Yanzhe Zhu

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Education

California Institute of Technology   2020.06
Ph.D. in Environmental Science and Engineering. Advisor: Dr. Michael R. Hoffmann
California Institute of Technology   2017.06
M.S. in Environmental Science and Engineering. Advisor: Dr. Michael R. Hoffmann.
Washington University in St. Louis   2014.12
B.S. in Chemical Engineering. Minors: Environmental Engineering Science; Music.

Professional Experience

Postdoctoral Scholar   2021.1 – Present
Department of Environmental Science and Engineering   Pasadena, CA
Project: High-throughput enrichment and physiological study of deep-sea microbial symbioses PI: Dr. Victoria J. Orphan
- Establishing a high-throughput hydrogel bead-based enrichment pipeline targeting deep-sea archaea and bacteria for physiological investigation of their associated metabolic symbioses

Postdoctoral Scholar   2020.07 – 2020.12
Department of Environmental Science and Engineering   Pasadena, CA
Project: Development of a rapid nucleic acid quantification platform for SARS-CoV-2   PI: Dr. Michael R. Hoffmann
- Developed and optimized loop-mediated isothermal amplification (LAMP) assays
- Designed and optimized sequence-specific fluorescence probes (molecular beacons and QUASR probes)
- Established pretreatment methods for application on wastewater samples

Graduate Research Assistant   2016.01 - 2020.06
Department of Environmental Science and Engineering   Pasadena, CA
Project: 3D microfluidics for environmental pathogen detection and single cell analysis   PI: Dr. Michael R. Hoffmann
- Acquired microfluidic fabrication skills including photolithography, soft lithography, hot embossing, CNC milling, and 3D printing
- Developed a microfluidic chip for live versus dead differentiation of bacterial cells as a pretreatment for PCR
- Conducted simulation using COMSOL to guide the design and understanding of microfluidic devices
- Invented and optimized disposable centrifugal device simply using needles and microcentrifuge tubes for monodispersed droplet generation
- Conceived and developed a hydrogel bead-based platform for combining single-cell phenotypic analysis and *in situ* molecular detection

Graduate Research Assistant   2016.04 - 2017.04
Department of Geology   Pasadena, CA
Project: Hydraulic modeling of catastrophic flood on Mars   PI: Dr. Michael Lamb
- Learnt Linux operation system and Python programming
- Simulated catastrophic floods on Mars using Python-based Geoclaw software with topographic data of Athabasca Valley region
- Examined the brimful hypothesis and critical shear stress hypothesis in flood discharge rate estimation

Undergraduate Research Assistant   2014.01 - 2015.05
Environmental NanoChemistry Laboratory (ENCL), Washington University in St. Louis   St. Louis, MO
Project: Fate and Transport of CeO_2 Nanoparticles in Presence of Mn(II) and As(III)   PI: Dr. Young-Shin Jun
- Conducted independent research that has implications in the treatment of wastewater containing engineered nanoparticles and common pollutant ions
- Improved and implemented experiments monitoring the dissolution and settlement of cerium in various concentrations of Mn(II) and As(III) loading
- Characterized aqueous and solid phase composition
- Proposed mechanism interpreting the observed dissolution and settlement kinetics

- Mentored summer high school student on his project investigating fate and transport of cerium oxide nanoparticles in simultaneous presence of Fe(II) and Cr(VI)

Engineering Consultant   2014.01 - 2014.05
Interdisciplinary Environmental Clinic, School of Law, Washington University in St. Louis   St. Louis, MO
- Contributed engineering perspectives to an engineer-and-lawyer team
- Modeled the 3-dimensional view and section view of ash ponds and groundwater flow
- Analyzed groundwater level monitoring data to provide evidence of hazards underestimated at the time
- Facilitated negotiation with Missouri Department of Natural Resource on behalf of an environmental group

Process Technology Intern   2013.05 - 2013.08
SABIC Innovative Plastics   Mt. Vernon, IN
- Optimized a lab-scale purification unit by varying temperature, pressure, and organic to aqueous ratio
- Developed models with Aspen One and spreadsheet for real plant mass transfer performance prediction
- Contributed to the proposal of scaling up to the corresponding pilot plant

