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Methods for detection of pork adulteration in veal product based on FT-NIR spectroscopy for laboratory, industrial and on-site analysis

Matthias Schmutzler, Anel Beganovic, Gerhard Böhler, Christian W. Huck*

Institute of Analytical Chemistry & Radiochemistry, CCB – Center for Chemistry and Biomedicine, Leopold-Franzens-University, Innrain 80-82, 6020 Innsbruck, Austria

*corresponding author

Phone: +43 512 507 57304

Fax: +43 512 507 57399

eMail: Christian.W.Huck@uibk.ac.at

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Abstract

Three different methods for near infrared (NIR) based multivariate analyses were developed to reveal deliberate adulteration or accidental contamination of a pure veal product with pork and pork fat. More precise, methods for laboratory use of high performance Fourier transform-NIR (FT-NIR) desktop devices, methods suitable for industrial purpose like in- and on-line application with a fibre optic probe and methods applying a handheld spectrometer ready for on-site analyses were established. The methods were developed for the detection of pork adulteration in the meat and fat part of veal sausages. Therefore sausages were self-made based on a commercial veal product. Adulterations up to 50 % (in 10 % steps) with pork and pork fat were analysed, respectively. Principal component analyses (PCA) were developed for every setup with previous data pre-treatment steps including wavelength selection, scattering corrections and derivatives of the spectral data. PCA scores were used as input data for support vector machines (SVM) classification and validation. Advantages and disadvantages of the equipment were discussed and the limits of detection regarding the setups were determined. Measurements were also carried out directly through a polymer packaging of the samples and compared to measurements through quartz cuvettes. Meat and fat adulteration could be detected up to the lowest level of contamination (10 %) applying the laboratory setup and the industrial fibre optics setup, regarding measurements through quartz and polymer packaging. Analyses with the on-site setup led to successful separation up to the lowest degree of contamination (10 %, measurement through quartz cuvettes) regarding meat adulteration and up to 20 % and 40 % contamination regarding the fat adulteration performing measurements through quartz cuvettes and through polymer packaging, respectively.