradable bioplastics from food waste*. *Virginia Tech News*. Retrieved from https://news.vt.edu/articles/2024/06/cals-bioplastics.html
- **ASABE Blog Post:** American Society of Agricultural and Biological Engineers. (n.d.). *Advancing circularity with bioplastics*. Retrieved from https://www.asabe.org/About-Us/News/ASABE-Blog/Advancing-Circularity-with-Bioplastics
- **Earth.com News Article:** Putol, R. (2024, July 11). *Transforming food waste into biodegradable bioplastics*. *Earth.com*. Retrieved from https://www.earth.com/news/transforming-food-waste-compost-into-biodegradable-bioplastics/
- **SCI Chemistry and Industry Article:** Reade, L. (2024). *Trash to treasure: Innovative uses for food waste*. *Chemistry & Industry*, (7-8). Retrieved from https://www.soci.org/chemistry-and-industry/cni-data/2024/7-8/trash-to-treasure-innovative-uses-for-food-waste
- **EurekAlert! Image:** Virginia Tech. (2024). *Fujunzhu Zhao, a Ph.D. student, works in Zhiwu "Drew" Wang's lab*. *EurekAlert!*. Retrieved from https://www.eurekalert.org/multimedia/1033611



2024 Wonderful Moments

Wang's team at a conference reception

Seafood gathering of Wang's team at Virginia Beach

Yitao and Dr. Wang in 2024 WEFTEC at New Orleans

Departmental beer gathering

Making dumpling in Wang's house

Wang's team in a trivia game

Xueyao got her white elephant

Yitao and Haiyi married in August. Their love story started from 2017 at NYU.

Suit up! Mr. Cyrus Li and Mr. Shashwat Dhanuka arrive in their "favorite" attires

Barbecue at Wang's House

2024 graduation ceremony in Lane Stadium

Xueyao in a Halloween costume

Yitao doing biosolids field research work