



Exponent®
Engineering & Scientific Consulting

Malcolm Driffield, Ph.D.

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Professional Profile

Dr. Driffield has 25 years' experience in the field of analytical chemistry, providing advice and guidance on the analytical techniques used to investigate problems across a number of commodities and Industries including food, beverages, food packaging and food contact materials such as plastics, coatings and printing inks, environmental samples and fuels.

Dr Driffield works with clients in the UK, EU, US and Asia to solve scientific, technical and regulatory challenges, specializing in the area of food contact materials, and also working with novel foods, food additives and colour additives. One area of expertise that Dr Driffield particularly enjoys working on is non-intentionally added substances (NIAS) in food contact materials and he uses his many years laboratory experience in this area to assist clients with all aspects of NIAS determination, including design and interpretation of analytical NIAS testing, identification and quantification of NIAS from analytical data and tracing the origin of these substances. Dr. Driffield has extensively published and is often an invited speaker at international conferences and workshops.

Dr. Driffield has experience in undertaking witnessed analysis of samples involved in disputes and litigation, for example contaminated ship cargoes and bunker fuel samples, in particular exploratory testing for fuel characterization and contaminant identification using mass spectrometric techniques, as well as overseeing testing according to ISO 8217 and other appropriate standards.

Before joining Exponent, Dr Driffield worked for over 16 years at a UK Government laboratory, Fera Science Ltd (previously The Food and Environment Research Agency (Fera) and the Central Science Laboratory (CSL)) where he gained widespread experience in analytical methodologies used in the determination of chemical contaminants in foods and food contact materials. It was at Fera as a Research Fellow, where he built-up his extensive knowledge of non-targeted analysis techniques used for the determination of NIAS. As well as a strong technical knowledge in applying analytical techniques, he has considerable experience in the interpretation of the complex data sets produced, for Industrial and Government clients, as well as global regulatory bodies.

In his previous role as Team Manager and Science Lead - Packaging and MS Solutions at Fera, Dr. Driffield led a team working on all aspects of food contact materials testing including product development, extraction and migration studies, and analysis using a wide range of state-of-the-art analytical technologies, often providing analytical data and interpretation of the results for regulatory submissions. He organized and presented on training courses and attended meetings held by the European Reference Laboratory for Food Contact Materials, representing the UK National Reference Laboratory in this area.

Academic Credentials & Professional Honors

Ph.D., Chemistry, University of York, UK, 2003

Master of Chemistry, Chemistry, University of York, UK, 1999

Prior Experience

Team Manager and Science Lead - Packaging and MS Solutions, Fera Science Ltd., 2015-2018

Research Fellow - Non-Targeted Analysis, Food and Environment Research Agency (Fera), 2010-2015

Higher Analytical Chemist - Food Contact Materials, Central Science Laboratory (CSL), 2004-2010

Higher Analytical Chemist - Mycotoxins, Central Science Laboratory (CSL), 2002-2004

Publications

Peer- Reviewed Publications

Driffield M, Garcia-Lopez M, Christy J, Lloyd AS, Tarbin J, Hough P, Bradley EL and Oldring P.K.T. (2018) The determination of monomers and oligomers from polyester-based can coatings into foodstuffs over extended storage periods. Food additives and Contaminants Part A, 35, 6, 1200-1213.

Garcia-Lopez M, Driffield M, Fernandes AR, Smith F, Tarbin J, Lloyd AS, Christy J, Holland M, Turford Z, Tlustos C (2018) Occurrence of polybrominated diphenylethers, hexabromocyclododecanes, bromophenols and tetrabromobisphenols A and S in Irish foods. Chemosphere, 197, 709-715.

Bengtstrom L, Trier X, Jensen LK, Granby K, Taxvig C, Vinggaard AM, Driffield M and Petersen JH (2016) Non-targeted screening for contaminants in paper and board food contact materials using effect directed analysis and accurate mass spectrometry. Food Additives and Contaminants, 33, 6, 1-14.

Maia J, de Quirós AR, Sendón R, Cruz JM, Seiler AM, Franz R, Simoneau C, Castle L, Driffield M, Mercea P, Oldring P, Paseiro P (2016) The determination of key diffusion and partition parameters and their use in migration modelling of benzophenone from low density polyethylene (LDPE) into different foodstuffs. Food Additives and Contaminants, 33, 4, 715-724.

