Internship offer for a student in food sciences

Laboratory :

Joint unit PAM (Procédés Alimentaires et Microbiologiques), équipe PCAV (Physico-Chimie de l'aliment et du vin)/ Joint Unit Food Processing and Microbiology, group Physical-Chemistry of Food and Wine (PCAV)
Location : UMR PAM AgroSupDijon/Université de Bourgogne, Campus Montmuzard, 1 esplanade Erasme, bâtiment Epicure, 21000 Dijon-France

Supervisors :

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Title of project: Biodegradable (PLA/PHA) coated films for food bioactive packaging

Period and duration : 4-6 month duration, could start since January 2021 or later

Student background : master/engineer degree level, skills in food chemistry and processing. A basic knowledge in packaging or polymer/biopolymer sciences would be welcomed.

Objectives and description :

To date, most active plastic materials are petroleum-based. The large amount of plastic waste generated every year in the world is widely concerned. However, use of bio-based polymers has risen as an important alternative to overcome this hurdle and therefore to protect the environment. Poly(lactic acid), a thermoplastic polymer obtained from renewable sources such as corn or sugar beet, and fully biodegradable and biocompatible, today is commercialized but with too few possibilities of applications in food. Almost same properties apply to PHA (PolyAlkanoates) which could be produced by Biorefinery processes from food waste. Moreover, about 30% of all packed-food worldwide is lost or wasted along the supply chain. Optimized packaging may be one of the solutions to reduce this staggering amount. Active coating made of bio-macromolecules, such as polysaccharides or proteins incorporating active agent, are an important option. Indeed, there are no safety hazards about migration into food and coating could reinforce the barrier selectivity. In addition, this kind of coating offer some potential advantages represented by food contact ability, availability, low cost and biodegradability. Moreover, these macromolecules will be obtained from valorization of by-products and wastes from marine/seafood industries (gelatine /chitosans), and the active compounds (antioxidants and antimicrobials) are natural compounds extracted from plants.

The overall target is to develop antimicrobial and antioxidant - eco-friendly - mono or bi-layer - materials, based on PLA or PHA films coated with chitosan/gelatin-phenolic acids based solutions. The central idea behind the project is to develop an active biodegradable PLA-based packaging system that would provide an extended shelf life for foods and improve both food safety and barrier properties. The design of an antimicrobial/antioxidant packaging system requires the knowledge of both the controlled release mechanism, the microbial growth kinetics, as well as a basic knowledge on packaging sciences.

The objective of this project consists to better understand the behavior of coated film in contact to aqueous or semi-hydrated media, the transfer of gas and release of phenolic acids, and the bioactivities of these phenolic acids against microbial pathogen strains. The efficacy of the bioactive coating on film structure and functional properties will be firstly studied (physicochemical, structural, transfer, and thermal properties). The film bioactivity (antimicrobial and antioxidants properties) will be characterized in relation to the release mechanism parameters (release rate, partition and diffusion coefficients, …). Two or three model will be selected to mimic foods. Knowledge on the phenolic acids efficacy against microorganisms as well as antioxidant efficacy have been already demonstrated on edible films in labs, but not were not validated for "industrializable" applications with activated film surface of biodegradable polymers such as PLA.

Key words: PLA/PHA, active coating, functional properties and bioactivity.