

Integrated soluble solid and nitrate content assessment of spinach plants using portable NIRS sensors along the supply chain

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Abstract

There has been increased interest in the implementation of near infrared spectroscopy (NIRS) as a non-destructive analytical technique to monitor the quality and safety of vegetables during their growing season and after harvest, throughout the food supply chain. The aim of this work was to evaluate the feasibility of using a portable NIR spectrophotometer (the MicroNIR™ Pro 1700 (spectral range 908–1676 nm) working in reflectance mode) based on Linear Variable Filter (LVF) technology to analyse soluble solid content (SSC) and nitrate content in spinach plants *in situ*, in the field and along the supply chain. A total of 77 spinach plants were analysed at three control points of the supply chain: 1) in the field, during the growing season and after harvest, 2) in the lab, simulating conditions at receipt at the processing industry and 3) on the leaves in the lab, after washing, thus simulating the analysis of the processed product ready to be packaged, as a previous step for the novel application of NIRS at delivery points and in the supermarkets. The results confirmed the feasibility of using this spectrophotometer throughout the supply chain to establish product quality and safety, which would allow to make real-time decisions related to the agricultural practices, optimum harvest time, industrial uses and commercial shelf-life. The comparison between the models developed for the NIRS analysis in the three control points studied indicated that the recommended procedure would be to take a single spectrum per plant as a suitable way of predicting quality and safety parameters in the field and at the reception points in the industry. Two spectra on each of the two leaves should be taken after the washing operation in the industry, with values of the standard error of cross validation of 1.0 % for SSC and 766 mg kg⁻¹ for nitrate content.