Mycotoxin Detection using Infrared Spectroscopy: Insights from Three Years of Research

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Analytical technology in food and agriculture

Mycotoxins are a significant burden on the food supply chain. Their toxicity necessitates strict regulations to ensure the safety of food and feed, resulting in substantial losses of agricultural commodities and, ultimately, severe economic impacts. While many rapid screening approaches exist, there is a need to further simplify mycotoxin detection, to support decision making along the food supply chain. Over the past several years, studies have highlighted the potential of infrared (IR) spectroscopy as a tool for detecting these food contaminants [1]. However, despite the promising performance reported in many studies, the adoption of IR spectroscopy for routine mycotoxin screening has not yet been realized. One reason might be that the optimistic performance of some mycotoxin screening models is often achieved using inoculated samples, small sets of selected samples, or by excluding a large number of samples as outliers, often without sufficient explanation. As a result, there is justified scepticism within the field of mycotoxin analysis regarding the use of IR spectroscopy for mycotoxin screening. In our recent work, we demonstrated the feasibility to screen for deoxynivalenol (DON) in complex, naturally contaminated wheat samples collected over multiple years from Austria and France using attenuated total reflection mid-IR spectroscopy [2]. Using partial least squares discriminant analysis (PLS-DA), models were developed to classify samples as compliant or non-compliant with the EC limit of 1000 µg/kg DON in unprocessed wheat. One of the key findings of our study is that the splitting of samples into calibration and validation sets had a significant influence on model performance. We observed a true positive rate ranging from 0.32 to 1 during validation depending on the sample split. This presentation will share insights gained from three years of research on mycotoxin prediction using IR spectroscopy, discussing challenges such as collecting a broad, naturally contaminated sample base and the influence of regional DON occurrence patterns, while also presenting preliminary results from efforts to advance the prediction models towards a quantitative approach.