Spectroscopic identification of fungis and mycotoxins on grains

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Introduction: Mycotoxins are toxic fungal metabolites that may contaminate primary food products such as cereals, nuts and fruits. The most predominant mycotoxins in Europe are among others the *Aflatoxins* and *Ochratoxins* produced by storage fungis, such as *Aspergillus* and *Penicillium* species, and toxins from field-borne *Fusarium* species, for example *Zearalenone* and *Deoxynivalenol*.
Because of the potential health hazards to humans the monitoring of food and feed for the presence of these toxins is highly important with respect to food safety aspects. Therefore, an urgent need for reliable, low-cost and easy-to-use experimental setups exists. A reliable and sensitive in-situ detection of contaminations with fungi as well as with mycotoxins in the raw materials at the beginning of the food production chain is indispensable in order to increase food and feed safety to the standards required.

Materials and Methods: The use of spectroscopic methods in food control and monitoring is increasing rapidly, in particular in combination with chemometric tools. Non-destructive methods, such as absorption, fluorescence and reflection spectroscopy, are powerful methods for the detection of mycotoxins in solution and on the surface of grains (wheat, rye) and flour.

Results: Because of its outstanding sensitivity fluorescence spectroscopy based techniques are especially suited for the in-situ detection of mycotoxins such as *Ochratoxins*, *Aflatoxins* as well as *Zearalenone*. These mycotoxins can be monitored using an excitation wavelength in the spectral range of 200 nm < λ_{ex} < 400 nm and a detection wavelength λ_{em} > 420 nm. In combination with absorption and reflection measurements, qualitative and quantitative information on the mycotoxins present can be obtained. In addition, NIR reflection spectra yield further information on the ingredients, the moisture content, and more important on the presence (or absence) of fungi in the sample.

Discussion and Conclusion: From the combination of fluorescence and diffuse reflection spectroscopy, qualitative and quantitative information on the ingredients, the moisture content and the presence (or absence) of fungi in the sample can be obtained. The application of diffuse reflectance and fluorescence spectroscopy on grains is demanding because of the large variance in size, shape, colour, density, composition (water, starch, protein) and texture. Hence, additional chemometric tools are essential in order to eliminate these disturbing factors and extract the desired chemical information of the sample with respect to contamination with fungi and/or mycotoxins.

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