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Quantitative analysis by HPLC and FT-MIR prediction of sugars in juice from the fruit of plum harvest during growth and fruit development

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Individual sugars contained by the plum juice samples obtained from the fruits of the Stanley, Vânt de Italia and Tuleu Gras were analyzed using high performance liquid chromatography (HPLC). Samples were harvested from the crown's interior and periphery during six developmental stages, with values ranging from 0.26 to 3.73% for fructose, 1.43-1.10% for glucose, and 0.01 to 10.19% for sucrose. Regardless of the variety which has been analyzed, the amount of fructose and glucose has increased significantly ($p<0.05$) during fruit development, while sucrose had an insignificant increase ($p>0.05$) in the first half of the study; during the second part of the study the amount of sucrose has been truly explosive. FT-MIR analysis (Fourier transform mid-infrared) confirmed the differences between juice samples, the spectral region characteristic to sugars ranging from 900 to 1500 cm-1. FT-MIR coupled with partial least squares regression (PLS) was designed to evaluate the predictive characteristics of the calibration models in order to estimate the individual sugars found in plum juice. Optimal regions and spectral pretreatments were 800-1600 cm-1 and Savitzky Golay first derivative (d1) for fructose, 800-1600 cm-1 for glucose and 915-1145 cm-1 and second derivative (d2) for sucrose. Optimal spectral domain selection and pre-treatments led to PLS calibration models with acceptable glucose results (Rcval2=0.90; SECV=0.98; RPD=3.03), less satisfactory for fructose and very good results in the case of sucrose Rcval2=0.96; SECV=0.65; RPD=4.9). For practical relevance, the FT-MIR results were compared with HPLC, obtaining the reference values for the external validation tests.

Recent Publications

1. Mureșan A E, Muste S, Vlaic R A, Bobiş O, Mureșan C, Socaciu C and Mureșan V (2015) HPLC determination and FT-MIR prediction of sugars from juices of different apple cultivars during fruit development. Not Bot Horti Agrobo 43(1):222-228.
2. Wilkerson E, Gordon D, Anthon E, Barrett D M, Glynda F F G, Sayajon A M, Santos L E and Rodrigues S (2013) Rapid assessment of quality parameters in processing tomatoes using hand-held and benchtop infrared spectrometers and mutivariate analysis. J. Agric. Food Chem. 61:2088-2095.
3. Scibisz I, Reich M, Bureau S, Gouble B, Causse M, Bertrand D and Renard C M G C (2011) Mid-infrared spectroscopy as a tool for rapid determination of internal quality parameters in tomato. Food Chem 125:1390-1397.
4. Wu B H, Quilot B, Genard M, Kervella J and Li S H (2005) Changes in sugar and organic acid concentrations during fruit maturation in peaches, *P. davidiana* and hybrids as analyzed by principal component analysis. Scientia Horticulturae 103:429–439.
5. Shiroma C and Rodriguez Saona L (2009) Application of NIR and MIR spectroscopy in quality control of potato chips. Journal of Food Composition and Analysis 22:596–605.

Biography

Romina Alina Vlaic, a Postdoctoral Researcher, has more than 5 years of experience in exploitation of food industry by-products; development and optimization of functional food products; extraction and analysis of bioactive compounds such as: polyphenols, volatile oils, natural pigments, vitamins, proteins, fiber, essential fatty acids, sugars and determination of food products quality parameters. She started her PhD stage during 2012-2015 in the field of Agriculture, having as research theme: Research on the assessment of biochemical evaluation for three plum varieties during fruit growth and development, granted by the PhD evaluation commission with the very good degree. In 2016 and 2017 she was awarded with Excellence Diploma at the International Salon of Inventions Pro-invent approved by Ministry of Education and the Academy of Technical Sciences of Romania and in 2017 she is responsible for 2 projects (Innovation Checks: PN-III-P2-2.1-CI-2017-0331, PN-III-P2-2.1-CI-2017-0722) and Research Assistant in 4 projects.

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