Near-infrared spectroscopy and hyperspectral imaging for sugar content evaluation in potatoes over multiple growing seasons

Ahmed M Rady, Daniel E Guyer and Nicholas J Watson

Food Analytical Methods 14: 581–595. (2021)

Abstract

Sugar content is one of the most important properties of potato tubers as it directly affects their processing and the final product quality, especially for fried products. In this study, data obtained from spectroscopic (interactance and reflectance) and hyperspectral imaging systems were used individually or fused to develop non-cultivar nor growing season-specific regression and classification models for potato tubers based on glucose and sucrose concentration. Data was acquired over three growing seasons for two potato cultivars. The most influential wavelengths were selected from the imaging systems using interval partial least squares for regression and sequential forward selection for classification. Hyperspectral imaging showed the highest regression performance for glucose with a correlation coefficient (ratio of performance to deviation) or *r*(RPD) of 91.8(2.41) which increased to 94%(2.91) when the data was fused with the interactance data. The sucrose regression results had the highest accuracy using data obtained from the interactance system with *r*(RPD) values of 74.5%(1.40) that increased to 84.4%(1.82) when the data was fused with the reflectance data. Classification was performed to identify tubers with either high or low sugar content. Classification performance showed accuracy values as high as 95% for glucose and 80.1% for sucrose using hyperspectral imaging, with no noticeable improvement when data was fused from the other spectroscopic systems. When testing the robustness of the developed models over different seasons, it was found that the regression models had *r*(RPD) values of 55(1.19)–90.3%(2.34) for glucose and 35.8(1.07)–82.2%(1.29) for sucrose. Results obtained in this study demonstrate the feasibility of developing a rapid monitoring system using multispectral imaging and data fusion methods for online evaluation of potato sugar content.