

Wangbiao Guo, Ph.D.

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Education

- 2021 Ph.D. Energy and Environmental Engineering, State Key Laboratory of Clean Energy Utilization and Center of Cryo-Electron Microscopy, Zhejiang University, China
- 2016 B.S. Safety Engineering, China University of Mining and Technology, China

Research Experience

- 9/21-present Postdoctoral Associate, Lab of Prof. Jun Liu, Microbial Sciences Institute, Department of Microbial Pathogenesis, Yale School of Medicine, New Haven, CT
Research focus: *in situ* cryo-electron tomography (cryo-ET), cryo-focused ion beam (cryo-FIB) milling of living microbes
- 9/19-/3/20 Postgraduate Fellow, Lab of Prof. Jun Liu, Microbial Sciences Institute, Department of Microbial Pathogenesis, Yale School of Medicine, New Haven, CT
Research focus: cryo-electron tomography, cryo-focused ion beam milling of microalgal cells (*Chlorella*, *Nannochloropsis salina*, *et al*)
- 9/18-6/21 Ph.D. student, Lab of Prof. Xing Zhang, Center of Cryo-Electron Microscopy Zhejiang University, China
Research focus: focused ion beam scanning electron microscopy (FIB-SEM) of high-pressure frozen *Chlorella pyrenoidosa* cells.
- 9/16-6/21 Ph.D. student, Lab of Prof. Jun Cheng, State Key Laboratory of Clean Energy Utilization, Zhejiang University, China
Research focus: Bio-engineering technology development of flue gas CO₂ fixation by microalgal cells: microalgal mutation by nuclear radiation, photobioreactor design for microalgal cultures, large-scale engineering processes of microalgal CO₂ fixation.

Bibliography

Selected Publications

1. **Guo, W.**, Feng, L., Wang, Z., Guo, J., Park, D., Carroll, B. L., . . . Cheng, J. (2022). In-situ high-resolution 3D imaging combined with proteomics and metabolomics reveals enlargement of subcellular architecture and enhancement of photosynthesis pathways in nuclear-irradiated *Chlorella pyrenoidosa*. *Chemical Engineering Journal*, 430, 133037.
2. Ye, Q., Shen, Y., Zhang, Q., Wu, X., & **Guo, W.***. (2022). Life-cycle assessment of flue gas CO₂ fixation from coal-fired power plant and coal chemical plant by microalgae. *Science of The Total Environment*, 848, 157728. (Corresponding author)
3. **Guo, W.**, Cheng, J., Ali, K. A., Kumar, S., & Guo, C. (2020). Conversion of NaHCO₃ to Na₂CO₃ with a growth of *Arthrospira platensis* cells in 660 m² raceway ponds with a CO₂ bicarbonation absorber. *Microbial Biotechnology*, 13(2), 470-478.
4. **Guo, W.**, Cheng, J., Liu, S., Feng, L., Su, Y., & Li, Y. (2020). A novel porous nickel-foam filled CO₂ absorptive photobioreactor system to promote CO₂ conversion by microalgal biomass. *Science of The Total Environment*, 713, 136593.
5. **Guo, W.**, Cheng, J., Song, Y., Kumar, S., Ali, K. A., Wang, Y., . . . Yang, W. (2020). Improving flashing light frequency and CO₂ fixation rate with vortex movement of algal cells in raceway pond with conic baffles. *Chemical Engineering Science*, 216, 115536.
6. **Guo, W.**, Cheng, J., Song, Y., Kumar, S., Ali, K. A., Guo, C., & Qiao, Z. (2019). Developing a CO₂ bicarbonation absorber for promoting microalgal growth rates with an improved photosynthesis pathway. *RSC Advances*, 9(5), 2746-2755.

