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Fighting Food Frauds with NIR Spectroscopy and Chemometrics: A Story of Success

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BOOK OF ABSTRACTS

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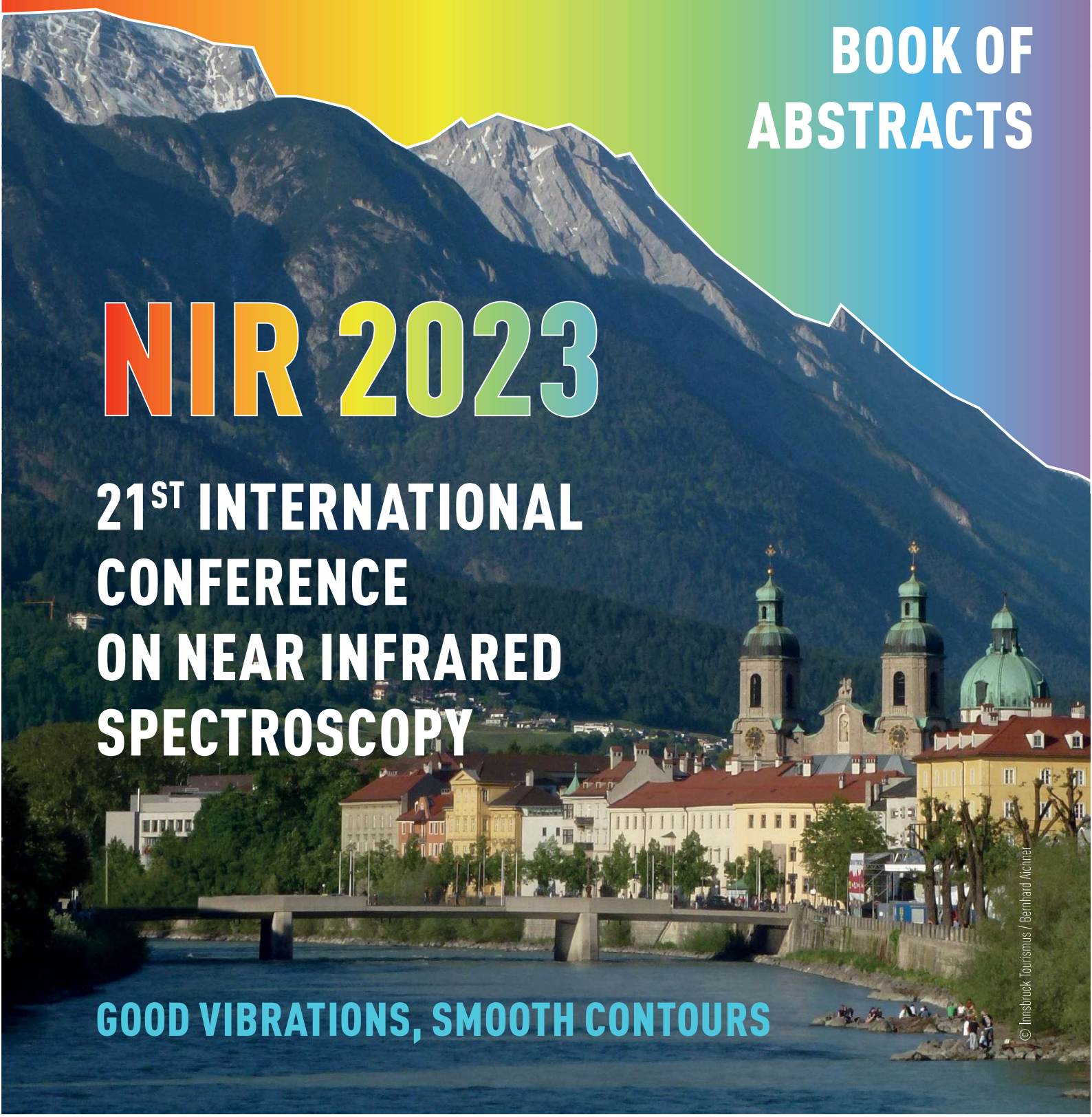

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FIGHTING FOOD FRAUDS WITH NIR SPECTROSCOPY AND CHEMOMETRICS: A STORY OF SUCCESS