Driffield M, Bradley EL, Castle L, Lloyd AS, Parmar M, Speck DR, Roberts DPT, Stead S (2015) Use of ASAP-TOF-MS to screen for plasticisers in gaskets used in contact with foods. Rapid Communications in Mass Spectrometry, 29, 1603-1610.

Driffield M, Bradley EL, Leon I, Lister L, Speck DR, Castle L, Potter ELJ (2014) Analytical screening studies on irradiated food packaging. Food Additives and Contaminants, 31, 3, 556-565.

Seiler A, Bach A, Driffield M, Paseiro P, Mercea P, Tosa V, Franz R (2014) Correlation of foodstuff with ethanol-water mixtures with regard to solubility of migrants from food contact material. Food Additives and Contaminants, 31, 3, 498-511.

Driffield M, Speck D, Lloyd AS, Parmar M, Crews C, Castle L, Thomas C (2014) Methods of analysis for 2-dodecylcyclobutanone and studies to support its role as a unique marker of food irradiation. Food Chemistry, 146, 308-313.

Bradley EL, Burden R, Bentayeb K, Driffield M, Harmer N, Mortimer DH, Speck DR, Ticha J, Castle L, (2013) Exposure to phthalic acid, phthalate diesters and phthalate monoesters from foodstuffs: UK total diet study results. Food Additives and Contaminants, 30, 4, 735-742.

Crews C, Driffield M, Thomas C (2012) Analysis of 2-alkylcyclobutanones for detection of food irradiation: current status, needs and prospects. *Journal of Food Composition and Analysis*, 26, 1-11.

Driffield M, Bradley EL, Harmer N, Castle L, Klump S (2010) The determination of polyadipates migrating from glass jar lid gaskets - Hydrolysis to adipic acid and measurement by LC-MS/MS. *Food Additives and Contaminants*, 27, 10, 1487-1495.

Hough RL, Crews C, White D, Driffield M, Campbell CD, Maltin CD (2010) Degradation of yew, ragwort and rhododendron toxins during composting. *Science of the Total Environment*. 408, 4128-4137.

Coulier L, Bradley EL, Bas EC, Verhoeckx KCM, Eigenhuijsen J, Driffield M, Harmer N, Castle L (2010) The analysis of reaction products of food contaminants and ingredients: Bisphenol A diglycidyl ether (BADGE) in canned foods (2010) *Journal of Agricultural and Food Chemistry*. 58, 4873-4882.

Donarski JA, Jones SA, Harrison M, Driffield M, Charlton AJ (2010) Identification of botanical biomarkers found in Corsican honey. *Food Chemistry*, 118, 987-994.

Jiang C, Driffield M, Bradley EL, Castle L, Oldring PKT, Guthrie JT (2010) The behaviour of MEKO-blocked isocyanate compounds in aluminium flake pigmented, polyester-polyurethane can coatings. *Journal of Coatings Technology and Research*, 7, 57-65.

Jiang C, Driffield M, Bradley EL, Oldring PKT, Cooke P, Castle L, Guthrie JT (2009) Studies of the ageing effect on the level of isocyanate residues in polyester-based can coating systems. *Journal of Coatings Technology and Research*, 6, 437-444.

Bradley EL, Jiang C, Guthrie JT, Driffield M, Harmer N, Oldring PKT, Castle L (2009) Analytical approaches to identify potential migrants in can coatings. *Food Additives and Contaminants Part A*. 26, 12, 1602-1610.

Crews C, Driffield M, Krska R, Berthiller F (2009) Loss of pyrrolizidine alkaloids on decomposition of ragwort (*Senecio jacobaea*) as measured by LC-TOF-MS. *Journal of Agriculture and Food Chemistry*, 57, 9, 3669-3673.

Bradley EL, Driffield M, Harmer N, Oldring PKT, Castle L (2008) Identification of potential migrants in epoxy phenolic can coatings. *International Journal of Polymer Analysis and Characterisation*, 13, 200-213.