Undergraduate Research Assistant   2012.01 - 2013.05
Department of Chemistry, Washington University in St. Louis   St. Louis, MO
Project: pH Modeling and Synthesis of Metal Carbonates for Geological Carbon Sequestration   PI: Dr. Sophia Hayes
- Developed integrated non-ideal pH model incorporating Duan's CO_2 solubility model, Phreeqc and Supcrt92 for high ionic strength, high temperature, and high pressure in geological carbon sequestration condition.
- Predicted the aqueous phase composition and mineral formation to support experimental measurement, with the error much smaller than Geochemist Workbench.
- Assisted the design of computation methods to utilize ^{13}C NMR measurement as a basis for pH detection.
- Designed and conducted experiments on synthesis and characterization of magnesium and calcium minerals under modeled conditions.

Peer-Reviewed Publications

Google Scholar Profile

[10] **Yanzhe Zhu**, Xunyi Wu, Alan Gu, Leopold Dobelle, Clément A. Cid, Jing Li, and Michael R. Hoffmann. (2021) "Membrane-based in-gel Loop-Mediated Isothermal Amplification (mgLAMP) System for SARS-CoV-2 Quantification in Environmental Waters". *Environmental Science & Technology:* 56, 2, 862–873. https://doi.org/10.1021/acs.est.1c04623

[9] Alan Gu*, **Yanzhe Zhu***, Jing Li, and Michael R. Hoffmann. (2021) "Speech-generated aerosol settling time and viral viability predict COVID-19 transmission". *Environmental Science: Atmospheres,* 2, 34-35. https://doi.org/10.1039/d1ea00013f
* Equal contribution

[8] **Yanzhe Zhu**, Jing Li, Xingyu Lin, Xiao Huang, and Michael R. Hoffmann. (2021) "Single-cell phenotypic analysis and digital molecular detection linkable by a hydrogel bead-based platform". *ACS Applied Bio Materials*, 4, 3, 2664-2674. https://doi.org/10.1021/acsabm.0c01615

[7] Chelsea W. Neil, Xuanhao Wu, Doyoon Kim, Haesung Jung, **Yanzhe Zhu**, Jessica R. Ray, and Young-Shin Jun. (2021) "Arsenite oxyanions affect CeO_2 nanoparticle dissolution and colloidal stability." *Environmental Science: Nano*, 8, 233-244. https://doi.org/10.1039/D0EN00970A

[6] Jing Li, **Yanzhe Zhu**, Xunyi Wu, and Michael R. Hoffmann. (2020) "Rapid detection methods for bacterial pathogens in ambient waters at the point-of-sample collection: A brief review." *Clinical Infectious Diseases* 71, no. Supplement_2: S84-S90. https://doi.org/10.1093/cid/ciaa498

[5] Xunyi Wu, Xiao Huang, **Yanzhe Zhu**, Jing Li, Michael R. Hoffmann. (2020) "Synthesis and application of superabsorbent polymer microspheres for the concentration and quantification of microbial pathogens in ambient water." *Separation and Purification Technology*, 116540. https://doi.org/10.1016/j.seppur.2020.116540

[4] Siwen Wang, **Yanzhe Zhu**, Yang Yang, Jing Li, and Michael R. Hoffmann. (2020) "Electrochemical cell lysis of gram-positive and gram-negative bacteria: DNA extraction from environmental water samples." *Electrochimica Acta*, 135864. https://doi.org/10.1016/j.electacta.2020.135864

[3] Xingyu Lin, Xiao Huang, **Yanzhe Zhu**, Katharina Urmann, Xing Xie, and Michael R. Hoffmann. (2018) "Asymmetric membrane for digital detection of single bacteria in milliliters of complex water samples." *ACS nano.* 12, no. 10: 10281-10290. https://doi.org/10.1021/acsnano.8b05384