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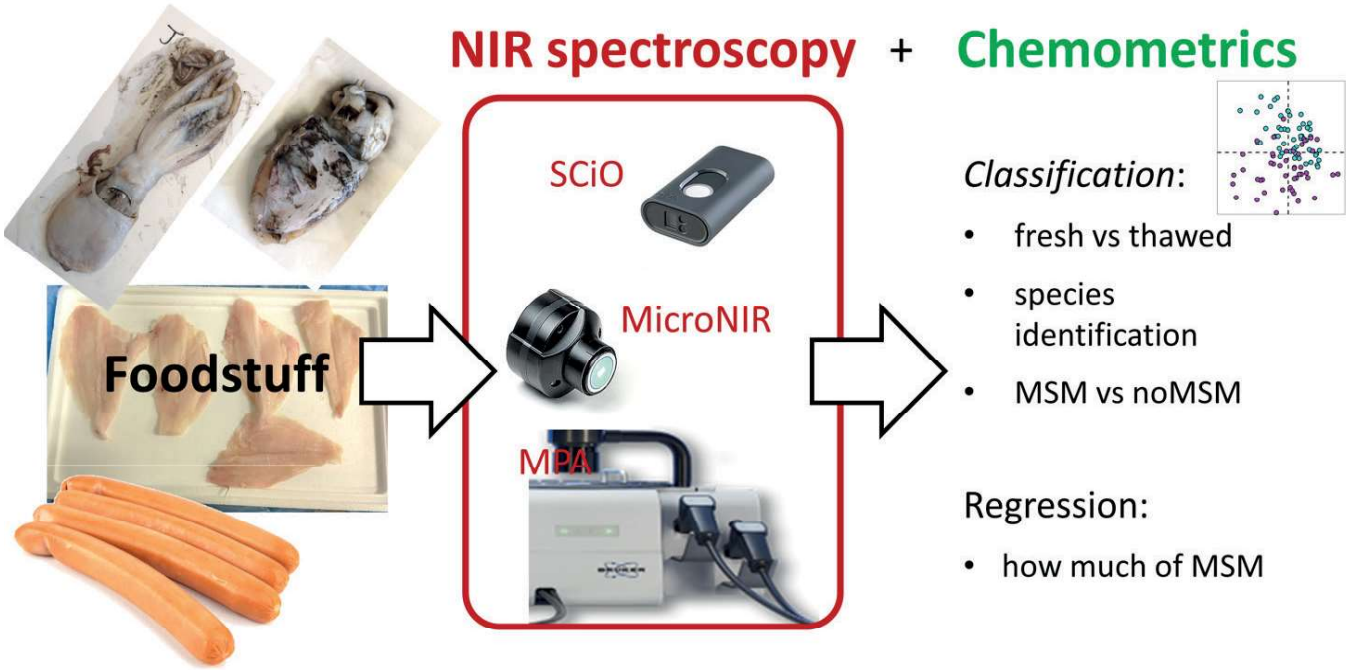

Food fraud is a widespread problem with potentially heavy and wide impacts on consumers' safety and health, as it affects almost any type of food commodity sold on the market. Products may be mislabelled or counterfeit, making it challenging to detect these illegal practices. Therefore, efficient and reliable methods are necessary to tackle this issue. NIR spectroscopy coupled with chemometrics is particularly suitable for this purpose due to its ease of use and promptness.

In collaboration with Istituto Zooprofilattico Sperimentale del Piemonte Liguria e Valle d'Aosta, our research group at Polytechnic of Turin carried out a project about different types of food fraud. We investigated three food commodities, aiming at specific frauds: 1) the sale of frozen-thawed cephalopods mislabelled as fresh; 2) the sale of mislabelled fish fillets which can be substituted with cheaper ones; 3) the adulteration of meat sausage products with the addition of undeclared mechanically separated meat (MSM).

All research lines were based on the same analytical approach. The experimental data were acquired using three different NIR instruments: one portable low-cost instrument (SCiO by Consumer Physics), one portable medium-high-cost instrument (MicroNIR by Viavi) and one benchtop instrument (MPA by Bruker). The data were then inspected and processed using chemometric methods, which allowed to fully exploit the information content of all acquired datasets. More specifically, we aimed at building classification models using partial least squares-discriminant analysis (PLS-DA) to perform quick and

automatic detection of food frauds. Regarding the research line about meat, we also dwelved into the possibility of quantifying the amount of MSM in the sausages, building PLS regression models.
Two papers from the cephalopods and fish research lines were published [1,2], and the work regarding the meat research line (identification and quantification of MSM) is currently under advanced development, close to submission.
The aim of this poster is to provide a representation of the research project and its results, showing how valuable the collaboration among different research groups is, and how powerful the combination of NIR spectroscopy and chemometrics can be. This project fully demonstrates that food fraud can sometimes be efficiently tackled even with simple instruments and methods.

[1] F. Pennisi, A. Giraudo, N. Cavallini, G. Esposito, G. Merlo, F. Geobaldo, P. L. Acutis, M. Pezzolato, F. Savorani, E. Bozzetta, Differentiation between Fresh and Thawed Cephalopods Using NIR Spectroscopy and Multivariate Data Analysis, Foods (2021), 10(3), 528; https://doi.org/10.3390/foods10030528
[2] N. Cavallini, F. Pennisi, A. Giraudo, M. Pezzolato, G. Esposito, G. Gavoci, L. Magnani, A. Pianezzola, F. Geobaldo, F. Savorani, E. Bozzetta, Chemometric Differentiation of Sole and Plaice Fish Fillets Using Three Near-Infrared Instruments, Foods (2022), 11(11), 1643; https://doi.org/10.3390/foods11111643

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