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The Role of Bio-Based Colloids in Gelation Technologies and Green Interfaces

In this talk, I will present emblematic cases from our recent work that illustrate the potential of biobased colloids derived from plant and ocean biomass and residues, including lignin and tannin particles as well as fibrillated polysaccharides. These materials demonstrate their suitability for tailoring surface chemistry, size and shape, which is critical for designing supraparticle assemblies, relevant to coatings, carbon capture and other applications. The correlation between particle size and physicochemical characteristics—such as molar mass, surface charge, and functional groups—is highlighted as a key strategy for identifying (nano)technological applications that leverage the functionality and cost-effectiveness of biogenic particles. Additionally, I will discuss processing routes that convert low-value residual biomass into all-green materials, showcasing their recyclability and biodegradability. These materials address challenges related to circularity and the end-of-life limitations of non-renewable products. Given the low cost of raw materials, their inherent microstructural design, and natural self-adhesion, this work demonstrates fully sustainable alternatives to fossil carbon-based products. The success of these technologies hinges on our ability to control water interactions and gelation phenomena, paving the way for broader adoption in sustainable material systems.

Professor Orlando J. Rojas is the Canada Excellence Research Chair at the University of British Columbia and Director of the BioProducts Institute. His research focuses on bio-based materials and soft matter, and he is internationally recognized for pioneering contributions to renewable materials science.

He has received several prestigious honors, including the **Anselme Payen Award**, the highest distinction in cellulose and renewable materials research. He is an elected **Fellow of the American Chemical Society (2013)**, the **Finnish Academy of Science and Letters (2017)**, and **TAPPI (2025)**.

Earlier in his career, Prof. Rojas served as a **Finland Distinguished Professor** and was named an inaugural **Faculty Scholar at North Carolina State University (NCSU)**. While at Aalto University, he was awarded a **European Research Council (ERC) Advanced Grant**, one of Europe's most competitive research awards. He is currently **Visiting Professor at Aalto University** and **Adjunct Professor in the Department of Chemical and Biomolecular Engineering at NCSU**. His recent appointments also include honorary guest professorships at **Mid-Sweden University**, the **University of Natural Resources and Life Sciences (Austria)**, **Universiti Putra Malaysia**, and several universities in Asia.

Prof. Rojas maintains active collaborations with institutions across **Europe, the Americas, and Asia**. He serves on the **Selection Committee of the Marcus Wallenberg Foundation** and advises industries and research organizations including the **Max Planck Institute of Colloids and Interfaces**, the **VALUED Program** (Imperial College London, University of Bristol, University of Cambridge), and the **Materials Institute of the University of Santiago de Compostela**. His research program has secured multi-million-dollar support from industry and government agencies, sustaining an annual budget exceeding **$2 million**.

He is **Emeritus Editor of the Journal of Dispersion Science and Technology** and **Associate Editor of ACS Biomacromolecules**. Over his career, he has supervised **55 postdoctoral fellows, 69 PhD students, and 51 MS students**, and has hosted more than **138 international visiting scholars**, including sabbatical professors.

With an **h-index of 109 (Sept. 2025)** and over **54,000 citations** (Google Scholar), Prof. Rojas has authored about **650 peer-reviewed papers** and numerous conference contributions. Since 2022, he has been consistently ranked among the **top 1% of researchers worldwide by citations** (Clarivate, Web of Science).