[2] **Yanzhe Zhu**, Xiao Huang, Xing Xie, Janina Bahnemann, Xingyu Lin, Xunyi Wu, Siwen Wang, and Michael R. Hoffmann. (2018) "Propidium monoazide pretreatment on a 3D-printed microfluidic device for efficient PCR determination of 'live versus dead' microbial cells". *Environmental Science: Water Research & Technology.* 4(7): 956-963. https://doi.org/10.1039/c8ew00058a
     * Featured as inside cover
     * Nominated for Best Papers from 2018 in the *Environmental Science* family of journals
[1] Andrew J. Surface, Fei Wang, **Yanzhe Zhu**, Sophia E. Hayes, Daniel E. Giammar, and Mark S. Conradi. (2015) "Determining pH at elevated pressure and temperature using in situ 13C NMR." *Environmental Science & Technology.* 49, no. 3: 1631-1638. https://doi.org/10.1021/es505478y

Conference Publications and Presentations

[8] Seminar talk. "Linking single cell phenotype with genotype by hydrogel bead-based platform". *Caltech ESE seminar: Current Problems in Environmental Science and Engineering*. December 2019, Pasadena, CA.

[7] Flash talk and poster. "Hydrogel bead-based platform for single-cell phenotypic analysis and digital molecular detection." *ACS Publications Symposium: Innovation in Materials Science and Technology*. November 2019, Singapore.

[6] Poster. "Development of a low-cost digital nucleic acid amplification test platform using hydrogel beads for environmental surveillance of *Salmonella* Typhi." Fall Poster Session of *Caltech Center for Environmental Microbial Interactions (CEMI)*. October 2019, Pasadena, CA.

[5] Conference oral presentation. "Development of a disposable centrifugal platform for hydrogel beads-based single-cell phenotypic and molecular analysis." *TechConnect World Innovation*. June 2019, Boston, MA.

[4] Poster. "Development of a low-cost digital nucleic acid amplification test platform using hydrogel beads for environmental surveillance of *Salmonella* Typhi." *11th International Conference on Typhoid and Other Invasive Salmonelloses*. March 2019, Hanoi, Vietnam.

[3] Seminar talk. "3D Microfluidic Solutions for Waterborne Pathogen Analysis." *Caltech Center for Environmental Microbial Interactions (CEMI)* Seminar. September 2018, Pasadena, CA.

[2] Seminar talk. "Microfluidic pathogen detection: live-dead differentiation and digital LAMP." *Caltech ESE seminar: Current Problems in Environmental Science and Engineering*. November 2017, Pasadena, CA.

[1] Poster. "Fate and transport of cerium oxide nanoparticles in aqueous system in presence of redox reactive Mn(II) and As(III)." *Washington University Undergraduate Research Symposium*. August 2014, St. Louis, MO.

Awards and Grants

Winner of WEF/CDC Challenge for SARS-CoV-2 detection in wastewater (Non-PCR group)	2022
Caltech Center for Environmental Microbial Interactions (CEMI) pilot grant	2020
Caltech Center for Environmental Microbial Interactions (CEMI) travel grant	2019
Caltech graduate student conference travel grant	2019
Washington University Undergraduate Summer Research Award	2014
Tau Beta Pi Engineering Honor Society	2013
AICHE Donald F. Othmer Sophomore Academic Excellence Award	2012

Teaching Experience

Teaching assistant, Caltech

• ESE 175: Physical Inorganic Chemistry of Natural Waters	2019.01 - 2019.03
• ESE 176: Physical Organic Chemistry of Natural Waters	2018.03 - 2018.06
• Ge 1: Earth and Environment	2017.03 - 2017.06

Mentorship

• Caris Lee, Westridge School	2020.07 - 2021.04
• Jennifer Zhang, Caltech	2016.06 - 2016.09
• Andrew Dong, Washing University in St. Louis	2014.06 - 2014.08

<u>Other Activities</u>

Harpist   2012.01 - 2015.05
Washington University in St. Louis   St. Louis, MO
- Performed the harp during rehearsals and concerts for Washington University Symphony Orchestra, Wind Ensemble, and Pops Orchestra.

Volunteer   2010.09 - 2013.05
Each One Teach One   St. Louis, MO
- Tutored students in Hamilton Elementary School in reading and math every week.