NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

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Rethinking Food Protein Waste

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Abstract

For each kilogram of food protein wasted, between 15 and 750 kg of CO_2 end up in the atmosphere. With this alarming carbon footprint, food protein waste not only contributes to climate change but also significantly impacts other environmental boundaries, such as nitrogen and phosphorus cycles, global freshwater use, change in land composition, chemical pollution, and biodiversity loss. This contrasts sharply with both the high nutritional value of proteins, as well as their unique chemical and physical versatility, which enable their use in new materials and innovative technologies. In this talk, I will discuss how food protein waste can be efficiently valorized not only by reintroduction into the food chain supply but also as a template for the development of sustainable technologies by allowing it to exit the food-value chain, thus alleviating some of the most urgent global challenges. I will showcase three technologies of immediate significance and environmental impact: biodegradable plastics, water purification, and renewable energy, and present original life cycle assessment (LCA) examples run ad hoc on both plant and animal waste proteins in the context of the technologies considered. I will finally conclude with an outlook on how such a comprehensive management of food protein waste is anticipated to transform its carbon footprint from positive to negative and, more generally, have a favorable impact on several other important planetary boundaries.

Biography

Raffaele Mezzenga received his master degree (Summa Cum Laude) from Perugia University, Italy, in Materials Science and Engineering, while actively working for the European Center for Nuclear Research (CERN) and NASA on elementary particle-polymer interactions (NASA Space Shuttle Discovery mission STS91). In 2001 he obtained a PhD in Polymer Physics from EPFL Lausanne, focusing on the thermodynamics of reactive polymer blends. He then spent 2001-2002 as a postdoctoral scientist at University of California, Santa Barbara, working on the self-assembly of polymer colloids. In 2003 he moved to the Nestlé Research Center in Lausanne as research scientist, working on the self-assembly of surfactants, natural amphiphiles and lyotropic liquid crystals. In 2005 he was hired as Associate Professor in the Physics Department of the University of Fribourg, and he then joined ETH Zurich on 2009 as Full Professor. In 2016 he founded BluAct Technologies, an ETH Spinoff exploiting a revolutionary technology for water purification, where he currently serves as Chief Scientific Officer. His research focuses on the fundamental understanding of self-assembly processes in polymers, lyotropic liquid crystals, food and biological colloidal systems. Prof. Mezzenga has been a visiting Professor from Helsinki University of Technology (now Aalto University), Nanyang Technological University, Monash University and RMIT Melbourne. He is recipient of several international distinctions such as the 2011 AOCS Young Scientist Research Award [citation: "For his pioneering work on polymers, colloids and liquid crystals"], the 2013 John H. Dillon Medal and the 2017 Fellowship of the American Physical Society [citation: "For exceptional contributions to the understanding of self-assembly principles and their use to design and control materials with targeted functionalities"], the Biomacromolecules/Macromolecules 2013 Young Investigator Award of the American Chemical Society [citation: “In recognition of his outstanding contributions to the fundamental understanding of self-assembly processes in polymers and biological colloidal systems”], and the 2004 Swiss Science National Foundation Professorship Award.