

Transforming agricultural waste into high-value bioproducts using subcritical water and supercritical carbon dioxide technologies

Abstract:

The global transition toward a sustainable, biobased economy requires innovative, environmentally responsible technologies that transform agricultural residues into high-value bioproducts. This seminar will highlight our efforts in developing green process engineering strategies that integrate subcritical water and supercritical carbon dioxide (SC-CO₂) technologies for cleaner, scalable, and efficient biomass and food processing. Specifically, the seminar will present how lignocellulosic biomass can be fractionated using subcritical water processing to produce cellulose-enriched streams, from which cellulose nanofibers, hydrogels, and aerogels with tunable structural and functional properties are obtained. These lightweight, porous, and biodegradable biostructures show strong potential for applications in food packaging, coatings, and tissue engineering. Complementing this work, the use of enzymatic biocatalysis in SC-CO₂ to synthesize phenolic lipids will be discussed, yielding antioxidant-rich molecules with enhanced oxidative stability and bioactivity. Together, these studies demonstrate how clean, solvent-free technologies can replace conventional chemical routes while enabling the design of high-performance biobased materials. Ultimately, these approaches advance a unified vision for circular bioprocessing, transforming agricultural byproducts into next-generation food, material, and health innovations that drive the bioeconomy forward.

Background:

Dr. Deniz Ciftci is an Assistant Professor of Practice in the Department of Food Science and Technology at the University of Nebraska–Lincoln (UNL). Her research focuses on value-added processing of food and agro-industrial byproducts to create bionanomaterials and biobased chemicals using clean, sustainable technologies such as subcritical water and supercritical CO₂ processing. She earned her Ph.D. in Bioresource and Food Engineering from the University of Alberta and completed postdoctoral research at UNL. She received her B.S. and M.S. in Food Engineering from Gaziantep University. Her research was supported by USDA NIFA and UNL Research Council. She worked as an industry expert to support Small and Medium-sized Enterprises' R&D, supported by the European Commission, and was recognized with awards such as the University of Alberta Graduate Teaching Award and Alberta Innovates Graduate Scholarship. At UNL, she teaches Food Chemistry, Advanced Food Analysis, and Sustainable Food Transformation.



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