

Circular valorization of cheese whey and spent coffee grounds for the development of edible films

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Abstract

Spent coffee grounds (SCG), the main by-product of coffee brewing process, is an unexploited source of valuable compounds. The oil content of SCG is about 11-15% (w/w), consisting mainly of palmitic and linoleic acid and it is currently utilized mostly for biodiesel production. Nevertheless, the significant content of SCG oil in unsaturated fatty acids (about 49%) suggests its potential utilization in food applications. In this study, edible films made from whey protein concentrate (WPC) were enriched with SCG oil and SCG oleogel (using candelilla wax as oleogelator). Oil and oleogel addition was adjusted to 2.5, 5 and 7.5% based on the WPC content, whereas both additions had an obvious effect on the hydrophobic character of the produced films.

More specifically, solubility of films was slightly decreased (about 30%), at 7.5% oil or oleogel addition, as compared to films prepared without the addition of oil or oleogel. Likewise, water swelling capacity was decreased by increasing oil and oleogel concentrations, whereas water vapor permeability (WVP) was also reduced with the increase of oil or oleogel content, indicating that the hydrophobic character of oil and oleogel decreased the diffusivity coefficient of water vapor molecules.

Conclusively, the results of the study showed that the synergistic action of oil or oleogel in the development of edible films offers technological advantages. Such films could be applied in various food applications, such as fruits, in which the hydrophobic coating and the low WVP are essential parameters for shelf-life extension. In parallel, the addition of oleogel has been proved to be more advantageous compared to free oil formulations, primarily due to its protecting effect against oil oxidation. This study presents the perspective to develop hydrophobic edible films enriched with protein and unsaturated lipids, through circular valorisation of cheese whey and SCG.

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