BIOMAC–BP Seminar Series

Time: **February 25, 2026 (Wednesday)**
3 PM CET
Location: **Online (link sent via invitation email)**

Joint Seminar

by

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Talk I

Environmental Fate of Starch Nanocrystal Stabilized Microbial Pesticide Formulation in Soil-Plant Systems

Venla Heininen

Conventional chemical pesticides pose significant environmental and health risks, highlighting the need for sustainable alternatives. Biopesticides offer a promising solution, but their large-scale use is hindered by a lack of effective, non-toxic formulations. Current formulations often rely on synthetic adjuvants that may exacerbate environmental harm and survival of the active ingredients, emphasizing the need for bio-based alternatives. Furthermore, the environmental fate of biopesticides, as well as their co-formulants, remains poorly understood, particularly for nanoformulations like starch nanocrystals (SNCs), whose behaviour in soil-plant systems is underexplored.

To improve our understanding of the environmental fate of bio-based nanoformulations, we are investigating an SNC-stabilized Pickering emulsion encapsulating a bacterial biopesticide under agricultural conditions. Using carbon-14 (^{14}C) labelled SNCs, we track the formulation transformation, distribution, and degradation pathways in soil, leachate, and plants, while assessing impacts on soil enzyme activity and microbial communities. A glasshouse soil column experiment involving a test crop of spring wheat (*Triticum aestivum*), two test soils, and different biopesticide concentrations is used to assess the effects of dose and soil type. By quantifying environmental fate and ecological interactions, we provide data to guide safer formulation design and environmental policy for next-generation agricultural pest control.

Talk II

Mechanically Mediated Interactions Between Biofilm Aggregates and Hydrogels

Ina Damm

Restricted bacterial motility in polymeric environments promotes the formation of suspended aggregates of biofilms, microbial communities encased in an extracellular polymeric matrix. Depending on the ratio of biofilm to polymer network stiffness, the aggregates display different morphologies. Despite the importance of these systems in environmental applications and microbial contamination, it is still understudied whether the network rheology influences the bacterial viability, size variability, and morphology transition of the biofilm aggregates. Moreover, the effect that the aggregate formation and properties have on the system's rheology is unknown. We study the morphology and viability of *Bacillus subtilis* aggregates in agarose hydrogels using phase contrast, brightfield, and fluorescent imaging. To pinpoint the impact these unique morphologies have on the properties of the hydrogel, agarose discs with and without embedded bacteria were rheologically characterised. An agarose concentration of 0.6% marks the transition from planktonic cells to aggregates. When increasing concentrations up to 2%, we observe the aggregates becoming denser and more filamentous. A reduction in viability is observed over time within their cores. Aggregates inside the hydrogels lead to an increase in G' and G'' after 24 h. The hydrogel's rheology introduces morphological changes in the aggregates which in turn shape the system's rheology by acting as mechanical inclusions that alter the network's stiffness.