

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	2020.07 – 2020.12
Department of Environmental Science and Engineering Pasadena, CA	
<i>Project: Development of a rapid nucleic acid quantification platform for SARS-CoV-2</i>	PI: Dr. Michael R. Hoffmann
<ul style="list-style-type: none">Established and optimized loop-mediated isothermal amplification (LAMP) assaysDesigned and optimized sequence-specific fluorescence probes (molecular beacons and QUASR probes)Developed a novel workflow that enables user-friendly operations and in-gel reagent storageEstablishing pretreatment methods for application on wastewater samples	
Graduate Research Assistant	2016.01 - 2020.06
Department of Environmental Science and Engineering Pasadena, CA	
<i>Project: 3D microfluidics for environmental pathogen detection and single cell analysis</i>	PI: Dr. Michael R. Hoffmann
<ul style="list-style-type: none">Acquired microfluidic fabrication skills including photolithography, soft lithography, hot embossing, CNC milling, and 3D printingDeveloped a microfluidic chip for live versus dead differentiation of bacterial cells as a pretreatment for PCRConducted simulation using COMSOL to guide the design and understanding of microfluidic devicesInvented and optimized disposable centrifugal device simply using needles and microcentrifuge tubes for monodispersed droplet generationDeveloped a novel hydrogel bead-based platform for combining single-cell phenotypic analysis and <i>in situ</i> molecular detectionDesigned gravity-driven acoustic fluorescence-based sorting system for beads sorting with affordable instrumentation, user-friendly operation, and low contamination risk	
Graduate Research Assistant	2016.04 - 2017.04
Department of Geology Pasadena, CA	
<i>Project: Hydraulic modeling of catastrophic flood on Mars</i>	PI: Dr. Michael Lamb
<ul style="list-style-type: none">Learnt Linux operation system and Python programmingSimulated catastrophic floods on Mars using Python-based Geoclaw software with topographic data of Athabasca Valley regionExamined 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	
<i>Project: Fate and Transport of CeO₂ Nanoparticles in Presence of Mn(II) and As(III)</i>	PI: Dr. Young-Shin Jun
<ul style="list-style-type: none">Conducted independent research that has implications in the treatment of wastewater containing engineered nanoparticles and common pollutant ionsImproved and implemented experiments monitoring the dissolution and settlement of cerium in various concentrations of Mn(II) and As(III) loadingCharacterized aqueous and solid phase compositionProposed mechanism interpreting the observed dissolution and settlement kineticsMentored 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 CO₂ 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 ¹³C 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

- [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*. In press.
- [7] Chelsea W. Neil, Xuanhao Wu, Doyoon Kim, Haesung Jung, **Yanzhe Zhu**, Jessica R. Ray, and Young-Shin Jun. (2021) "Arsenite oxyanions affect CeO₂ nanoparticle dissolution and colloidal stability." *Environmental Science: Nano*. <https://doi.org/10.1039/DOEN00970A>
- [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 Salmonellosis*. 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

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

Other Activities

Harpist

Washington University in St. Louis 2012.01 - 2015.05
St. Louis, MO

- Performed the harp during rehearsals and concerts for Washington University Symphony Orchestra, Wind Ensemble, and Pops Orchestra.

Volunteer

Each One Teach One 2010.09 - 2013.05
St. Louis, MO

- Tutored students in Hamilton Elementary School in reading and math every week.