



Environmental Engineering & Sciences

Department of Civil and Environmental Engineering
Spring '24: CEE 595AG Seminar

Friday, April 19, 2024 | 10:00 – 10:50 a.m. CST | 3310 Yeh Center

Engineering Functional Biomaterials to Advance Environmental and Resource Sustainability

Recovering resources from waste streams offers a sustainable solution to combatting the escalating scarcity of resources and the mounting environmental impact of waste on our planet. A significant obstacle lies in effectively extracting or converting desired resources from complex waste mixtures into recoverable forms. In recent years, protein-based biosorption and biocatalysis have emerged as promising alternatives to conventional methods due to their inherent benefits such as strong substrate affinity, selectivity, rapid adsorption kinetics, potent enzyme catalytic activity, and minimal energy/chemical requirements. The ability to engineer and manipulate proteins opens avenues for creating innovative biomaterials with tailored functionalities to tackle pressing environmental and resource sustainability issues.

The overarching objective of this study was to develop novel protein-based biosorbents and enzyme-based biocatalysts for resource recovery, separation, and conversion applications. This presentation will delve into three key aims of the research: (1) designing a novel magnetic nanoplatform for protein immobilization; (2) evaluating the potential applications of this magnetic nanoplatform by fabricating protein-based biosorbents to selectively recover and efficiently separate rare earth elements (REEs); (3) engineering renewable enzyme biocatalysts for the conversion and recovery of phosphates from biorefinery waste streams. The findings from this study contribute to the advancement of innovative biosorptive and biocatalytic technologies aimed at addressing crucial resource recovery challenges and facilitating the sustainable management of phosphorus and rare earth elements in human activities, thereby fostering a more sustainable Earth.

2024 Engelbrecht Fellowship Recipient

Quanhui Ye
PhD Candidate (Advisor Na Wei)



Quanhui Ye is a 5th Ph.D. candidate working with Dr. Na Wei. He obtained his Master's degree in Environmental Engineering from Tsinghua University. His research lies in the intersection between environmental engineering and synthetic biology, with a particular focus on repurposing proteins/enzymes for designing and engineering new types of functional biomaterials for resource recovery and waste-to-value transformation applications, and the long-term goal of his research is to contribute to achieving environmental and resource sustainability by harnessing the power of synthetic biology and protein engineering. Outside the lab, he enjoys playing with his 1-year-old kid, listening to podcast, playing basketball, and gardening with his wife.