NIR SPECTROSCOPY AS A TOOL TO FOSTER THE LIPID SECTOR SUSTAINABILITY

Cristina ALAMPRESE

University of Milan, Department of Food, Environmental and Nutritional Sciences (DeFENS), Milan, Italy; cristina.alamprese@unimi.it; ORCID: 0000-0002-9119-6752, +39 0250319187

Abstract

Green chemistry can play a pivotal role for sustainability of agri-food chains, by providing on-line techniques for automatic evaluation of food quality and optimization of food processes, while minimizing the use of hazardous materials, decreasing energy and water usage, and maximizing efficiency. The aim of this presentation is to show key applications of NIR spectroscopy (NIRS) in the lipid sector, which can foster sustainability. In particular, the effectiveness of NIRS is shown for olive ripening evaluation, extra virgin olive oil (EVOO) process guidance and authenticity assessment, as well as for physical property prediction of structured lipids.

A first case study refers to an objective and automatable NIRS method for the assessment of olive maturity and some chemical characteristics. Data collected on thirteen cultivars, harvested at different ripening stages along three years were used to develop PLS-DA models to classify olives based on ripening degree, reaching sensitivity and specificity of 79% and 75%, respectively. With the same data, PLS regression models were calculated to predict chemical characteristics, obtaining R^2pred ranging from 0.68 to 0.77, and low RMSEP values.

A second application focuses on EVOO authentication based on fatty acid ethyl esters content. FT-NIR spectra of 197 olive oil samples were collected and used for calculation of PLS regression models, reaching a R^2pred of 0.85 and a RMSEP of 4.63 mg/kg.

At last, the application of NIRS to evaluate slip melting point (SMP), melting points at different melted fat percentages (MP85, MP90, MP95), and consistency of structured lipids is shown. Sixty different samples of tallow chemically or enzymatically interesterified with corn, canola, or safflower oils at different ratios were produced and analysed. Promising PLS models were obtained, with R^2 higher than 0.85 and RMSECV of 1.7°C, 2.8°C, and 14 MPa for SMP, MP90, and consistency, respectively.

Keywords: NIR spectroscopy, non-destructive methods, olives, olive oil, structured lipids, sustainability.