Abstract

Improving mycotoxins measurements and analysis by selected near infrared instrumentation

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Introduction

The frequent contamination of cereal grains with *Fusarium* toxins, zearalenone (ZEN) and with *Penicillium* species, producing ochratoxin A (OTA), are important issues in animal and human nutrition. They can contaminate feed and foodstuff and the determination their presence is essential. The major concern is the possible toxicant effect that can cause serious health problems for animals as well as for humans and for economic reasons. The aim of the present study was to evaluate different NIR spectroscopy instruments (at-line, on-site or on-line) to examine the quantitative levels of OTA and ZEN in wheat.

Materials and Methods

Four different NIR instruments have been used in this study: INS-I-Foss NIRSystems 6500 spectrophotometer (400-2500 nm) and two modules: transport and optical fiber probe; INS-II-Fourier transform (FT-NIR) by Perkin–Elmer (1112–2500 nm), INS-III-Polychromix PHAZIR^{TM}, portable NIR spectrometer (1600-2400 nm); and INS-IV-CORONA 45 VisNIR 1.7 on-line instrument (400-1680 nm). All spectral data were recorded as log 1/R. Chemometric models were developed using WinISI II software v.1.5 and performing quantitative analysis with PLS. The reference data were determined by HPLC-Ms. Different strategies, data pretreatments and derivatives were tested.

Results and Discussion

For OTA the preliminary results showed low errors and high correlations; especially for the instruments working in a wide spectral range. The INS-III and INS-IV instruments with high/medium portability showed slightly worse prediction statistics compared to the other instruments. It is expected that by increasing variation in the sample set, the statistics could be improved. For ZEN excellent prediction statistics were obtained with the INS-I and INS-II instruments with the SECV ranging from 0.54 ppb (INS-II) to 0.89 ppb (INS-I-transport module) and r^2 ranging from from 0.96 (INS-II) to 0.93 (INS-I-transport module or optical probe). Regarding spectral data collected from the INS-IV instrument, good results were obtained (SECV= 0.93 ppb; $r^2 = 0.91$). This was in spite of spectra covering the visible and only the short wavelengths of the NIR region. Promising results were obtained with the INS-III portable instrument.

Conclusion

A comparison between NIR instruments confirmed the capability of all instruments tested to predict ZEN contamination in wheat. For OTA, the results obtained with the INS-III needs to be improved; the poor results could be related to its narrow scanning window.

Reference paper as:
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