

Sensor technology for the identification of mycotoxins and fungi in the processing of grain - first results

Christine Idler¹, Claudia Rasch², Michaela Ditz¹, Michael Kumke², Andreas Walte³, Kerstin Briesse³

¹ Leibniz-Institute for Agricultural Engineering, Potsdam-Bornim, Germany

² University of Potsdam, Department of Chemistry (Physical Chemistry), Potsdam-Golm, Germany

³ Airsende Analytics GmbH, Schwerin, Germany

The German Ministry of Education and Research (BMBF) provides funding of more than 1.9 million Euros for a large joint project ("ProSenso.net2") on the development of innovative sensor-based techniques and processes in the field of food quality and safety. In this research-project "Exploration of sustainability potentials by use of sensor-based technologies and integrated assessment models in the production chain of plant related food". The expected results shall contribute to maintain freshness and improve food safety.

The Goal

In one of the seven subprojects "Indicators and sensor technology for the identification of mycotoxine producing fungi in the processing of grain" spectroscopic methods and electronic noses are tested for the detection on moulds and/or mycotoxins.

Material and Methods

Wheat with various moisture content and inoculated with various fungi is used. Non-destructive methods, such as absorption, fluorescence, reflection spectroscopy and homogenic sensor array system PEN 3 (fig.7) are explored for the in-situ detection of fungi on grain.

Results

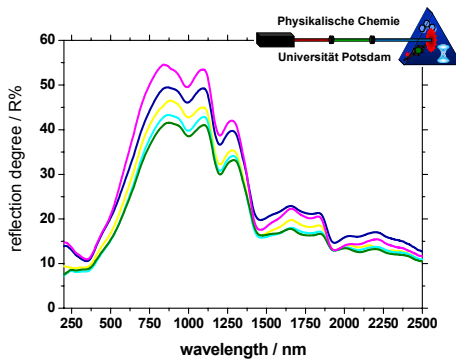


Figure 1: Reflection spectra of uncontaminated wheat with variable moisture content: 11% (green), 15% (light blue), 18% (yellow), 21% (blue) and 25% (pink)

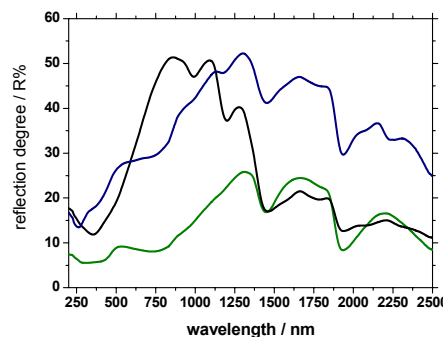


Figure 2: Reflection spectra of uncontaminated wheat (black), wheat with contamination of *Penicillium verrucosum* (blue) and the pure culture *Penicillium verrucosum* on agar (green)

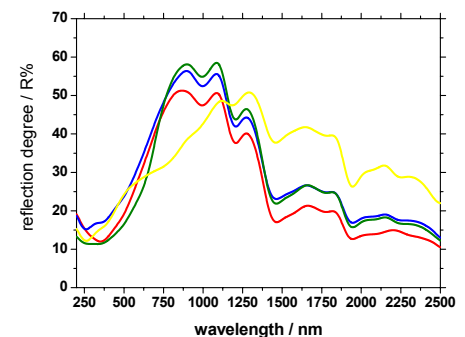


Figure 3: Reflection spectra of uncontaminated wheat (red), wheat contaminated with *Fusarium graminearum* (blue), *Aspergillus niger* (green), *Penicillium verrucosum* (yellow)

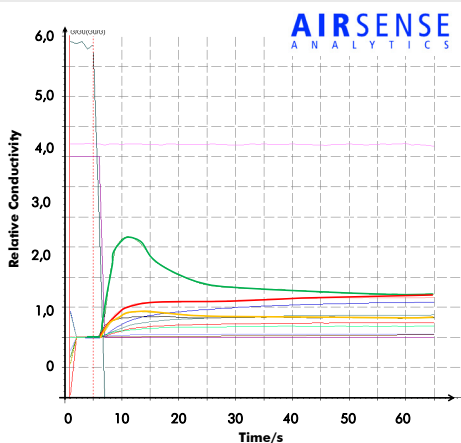


Figure 4: Response of the gas sensors after exposure to the headspace of uncontaminated wheat

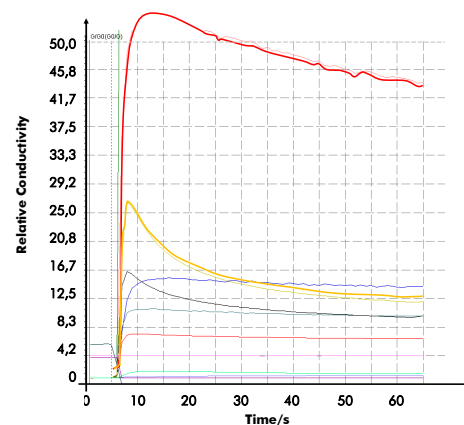


Figure 5: Response of the gas sensors after exposure to the headspace of contaminated wheat: VOC of *Fusarium graminearum*

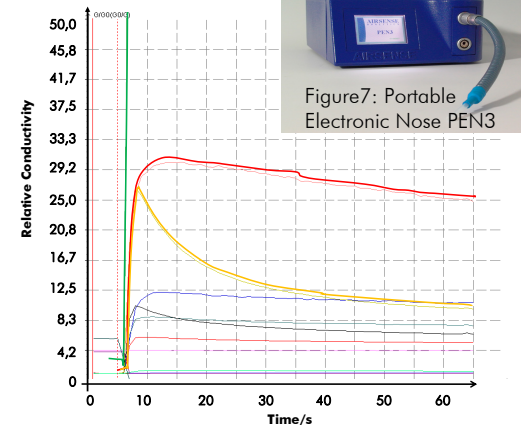


Figure 6: Response of the gas sensors after exposure to the headspace of contaminated wheat: VOC of *Fusarium culmorum*

Conclusion

With 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 (fig.1-3). However, the experimental NIR spectra depend on the shape, colour, density and texture and composition of the kernels. Therefore, chemometric tools are indispensable to properly account for these disturbing factors and reach out for the desired chemical information of the sample (Kessler, 2006).

With the homogenic sensor array system PEN 3 it is possible to differentiate wheat samples inoculated with various species of *Fusarium* (fig. 4-6) due to different volatile organic compounds (VOC).

References: Kessler, R.W. (ed.), 2006. Prozessanalytik. Strategien und Fallbeispiele aus der industriellen Praxis.