Internship opportunity – 3 to 6 months

Rheological characterization of the HPMC / κ-carrageenan / KCl system for the industrial production of plant-based hard capsules

Host laboratory: Laboratoire Rhéologie et Procédés, Université Grenoble Alpes, CNRS, Domaine Universitaire, 363 rue de la Chimie, 38610 Gières, France

Industrial partner: SN Roxlor, La Ciotat, France

Preferred start date: January–April 2027 | Duration: 3–6 months

Background

SN Roxlor has manufactured hard capsules in La Ciotat since 1993 for the pharmaceutical and nutraceutical industries, at a facility certified to ISO 9001, ISO 14001 and EXCiPACT standards. Roxlor is developing a plant-based capsule made from HPMC (hypromellose) as an alternative to gelatin, using a dip-molding process. The formulation combines HPMC, κ-carrageenan and KCl: potassium ions promote carrageenan gelation, allowing the film to set between the dipping bath at 55 °C and the initial drying stage at 30 °C. This gelation step remains difficult to control and leaves limited scope for adjusting the process settings.

Project objectives

The aim of this internship is to characterize the rheological and gelation properties of the ternary HPMC / κ-carrageenan / KCl system and establish how its composition affects the gelation temperatures and gel strength. The findings will help optimize the formulation to achieve better control over film formation on the dipping pins.



Internship activities

- Review the literature on HPMC and κ-carrageenan gelation.
- Monitor gelation kinetics and melting temperatures using cooling and heating temperature ramps by rheometry within the process temperature range (25–55 °C).
- Experimental techniques: rotational rheometry (steady shear, small-amplitude oscillatory tests) and differential scanning calorimetry (DSC).

Desired skills: materials science, rheology, process engineering, polymer physical chemistry, experimental rigor, analytical and synthesis skills, communication.

Education level: 4th- or 5th-year higher education student (Master's year 1 or 2, or equivalent engineering degree programme).

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Application documents: CV, cover letter and academic transcripts (L3, M1 and M2, as applicable).