

## **Citrus fibres for the formulation of Pickering emulsions: a sustainable multiphase system**

### **Aim:**

Citrus is one of the most widely grown fruit crops in the world, with over 145 million tons produced in 2019. Since it is a main source of pectin, there is a great number of citrus by-products from the industry that can be valorised by recovering fibres to be used as natural food additives. Pickering emulsions are stabilized by solid particles, and citrus fibres can act as a sterical barrier against coalescence and increase the stability of emulsions by gelling the water phase, thanks to their high viscosity and gelation ability. This work aimed to test citrus fibres (CF) as emulsifier in the development of a sustainable multiphase system to be used as a fat substitute in low-fat products and/or as a carrier for bioactive compounds, thus increasing the nutritional value of the final product.

### **Method:**

A Central Composite Design (CCD) was used to investigate the effect of 3 factors (type of emulsifier, emulsifier amount, and oil amount) on the characteristics of emulsions stabilized by CF or lecithin (used as reference). CF ranged from 8 to 16% (on the water phase), while lecithin ranged from 0.5 to 2.5% (on the oil phase), and corn oil ranged from 15 to 60% in both cases. All the runs were characterized for particle size distribution, apparent viscosity, and stability at 4°C until 14 days; images at the optical microscope were also acquired. The Response Surface Methodology (RSM) based on the desirability function was applied to obtain the optimized formulations.

### **Results:**

Apparent viscosity increased when increasing the concentration of oil and CF; the particle size analysis showed an increase in droplet dimensions with the increase of oil volume phase and the decrease of emulsifier percentage. CF gave higher stability to the water phase until 14 days, while creaming stability resulted better with lecithin. The optimized formulations resulted in 8% CF with 40.66% corn oil, and 2.5% lecithin with 58.49% corn oil.

### **Conclusion:**

CF gave promising results in terms of higher apparent viscosity and stability, with the advantage to use a lower oil percentage than in the optimized formulation with lecithin.