Title Indirect detection of fumonisins in maize by chemical imaging

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Abstract

Introduction: Fungal growth in Maize (*Zea mays*) can occur during crop growth, harvesting or storage. When cereal grains are colonized by fungi (*Fusarium*) contamination with mycotoxins of these fungi can occur. These toxins are natural contaminants of cereal grains and mostly found in maize. Currently fumonisins are mainly quantified by HPLC. HPLC is an accurate, but slow and expensive analysis requiring chemical reagents. The possibility of using a near infrared (NIR) chemical (hyperspectral) imaging system to detect *Fusarium* infection in whole maize kernels, non-destructively, was evaluated. **Materials and methods:** Whole maize kernels (uninfected, infected with no visible fungal growth, infected with visible fungal growth) were selected and NIR hyperspectral images of a 50 mm × 62 mm area were acquired using an InGaAs camera (Spectral Dimensions, Malvern) with LCTF filter (960-1662 nm). The transformation to absorbance was made using Spectralon reflectance standards and the ISys (v. 4.0) software. Evince (v. 2.0) software was used for image cleaning on principal component analysis (PCA) score images and score plots. This is a powerful interactive combination that can identify and remove unwanted regions in the image (background, shading, dead pixels and specular reflection) without prior knowledge. Cleaned images were further subjected to exploratory interactive multivariate analysis (Evince v. 2.0) using PCR. **Results and discussion:** By evaluating score plots and identifying clusters for projection onto the associated scored images, it was possible to find regions of different histological composition in the kernels. Similarly the slightly infected kernels (no visible fungal growth) could be distinguished as being different from non-infected kernels. The interpretation of important wavelengths and their associated functional groups was confirmed in the corresponding loading line plots.