UMR408 SQPOV	***Implanteus* Graduate School** Academic Year 2023 - 2024 **Proposal of Master's Internship (M1 or M2)**	

Title: *Coloring properties and formulation of red sorghum pigments and their complexes*

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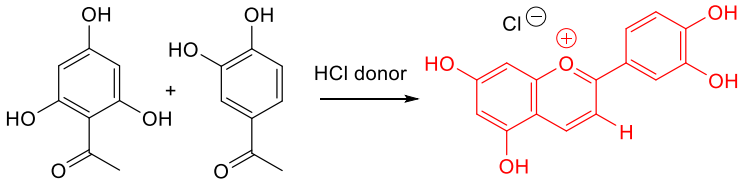
Context

Anthocyanins are natural phenolic pigments widely distributed in fruit and vegetables, where they express deep red, purple and even blue colors depending on pH and environment (e.g., binding to metal ions and other natural phenols). Anthocyanin-rich extracts could be developed as colorings for food applications. Although much less common in nature than anthocyanins, 3-deoxyanthocyanidins (3-DAs) are the pigments of red sorghum, a cereal widely cultivated in Africa. 3-DAs are known to be more resistant than regular anthocyanins to bleaching by water addition or thermal degradation. Thus, 3-DAs have potential for development as red-pink food colors. Their formulation by encapsulation involving food-grade matrices (polysaccharides, proteins) could increase their solubility in water and the stability of their color, while facilitating handling, storage, and dispersion of 3-DAs into food.

Objectives

The topics that will be addressed during this internship are as follows:

a) Exploit a simple chemical synthesis of 3-DAs (protocol already optimized in the team):



b) Set up a simple efficient procedure for the preparation of red sorghum extracts rich in 3-DAs

c) Combine anthocyanins with colorless plant phenols (copigments) and/or metal ions (Fe^{3+}, Al^{3+}) to prepare complexes with enhanced color stability and diversity

d) Incorporate pure 3-DAs and red sorghum extracts, as well as their complexes, into solid beads based on alginate, a food-grade anionic polysaccharide from brown algae, as a straightforward way to ready-to-use formulations

e) Check color stability in the beads and the possible release of 3-DAs from the alginate beads to the surrounding aqueous medium under different conditions mimicking food or the digestive tract.

Prerequisite skills: Sound foundation in chemistry (organic, physical, analytical, practical).

Main competences acquired during the internship: chemical synthesis, extraction and characterization of natural pigments (3-DAs), mechanisms of color expression and stabilization, formulation of natural pigments into gel beads, a range of analytical methods, including UV-visible spectroscopy, colorimetry, and a generator of alginate beads.