7. **Guo, W.**, Cheng, J., Song, Y., Liu, S., Ali, K. A., & Kumar, S. (2019). Three-dimensional numerical simulation of light penetration in an optimized flow field composed of microalgae cells, carbon dioxide bubbles and culture medium. *Bioresource Technology*, 292, 121979.
8. Cheng, J., **Guo, W.**, Ali, K. A., Ye, Q., Jin, G., & Qiao, Z. (2018). Promoting helix pitch and trichome length to improve biomass harvesting efficiency and carbon dioxide fixation rate by *Spirulina sp.* in 660 m² raceway ponds under purified carbon dioxide from a coal chemical flue gas. *Bioresource Technology*, 261, 76-85. (advisor)
9. Cheng, J., **Guo, W.**, Cai, C., Ye, Q., & Zhou, J. (2018). Alternatively permutated conic baffles generate vortex flow field to improve microalgal productivity in a raceway pond. *Bioresource Technology*, 249, 212-218. (advisor)
10. Cheng, J., **Guo, W.**, Song, Y., Kumar, S., Ali, K. A., & Zhou, J. (2018). Enhancing vorticity magnitude of turbulent flow to promote photochemical efficiency and trichome helix pitch of *Arthrospira platensis* in a raceway pond with conic baffles. *Bioresource Technology*, 269, 1-8. (advisor)
11. Wang, H., **Guo, W.**, Zheng, C., Wang, D., & Zhan, H. (2017). Effect of temperature on foaming ability and foam stability of typical surfactants used for foaming agent. *Journal of Surfactants and Detergents*, 20(3), 615-622. (advisor)

Additional Publications

1. Carroll, B. L., Nishikino, T., **Guo, W.**, Zhu, S., Kojima, S., Homma, M., & Liu, J. (2020). The flagellar motor of *Vibrio alginolyticus* undergoes major structural remodeling during rotational switching. *elife*, 9, e61446.
2. Cheng, J., Lai, X., Ye, Q., **Guo, W.**, Xu, J., Ren, W., & Zhou, J. (2019). A novel jet-aerated tangential swirling-flow plate photobioreactor generates microbubbles that enhance mass transfer and improve microalgal growth. *Bioresource Technology*, 288, 121531.
3. Cheng, J., Lai, X., Ye, Q., **Guo, W.**, & Zhou, J. (2020). Numerical simulation on optimizing flow field and flashing-light effect in jet-aerated tangential swirling-flow plate photobioreactor to improve microalgal growth. *Chemical Engineering Science*, 215, 115371.
4. Cheng, J., Liu, S., **Guo, W.**, Song, Y., Kumar, S., Kubar, A. A., . . . Li, Y. (2021). Developing staggered woven mesh aerator with three variable-micropore layers in recycling water pipeline to enhance CO₂ conversion for improving *Arthrospira* growth. *Science of The Total Environment*, 760, 143941.
5. Cheng, J., Miao, Y., **Guo, W.**, Song, Y., Tian, J., & Zhou, J. (2018). Reduced generation time and size of carbon dioxide bubbles in a volute aerator for improving *Spirulina sp.* growth. *Bioresource Technology*, 270, 352-358.
6. Cheng, J., Song, Y., **Guo, W.**, Miao, Y., Chen, S., & Zhou, J. (2019). Developing microporous fibrous-diaphragm aerator to decrease bubble generation diameter for improving microalgal growth with CO₂ fixation in a raceway pond. *Bioresource Technology*, 276, 28-34.
7. Cheng, J., Song, Y., Miao, Y., **Guo, W.**, Wang, Y., Li, X., . . . Zhou, J. (2019). Three-stage shear-serrated aerator broke CO₂ bubbles to promote mass transfer and microalgal growth. *ACS Sustainable Chemistry & Engineering*, 8(2), 939-947.
8. Kubar, A. A., Cheng, J., **Guo, W.**, Kumar, S., & Song, Y. (2020). Development of a single helical baffle to increase CO₂ gas and microalgal solution mixing and *Chlorella* PY-ZU1 biomass yield. *Bioresource Technology*, 307, 123253.
9. Kumar, S., Cheng, J., **Guo, W.**, Ali, K. A., & Song, Y. (2019). Self-rotary propellers with clockwise/counterclockwise blades create spiral flow fields to improve mass transfer and promote microalgae growth. *Bioresource Technology*, 286, 121384.
10. Kumar, S., Cheng, J., Kubar, A. A., **Guo, W.**, Song, Y., Liu, S., . . . Tian, J. (2021). Orange light spectra filtered through transparent colored polyvinyl chloride sheet enhanced pigment content and growth of *Arthrospira* cells. *Bioresource Technology*, 319, 124179.
11. Song, Y., Cheng, J., **Guo, W.**, Liu, S., Zhang, L., Kumar, S., & Ali, K. A. (2020). Microporous diaphragm aerator improves flue gas CO₂ dissolution and photosynthetic characteristics of *Arthrospira* cells in 660 m² raceway ponds. *ACS Sustainable Chemistry & Engineering*, 8(31), 11558-11568.
12. Song, Y., Cheng, J., Lai, X., **Guo, W.**, & Yang, W. (2021). Developing a three-dimensional tangential swirl plate photobioreactor to enhance mass transfer and flashlight effect for microalgal CO₂ fixation. *Chemical Engineering Science*, 244, 116837.
13. Song, Y., Cheng, J., Miao, Y., **Guo, W.**, & Zhou, J. (2021). SO₂ Impurity in Simulated Flue Gas with 15% CO₂ Affects Dynamic Bubble Dissolution and *Arthrospira* Photosynthetic Growth. *ACS Sustainable Chemistry & Engineering*, 9(16), 5580-5589.
14. Ye, Q., Cheng, J., **Guo, W.**, Xu, J., Li, H., & Zhou, J. (2018a). Numerical simulation on promoting light/dark cycle frequency to improve microalgae growth in photobioreactor with serial lantern-shaped draft tube. *Bioresource Technology*, 266, 89-96.
15. Ye, Q., Cheng, J., **Guo, W.**, Xu, J., Li, K., & Zhou, J. (2018b). Serial lantern-shaped draft tube enhanced flashing light effect for improving CO₂ fixation with microalgae in a gas-lift circumflux column photobioreactor. *Bioresource Technology*, 255, 156-162.

