TOPIC: Processing Food Contaminant: Modern Analytical Strategies

Richard STADLER

Address:
Quality Management Dept. Nestlé Product Technology Centre
Orbe
Switzerland

Present position:
Head, Quality Management Dept. Nestlé Product Technology Centre, Orbe, Switzerland

BIOGRAPHY

Dr. Stadler is currently heading the Quality Management Department at the Nestlé Product Technology Centre (PTC) in Orbe, Switzerland. His main tasks are to ensure that Food Safety & Quality are adequately addressed in all new product developments, as well as to support markets and operating companies in all Food Safety & Quality aspects for the pertinent products within the PTC's portfolio (coffee, coffee mixes, cocoa-malt beverages, cereal products, performance nutrition, foodservices). Within the frame of his current position, he also manages corporate R&D projects related to process contaminants. Dr. Stadler completed his PhD in 1989 at University of Munich in Germany, studying the biosynthesis and chemistry of morphine and bisbenzylisoquinoline alkaloids. After a 2-year post-doc at the same University, he joined the Nestlé Research Center in Lausanne Switzerland, where he started as a Research Scientist in the *Chemical Toxicology* group investigating the chemistry and bioactivity of foods and food constituents, in particular novel chemicals isolated from coffee and tea. In 1995 he was transferred to Nestlé R&D Singapore as Senior QA Technologist, and from 1998-2003 he headed the *Contaminants and Biomarkers* Group at the Nestlé Research Center in Lausanne.

ABSTRACT

Food Processing Contaminants: Modern Analytical Strategies

Richard Stadler[1*]

[1] Nestlé Product Technology Centre, CH-1350 Orbe, Switzerland
[*] Corresponding author - E-mail: richard.stadler@rdor.nestle.com; Phone: 079 3480103; Fax: +41 24 442 2021

Rapid analytical developments particularly over the past decade are clearly evident in the area of food-borne chemicals that are considered as ‘‘undesired’’ in foods. Such chemicals are part of our daily diets, and the very low detection limits of the analytical methods enable their quantification in many different foods at the low part-per-billion (ppb) level. Research in terms of method development for this group of substances has in the past years particularly focused on acrylamide, furan, and MCPD esters and related compounds.

In the case of acrylamide, several excellent reviews have been published on the different methods employed for acrylamide determination in foodstuffs. The analytical procedure broadly speaking encompasses (i) extraction (ii) clean-up and (iii) the instrumental technique. In all method developments, the extraction and clean-up steps are optimized/adapted to the corresponding instrumental tool, to which the protocol invariably refers. LC-MS/MS is considered to be the more appropriate instrument for that purpose as it is adapted for hydro-soluble analytes whilst achieving the adequate performance. The use of a mass detector is a major advantage in terms of analyte confirmation and quantitation when using stable isotope-labelled internal standards. However, the relatively high cost of this instrument may explain why the use of ‘‘cheaper’’ GC-based methods are also frequently described.

Several methods for the determination of chloropropanols at trace amounts in foodstuffs such as acid-HVP, soy sauces and related products, as well as processed foods have been published in the literature. The absence of suitable chromophores has made approaches based on GC the methods of choice, and in the earlier stages of method development the native compound was determined without derivatization using an MS detector or electrolytic conductivity detection. More recent GC-MS methods have been adapted to afford stable volatile derivatives that can be readily characterized by selective MS detection. In addition, the commercial availability of stable isotope-labelled 3-MCPD has contributed significantly to the reliability of the data. Recently, the issue of MCPD esters in refined and deodorised vegetable oils have raised concern. To date, there are only a few methods reported for the analysis of MCPD esters and the isolation and measurement of all chloroesters is a lengthy process due to the many species arising from the different fatty acid combinations associated with each chloropropanol moiety. The quantification and ratio of 3-MCPD mono to -diesters are important to assess the contribution of foods to the bioavailability of 3-MCPD. Further challenges are the quantification of glycidol esters that may also be formed during the analytical work-up when using certain methods.

However, the rapid pace of research in this field will continue, and more compounds with potential health concerns in foods will be discovered albeit at very low amounts. Consequently, there is an urgent need of reliable mechanisms whereby the compounds can be prioritized based upon the margin of safety (effect/exposure relationship), as well as future guidance toward the toxicological evaluation of food within a holistic , i.e., avoid testing individual compounds but rather the complete foods.

Keywords: Process contaminants, MCPD, acrylamide, furan