Applying Biosorption for Rare Earth Element Recovery from Low-Grade Sources

YONGQIN JIAO[1*], DAN PARK[1], HONGYUE JIN[2], AARON BREWER[1], ELLIOT CHANG[3], LAURA LAMMERS[3], DAVID REED[4] AND JOHN SUTHERLAND[2]

[1]Lawrence Livermore National Laboratory, Livermore, CA, (*correspondence: jiao1@llnl.gov)
[2]Purdue University, West Lafayette, IN
[3]UC Berkeley, Berkeley, CA
[4]Idaho National Laboratory, Idaho Falls, ID

There is an ever-increasing demand for rare earth elements (REEs) in renewable energy, consumer products, and defence and national security applications. Low-grade REE resources in the U.S., such as mine tailings, geothermal brines, and coal byproducts, are abundant and offer an attractive non-traditional alternative for obtaining REEs. Due to the uncertainty in the global REE supply chain, there is an urgent need for the development of new technologies that enable cost-effective recovery of REEs from these feedstocks. To address this need, we have developed an innovative biotechnology that relies on bacterial native cell surface functional groups and incorporates enhanced bioengineered features to sequester REEs from low-grade sources [1, 2]. Technology features and initial performance of batch scale tests with various low-grade feedstocks will be described, followed by scalability and chemical engineering approaches towards a flow through operation. Finally, preliminary predictions [3] on the economic viability of integrating a biosorption approach into an industrial scale REE recovery process will be discussed.

[1] Park et al. (2016) *Environ. Sci. Technol.*, 50 (5), pp 2735–2742. [2] Park et al. (2017). *Environ. Sci. Technol.*, 51 (22), pp 13471–13480. [3] Jin, et al. (2017) *ACS Sustainable Chem. Eng.*, 5 (11), pp 10148–10155