

Abstract

On-line detection and quantification of ergot bodies in cereals by near infrared hyperspectral imaging

Philippe Vermeulen, Juan Antonio Fernández Pierna, Pierre Dardenne and Vincent Baeten*

Food and Feed Quality Unit, Valorisation of Agricultural Products Department, Walloon Agricultural Research Centre (CRA-W), Gembloux, 5030, Belgium

*Corresponding author: baeten@cra.wallonie.be

Introduction

Contamination of cereals with ergot (*Claviceps purpurea* Tul.) is well known. For the farmer, the damage caused by ergot is a yield reduction. For the feed and food sectors, the presence of ergot involves high toxicity risk for animals and humans due to its content of alkaloids. To reduce the risk of poisoning, the European Directive 2002/32/EC on undesirable substances in animal feed fixed a limit of 0.1% for ergot in all feedstuffs containing unground cereals. The regulation EEC No 689/92 restricted to 0.05% the concentration of ergot bodies in cereals for humans. The current work, performed within the CONFIDENCE project (<http://www.confidence.eu>), aims to detect and quantify on-line the presence of ergot bodies in cereals by NIR hyperspectral imaging.

Materials and Methods

Seven samples of wheat contaminated with 0.01% to 1% (100 to 10 000 ppm) of ergot were prepared and measured using a NIR hyperspectral line scan system combined with a conveyor belt (BurgerMetrics). All images consisted of lines of 320 pixels that were acquired at 209 wavelength channels (1100 - 2400 nm). Discriminant models were built based on specific spectral libraries. Partial Least Squares Discriminant Analysis (PLSDA) and Support Vector Machines (SVM) were used as classification methods for the construction of these models. They were applied to all the individual pixels in the images of the adulterated wheat samples in order to isolate and quantify the number of pixels detected as ergot.

Results and Discussion

The results showed a correlation higher than 0.99 between the predicted values obtained using PLSDA or SVM and the reference values. For a wheat sample containing a level of contamination of ergot as low as 0.01 %, it has been possible to detect enough pixels of ergot to conclude that the sample was contaminated. Moreover, no false positives were obtained when dealing with non-contaminated samples (0% ergot samples).

Conclusion

This study has shown the potential of the NIR hyperspectral imaging to quantify the ergot bodies in wheat kernels.