Harmer N, Driffield M, Bradley EL, Fernandes A (2008) The determination of brominated flame retardants in food by liquid chromatography with tandem mass spectrometric detection: diastereoisomer specific hexabromocyclododecane and tetrabromobisphenol A. *Food Additives and Contaminants Part A*. 25, 1, 1-9.

Fernandes A, Dicks P, Mortimer D, Gem M, Smith F, Driffield M, White S, Rose M (2008) Brominated and Chlorinated Dioxins and Brominated Flame Retardants in Scottish Shellfish: Methodology, Occurrence and Human Dietary Exposure. *Molecular Nutrition and Food Research*, 52, 238-249.

Bradley EL, Castle L, Driffield M, Guthrie JT, Hill P, Jiang C, Mundt S, Oldring P, Stocker J, Wagner J, Wedzicha B, Yang N (2007) New technologies and chemistries and chemistries for food can coatings. *New Food*, 3, 46-51.

Worrall K, Hancock P, Fernandes A, Driffield M (2007) Enhanced separation and detection of tetrabromobisphenol A and hexabromocyclododecane isomers using UPLC®/MS/MS. *Organohalogen Compounds*, 69, 698-701.

Driffield M, Bradley EL, Castle L (2007) A method of test for residual isophorone diisocyanate trimer in new polyester-polyurethane coatings on light metal packaging using liquid chromatography with tandem

mass spectrometric detection. *Journal of Chromatography A*, 1141, 61-66.

Driffield M, Chan D, Macarthur R, MacDonald S, Brereton P (2004) Single laboratory validation of a method for the determination of hydroxymethylfurfural in honey using solid phase extraction cleanup and liquid chromatography. *Journal of the Association of Analytical Chemists International*, 88, 1, 1-7.

Driffield M, Goodall DM, Smith DK (2003) Syntheses of dendritic branches based on L-lysine: Is the stereochemistry preserved throughout the synthesis? *Organic and Biomolecular Chemistry*, 1, 2612-2620.

Driffield M, Hird SJ, MacDonald SJ (2003) The determination of a range of mycotoxins in animal offal food products by HPLC-MS/MS. *Aspects of Applied Biology*, 68, 205-210.

Driffield M, Goodall DM, Klute AS, Smith DK, Wilson K (2002) Synthesis and characterisation of silica-supported L-lysine-based dendritic branches. *Langmuir*, 18, 8660-8665.

Davies AV, Driffield M, Smith DK (2001) A dendritic active site: Catalysis of the Henry reaction. *Organic Letters*, 3, 3075-3078.

Driffield M, Bergstrom ET, Goodall DM, Klute AS, Smith DK (2001) High-performance liquid chromatography applications of optical rotation detection with compensation for scattering and absorbance at the laser wavelength. *Journal of Chromatography A*, 939, 41-48.

Book Chapters

Driffield M, Bradley EL, Castle L, Coulier L (2011) Identification of unknown migrants from food contact materials, in *Mass Spectrometry in Food Safety, Methods and Protocols*, edited by J. Zweigenbaum, 357-372.

Driffield M (2004) Food and nutritional analysis: Mycotoxins. *Encyclopedia of Analytical Science*, 2nd Edition, 261-271.

Application Notes and White Papers

Driffield M, Bradley EL, Castle L (2016) Safety assessment of food contact materials: The role of high-resolution mass spectrometry in the comprehensive analysis of the total migrate. *Thermo White Paper*.

Driffield M, Lloyd AS, Bradley EL, Roberts DPT (2013) The identification and structural elucidation of potential migrants from paper and board food packaging using UPLC/QTOF-MS with MSE and MassFragment. *Waters Application Note*.

Lloyd AS, Salanson CA, Semizer H, Leak J, Driffield M, Bradley EL (2012) Analysis of printing ink components from food packaging materials by GC-MS/MS. *Agilent Application Note*.

Driffield M, Lloyd AS, Noonan G, Morphet J (2011) High throughput screening of food contact materials. *Waters Application Note*.

Driffield M, Bradley EL, Castle L, Zweigenbaum J (2007) LC-TOF-MS as a tool to support can-coating-food interaction studies. *Agilent Application Note*.

