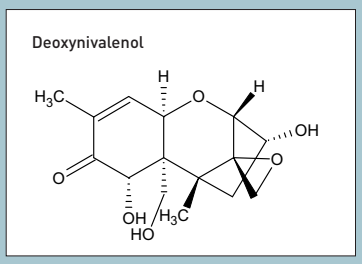
Fate of Mycotoxins in a Laboratory Scale Bio-ethanol Production System

INTRODUCTION

The production of bio-ethanol from wheat gives rise to distiller's grains which may be used as an animal feed co-product. The effect of this process on the mycotoxins present is not known. It has been reported that this process releases masked mycotoxins, e.g. leading to higher levels of deoxynivalenol (DON) in the resulting Dried Distillers Grains with Solubles (DDGS) compared to the starting wheat feed stock, and that yeasts can convert some toxins to more toxic metabolites, e.g. zearalenone to zearalenols. In addition typically 3 tonnes of wheat produce 1 tonne of animal feed and hence any free mycotoxins present could also be concentrated 3-fold.



AIM

The aim of the work is to establish the impact of the fermentation process on mycotoxin concentrations and to assess which toxins, if any, are concentrated in the final animal feed products and which toxins may be converted to different forms.

This work is being carried out as part of the EU FP7 project "Quality and Safety of Feeds and Food for Europe" (QSAFFE; www.qsaffe.eu).

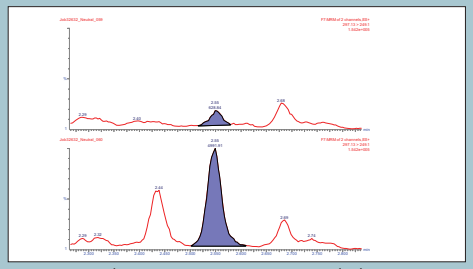
SAMPLES

Wheat contaminated with significant levels of DON, and as such with potentially high levels of other mycotoxins too, has been grown and harvested. Additional field plots of wheat have been inoculated with strains of *Fusarium poae* and *Fusarium avenaceum* which are known toxin producers (T2/HT2 toxin, beauvericin, enniatins, moniliformin).

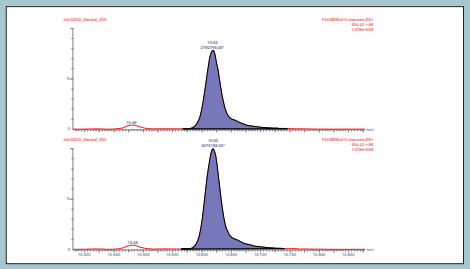
The mycotoxin levels in the inoculated wheat samples will be compared with the levels following fermentation. A laboratory scale fermentor has recently been commissioned and will be used to carry out these studies. Using inoculated wheat samples means that the mycotoxins and other possible new conjugates should be present at high enough levels to be easily measured and to allow mass balance studies to be conducted.

ANALYSIS

Analyses will be carried out using an LC-MS/MS multi-mycotoxin method that has been developed and is capable of the detection of approximately 50 mycotoxins. The method uses a Waters Acquity UPLC system with Xevo TQS MS detection. As examples the MS/MS chromatograms derived from the analysis for DON and for enniatin B1 are shown for DDGS sample extracts and for overspiked DDGS sample extracts.



DON analysis: MS/MS chromatograms for DDGS unspiked (top) and DDGS spiked with DON (at 250 µg/kg) before extraction (bottom)



Enniatin B1 analysis: MS/MS chromatograms for DDGS unspiked (top) and DDGS spiked with enniatin B1 (at 250 µg/kg) before extraction (bottom)

CONCLUSION

Inoculated wheat plots have been harvested and the performance of the recently-commissioned laboratory scale fermentor is being evaluated now. LC-MS/MS methodology for determination of approximately 50 mycotoxins in animal feedstuffs has been developed and will be used to monitor changes in the mycotoxin profile through the fermentation process.

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SEVENTH FRAMEWORK PROGRAMME

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