Novel approaches to oil structuring through capillary suspensions

DONSI' F. (1), PIROZZI A. (1)
1 University of Salerno, Fisciano, Italy

Oil structuring has attracted increasing attention because of its potential use in various applications in the food, pharmaceutical and biotechnology industries. This work aimed at structuring sunflower oil through the formation of capillary suspensions using wheat middlings (WM) and pure cellulose (CL) as a structuring solid fraction. High-pressure homogenization (HPH), which is an emerging, purely mechanical cell disruption technology, was used as a wet milling technique directly applied on oil-dispersions of WM or CL, at 80 MPa and 25 °C for 20 passes. The HPH treatment enabled the reduction of particle size by one order of magnitude, causing also fiber activation and, in the case of WM, the release of high value-added intracellular compounds with high antioxidant activity into the sunflower oil. The addition under high-shear mixing of a secondary immiscible fluid (i.e. water) as a function of saturation ratio (volume of water per total volume) in a continuous phase (i.e. oil) of HPH-treated particle suspension drastically altered the rheological behavior, evaluated by using a rotational rheometer equipped with a concentric cylinder, and the strength of these suspensions due to the formation of a sample-spanning particulate 3D network. This phenomenon can be attributed to the capillary bridge forces of the two fluids acting on the fibrous solid particles, which cause the transition from liquid to gel-like state. The WM-in-oil-dispersion at 30 wt% of particle fraction treated by HPH with the addition of 50 wt% of saturation ratio exhibited a high apparent viscosity and apparent yield stress (about 300 Pa). While, the higher viscosity for CL-in-oil dispersion is achieved at 15% of saturation ratio. Remarkably, WM as opposed to CL released the antioxidant compounds in the oil which contributed to slowing down the oil oxidation phenomena during the entire period of storage. In conclusion, the obtained oleogels are very promising materials for the formulation of healthier and more sustainable food products in replacement of solid fats, enabling to reduce the overall caloric content while especially adding the benefits related to the dietary fiber content of WM, as well as exploit the recovery of valuable bioactive compounds still present in the AFRs