Worrall K, Hancock P, Fernandes A, Driffield M (2007) Utilising the speed and resolution of UPLC to enhance the MS/MS detection of HBCD and TBBPA diastereoisomers. *Waters Application Note*.

Driffield M, Bradley EL, Castle L, Zweigenbaum J (2007) Identification of unknown polyester oligomers in polyester polyurethane based food can coatings by LC-TOF-MS using molecular feature extraction and database searching. *Agilent Application Note*.

Driffield M, Bradley EL, Castle L, Zweigenbaum J (2007) Identification of reaction by-products and contaminants in epoxyphenolic coatings for food cans. Agilent Application Note.

Posters

Christy J, Driffield M, Garcia Lopez M, Fernandes A, Lloyd AS, Tlustos C (2017) The determination of HBCDs, a range of bromophenols, tetrabromobisphenol A and tetrabromobisphenol S in foodstuffs from Ireland. BFR 2017, in York, UK, May 2017.

Driffield M, Bradley EL, Speck DR, Lister L, Parmar M, Leak J, Roberts DPT, Stead S (2013) Rapid screening of gaskets using ASAP and high resolution mass spectrometry. 61st ASMS Conference on Mass Spectrometry and Allied Topics, in Minneapolis, Minnesota, USA, June 2013.

Driffield M, Bradley EL, Speck DR, Lister L, Parmar M, Leak J, Roberts DPT, Stead S (2013) Rapid screening of gaskets using ASAP and high resolution mass spectrometry. British Mass Spectrometry Society Annual Conference, in Eastbourne, UK, September 2013.

Lloyd AS, Salanson C-A, Semizer H, Leak J, Driffield M, Bradley EL (2012) GC-MS/MS analysis of foods for printing ink components migrating from food packaging. ILSI Europe 5th International Symposium on Food Packaging - Scientific Developments Supporting Safety and Innovation, in Berlin, Germany, November 2012.

Bradley EL, Lloyd AS, Leak J, Driffield M, Castle L, Stratton J (2012) Detection, identification and quantification of NIAS from food contact materials and articles. ILSI Europe 5th International Symposium on Food Packaging - Scientific Developments Supporting Safety and Innovation, in Berlin, Germany, November 2012.

Castle L, Driffield M, Bradley EL, Speck DR, Parmar M, Mercea P (2012) Model studies to determine diffusion and partition parameters for substance migration from paper and board for use in the FACET project. ILSI Europe 5th International Symposium on Food Packaging - Scientific Developments Supporting Safety and Innovation, in Berlin, Germany, November 2012.

Driffield M, Bradley EL, Speck DR, Lloyd AS, Roberts DPT (2012) Non-targeted screening to investigate markers of recycling in paper and board for use in food packaging. ILSI Europe 5th International Symposium on Food Packaging - Scientific Developments Supporting Safety and Innovation, in Berlin, Germany, November 2012.

Driffield M, Bradley EL, Speck DR, Lister L, Parmar M, Roberts DPT (2012) Rapid screening of gaskets using ASAP and high resolution mass spectrometry. ILSI Europe 5th International Symposium on Food Packaging - Scientific Developments Supporting Safety and Innovation, in Berlin, Germany, 2012.

Morphet J, Gay M, Gledhill A, Driffield M, Lloyd AS (2011) Food packaging migration - direct injection (ASAP) and LC analyses using QToF MS. 59th ASMS Conference on Mass Spectrometry and Allied Topics, in Denver, Colorado, USA, June 2011.

Presentations

Non-intentionally added substances (NIAS): How to identify the unidentified at Food Contact Regulations Europe 2023, organised by Chemical Watch, in Brussels, Belgium, 17th-18th April 2023.

Non-intentionally added substances (NIAS): Importance, approach, and recent advances at Chem Academy Food Contact Material Regulations Conference, in Berlin, Germany, 6th-7th February 2023.

Regulatory considerations in formulating sustainably at SCI Formulation Forum 4th Annual Event: Challenges and opportunities in formulating a sustainable future, in London, UK, 24th-25th January 2023.

Printing ink regulation in Europe: The new German Ordinance and changes to Swiss rules at Plastics & Paper in Contact with Foodstuffs 2022, in Amsterdam, The Netherlands, 13th-14th December 2022.

