

TOPIC: Modern LC-MS in Natural Toxins (including Mycotoxins) Analysis

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BIOGRAPHY

Prof. Dr. Rudolf Krska is head of the Center for Analytical Chemistry (45 co-workers) of the Department for Agrobiotechnology (IFA-Tulln) of the BOKU-University of Natural Resources and Applied Life Sciences, Vienna. In Dec. 2008 he has been appointed full professor for (Bio-)Analytics and Organic Trace Analysis and since 2005 has acted as deputy director of the IFA-Tulln. Rudolf Krska is an expert in food and feed analysis by chromatographic, mass spectrometric and immunoanalytical techniques. After obtaining his degree in chemistry at the Vienna University of Technology he carried out postdoctoral studies in the field of mycotoxin determination at Health Canada in Ottawa. Rudolf Krska has established intensive interdisciplinary cooperation with universities and companies and was coordinator of three European Commission funded projects dealing with the determination of mycotoxins and allergens in food. In 2002 he also became head of the Christian Doppler Laboratory for Mycotoxin Research in Tulln. As member of JECFA (Joint Expert Committee for Food Additives) of the FAO/WHO he has evaluated the impact of trichothecenes on humans. Rudolf Krska is also involved in other international activities such as two working groups of the European Committee for Standardization. Moreover, he has received 6 scientific awards, is (co-)author of more than 230 scientific publications (142 being peer reviewed) and given more than 260 presentations (97 of those being invited lectures) of his work at international conferences. 2006/2007 he worked for one year as a visiting scientist at the Food Science Group of Central Science Laboratory in York, UK where he studied the fate of ergot alkaloids and pyrrolizidine alkaloids using LC/MS/MS and LC/TOFMS methods. Recently, he accepted a temporary appointment as chief of division for food research at Health Canada from 07/2009 to 07/2010.

ABSTRACT

Modern LC-MS Methods for the Determination of Natural Toxins and their Metabolites

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This paper describes the development of modern LC-MS based analytical methods for the study of selected natural toxins and their metabolites in plants and foods. This includes the determination of multiple mycotoxins and the detection and identification of pyrrolizidine alkaloids in ragwort.

A previously published multi-mycotoxin method for the determination of mycotoxins in food and feed matrices based on liquid chromatography / electrospray ionization tandem mass spectrometry (HPLC/ESI-MS/MS) has been extended by 99 fungal and bacterial metabolites to cover 186 compounds overall. The method is based on a single extraction step using an acidified acetonitrile/water mixture followed by analysis of the diluted crude extract. 87 moldy food samples from private households were analysed, including bread, fruits, vegetables, cheeses, nuts and jam. In the 247 investigated sub-samples, 49 different analytes were identified, some of which were never reported before to occur in naturally contaminated food. Enniatins and ergot alkaloids occurred in all samples of (dark) bread/pastries at low µg/kg-levels. From the remaining analytes, chanoclavine, emodin, mycophenolic acid and roquefortine C were found most frequently.

In our attempts to understand the interaction between fungi and plants we have been carrying out metabolite profiling using LTQ-Orbitrap MS. The combination of the extraordinary resolution of the MS instrument (up to 100.000) and high mass accuracy (usually around 1ppm) with specific database searches (facilitates to generate the sum formulae and to assign (tentative) structure formulae to the detected metabolites.

A new time-of-flight mass spectrometric detection method (LC-TOFMS) for determining pyrrolizidine alkaloids (PA) in ragwort will also be presented. A database covering 176 PA was generated and was used to screen for this plant toxins which can also be found in honey. Experiments have demonstrated the rapid decomposition of the toxins in ragwort stored in bags.

Keywords: LC-MS/MS, LC-TOFMS, mycotoxin, pyrrolizidine alkaloids