16. Ye, Q., Cheng, J., Liu, S., Qiu, Y., Zhang, Z., **Guo, W.**, & An, Y. (2020). Improving light distribution and light/dark cycle of 900 L tangential spiral flow column photobioreactors to promote CO₂ fixation with *Arthrospira* sp. cells. *Science of The Total Environment*, 720, 137611.

Specialized Skills

Cryo-Electron Tomography:

FIB milling (Aquilos 1 and 2, ThermoFisher), cryo-correlative light and electron microscopy (cryo-CLEM, Leica), data collection (FEI Polara, Krios, Glacios), cryo-ET data processing, subtomogram averaging (i3, EMAN2), 3D modeling (Chimera, Amira, IMOD, EMAN2)

Technology of flue gas CO₂ fixation by microalgae:

Microalgae cultures, photobioreactor design, computational fluid dynamics (CFD) simulation (FLUENT, Ansys)

Honors and Awards

2021 Zhejiang Province Award for Excellent Doctoral Graduate, China

2020 Zhejiang University Academic Award for Outstanding Doctoral Candidates, China

2019 Zhejiang University Outstanding Graduate Student, China

Talks and Posters

11/22 **Selected Speaker:** 9th Semi-Annual New England Cryo-EM Symposium, Boston, Harvard Medical School, “Capturing the structural dynamics of the bacterial flagellar motor”

10/22 Speaker: Postdoctoral Research in Progress Seminar Series, Department of Microbial Pathogenesis, Yale School of Medicine, “*In-situ* structural basis of flagellar-based motility”

9/22 **Selected speaker:** Gordon Research Conferences of Sensory Transduction in Microorganisms, California, “*In-situ* structural basis of how bacteria control flagellar motility”

9/22 Poster: Annual Microbiology Retreat, Yale School of Medicine, “*In-situ* structural basis of how bacteria control flagellar motility”

4/22 Speaker: Annual Yale Microbial Sciences Institute Retreat, “How do spirochetes swim?”

11/21 **Selected Speaker:** 7th Semi-Annual New England Cryo-EM Symposium (virtual), “Combination of FIB-SEM and cryo-FIB/cryo-ET achieves *in-situ* 3D imaging of the subcellular architecture in *Chlorella pyrenoidosa*”

11/20 **Best Presentation Award:** 2nd Beihang International Forum for Young Scientists, Ningbo, China, “Photobioreactor development for improving CO₂ fixation from coal-fired power plant flue gas by microalgae”

Ad hoc journal reviewer and editor

2019-22 Chemical Engineering Journal, Bioresource Technology, Water Management, Algal Research, ACS Sustainable Chemistry & Engineering

2/22 Guest Associate Editor, *Frontiers in Marine Science*

Membership and Service

2023 Committee, Yale Microbial Sciences Institute Annual Retreat

2022 Committee, Yale Microbiology Seminar Series

2022 Committee, Yale Microbial Sciences Institute Annual Postdoctoral Retreat

2022 Student member, International Society of Photosynthesis Research

2017-21 Ph.D. mentor for Ph.D. candidates: Yanmei Song, Santosh Kumar, Kubar Ameer Ali, and Lingchong Feng, M.S. student Shuzheng Liu, Zhejiang University, China

Complete List of Published Work in MyBibliography

<https://www.ncbi.nlm.nih.gov/myncbi/wangbiao.guo.1/bibliography/public/>