

Interdisciplinary Efforts to Transform Waste into Valuable Products for a Circular Economy

Prof. Jikai Zhao
Department of Biological and Agricultural Engineering
Kansas State University
Manhattan, KS 66506

Abstract: My group develops integrated biological, chemical, and materials-based approaches to convert renewable feedstocks into valuable chemicals, functional materials, and food products, contributing to a circular bioeconomy. This seminar will delve into three interconnected research directions. First, I'll discuss biochemical conversion strategies for producing platform chemicals from agricultural biomass and food waste. For instance, we're exploring the production of 3-hydroxypropionic acid from biomass hydrolysates and itaconic acid from kitchen food waste. Second, I'll present approaches for developing gel-based precursor resins through cellulose modification and polymer synthesis, which have potential applications in advanced manufacturing. Third, I'll describe the valorization of food and agricultural processing waste into high-value products, such as cider, functional ingredients, low-calorie tagatose, and low-glycemic-index foods. Looking ahead, my research aims to advance mechanistic understanding and process engineering while incorporating technoeconomic and life-cycle considerations to translate laboratory innovations into scalable and sustainable biomanufacturing practices.

Biosketch: Jikai Zhao is an Assistant Professor in the Department of Biological and Agricultural Engineering at Kansas State University. His research focuses on converting agricultural biomass and food-processing byproducts into value-added platform chemicals, functional materials, and food ingredients. Beyond his research, Zhao is committed to enhancing STEM education by providing hands-on experiential learning opportunities and hosting virtual seminars for undergraduate students. He firmly believes that we should not only focus on our own matters but also consider others. Since 2024, Zhao has secured over \$16 million in funding from the USDA, NSF, and EPA in collaboration with colleagues from precision agriculture, water treatment, materials science, and AI. Furthermore, he actively participates in professional leadership roles through ASABE and IFT, including serving as Chair of ASABE's bioprocess startup competition, Vice Chair of ASABE's circular bioeconomy systems institute working team 3, and Chair of the IFT's biotechnology division in 2025–2026.

