Biosourced Complex Coacervates for the Development of Tissue Adhesives

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Approximate starting date: Jan-March 2025
*Note that the lab is within a ZRR (Zone à Régime Restrictive)

Context

Replacing invasive wound closure procedures such as sutures and staples with minimally invasive adhesives and sealants is a well-established need in the field of medical devices. Most current surgical adhesives and sealants rely on the in-situ polymerization and or cross-linking of a liquid-like precursor to form strong bonds to tissues [1]. Several natural organisms, such as mussels and sandcastle worms, have developed robust underwater adhesives based on complex coacervates of charged biomacromolecules [2]. Polyelectrolytes complex coacervates are obtained via associative phase separation of a polycation (positively charged polymer) and a polyanion (negatively charged polymer) in aqueous medium. The polymer-rich materials obtained have good wetting properties (important for bonding to substrates) and widely tuneable viscoelastic properties. Model and bio-inspired complex coacervates have shown great potential for the development of soft tissue adhesives [3]. Our group recently highlighted the potential of bio-sourced complex coacervates in this context [4].

Objectives

The internship subject aims to study the phase behavior and mechanical properties of bio-sourced complex coacervates for potential biomedical applications. The intern will investigate different combinations of polysaccharides as bio-sourced polymers to develop a library of complex coacervates. The parameters of the study include the chemistry, molecular weight, and concentration of the polymers as well as the salt concentration. The composition of the complex coacervates will be studied via thermogravimetric analysis and the mechanical properties will be characterized using a rheometer.

Candidate's profile and selection criteria: An open-minded, curious, and interactive student ready to work as part of a multidisciplinary research team. Interest in the physical chemistry of (bio-sourced) polymers and biomedical applications is a plus. No previous experience in biology is required. Applications will be assessed based on motivations, relevance, and DE&I (Diversity, Equity, and Inclusion). Fluent communication in English is a requirement.

How to apply: Please send a CV and a motivation letter to mehdi.vahdati@ics-cnrs.unistra.fr and maxime.precheur@ics-cnrs.unistra.fr. The motivation letter must clearly state the relevance of the application to the group's areas of research.

References

[1] Ge, Chen, *Polymers*, 2020, 12; [2] Hofman, et al. *Adv. Mater.* 2018, 30; [3] Vahdati, et al. *Prog. Polym. Sci.* 2023, 1392; [4] Galland, et al. *JCIS*, 2024, 661.