PFAS in food: A persistently emerging issue at the European Crisis Management Summit 2022, in Hertfordshire, UK, 17th to 19th October 2022.

Advances in NIAS analysis at Food Contact Regulations Europe 2022, organised by Chemical Watch, 29th-30th March 2022.

Bio-based food contact materials at Food Contact Regulations Europe 2022, organised by Chemical Watch, 29th-30th March 2022.

Technical requirements on testing for a holistic approach to FCM compliance at Global Food Contact 2021, Virtual pre-conference workshop organised by Smithers Pira, 8th June 2021.

Day two keynote: Hot topics for food contact materials assessment in 2021 at Food Contact Regulations Europe 2021, Virtual event organised by Chemical Watch, 23rd-24th February 2021.

Approaches to safety assessments of adhesives and printing inks for regulatory submissions in Europe at Plastics & Paper in Contact with Foodstuffs 2019, in Amsterdam, The Netherlands, 3rd to 5th December 2019.

Analytical approaches to NIAS for regulatory submission at the NIAS, Mineral Oils, Risk Assessment and Testing, Predictive Models Conference, in Munich, Germany, 27th-28th March 2019.

Comprehensive analysis of the total migrate from can coatings: Solvents vs. simulants vs. foods at the 7th International Fresenius Conference Residues of Food Contact Materials in Food, in Cologne, Germany, June 2018.

The determination of NIAS from can coatings into foodstuffs at the Plenary EURL-FCM NRL Network Meeting, in Ispra, Italy, October 2017.

Advanced analytical approaches to NIAS determination from food contact materials at the 4th International Conference on Food Contact Compliance, in Baveno, Italy, September 2017.

The determination of NIAS from can coatings into foodstuffs at the 6th International Fresenius Conference Residues of Food Contact Materials in Food, in Cologne, Germany, June 2017.

Advanced analytical approaches to NIAS determination from food contact materials at the NIAS and Mineral Oils in Food Contact Materials: Regulatory and Analytical Affairs Conference, in Munich, Germany, March 2017.

Approaches for the determination of NIAS as a part of Safety-By-Design at the 6th International Symposium on Food Packaging: Scientific Developments Supporting Safety and Innovation, in Barcelona, Spain, November 2016.

Recent advances for the determination of NIAS as part of safety by design at the 5th International Fresenius Conference Residues of Food Contact Materials in Food, in Cologne, Germany, June 2016.

Targeted and non-targeted analytical techniques for the determination of migrants from food contact materials at the Agilent Environmental & Food MS Meeting in Bristol, UK, January 2016.

Advanced analytical approaches for the determination of IAS and NIAS from food contact materials at Plastics & Paper in Contact with Foodstuffs 2015, in Barcelona, Spain, December 2015.

Targeted and non-targeted analytical techniques for the determination of migrants from FCMs at the 4th International Fresenius Conference Residues of Food Contact Materials in Food, in Cologne, Germany, March 2015.

Mass spectrometric profiling tools to verify the declared origin of timber at the British Mass Spectrometry Society Environmental Monitoring Special Interest Group meeting, in Southampton, UK, July 2014.

Development of state-of-the-art mass spectrometric techniques for non-targeted detection at the Fera Science Conference 2013, in York, UK, October 2013.

The challenges in analysis of food and food contact materials and solutions provided by ion mobility separation at the Ion Mobility-MS Knowledge Transfer and Networking meeting, Waters, in Manchester, UK, September 2013.

Isotopic, chemical and genetic profiling tools to verify the declared origin of timber at the British Mass Spectrometry Society Annual Conference, in Eastbourne, UK, September 2013.

The chemical safety of food and food contact materials - the role of high resolution mass spectrometry at the Mass Spectrometry in Manchester Food workshop, University of Manchester, UK, September 2013.

Analytical screening studies on irradiated food packaging at ILSI Europe 5th International Symposium on Food Packaging - Scientific Developments Supporting Safety and Innovation, in Berlin, Germany, November 2012.

The use mass spectrometry with ASAP sample introduction for the analysis of plasticisers in the gaskets of food jar lids at 1st European Workshop on Ambient Mass Spectrometry and Related Mass Spectrometry-Based Techniques in Food/Natural Products Control: Safety, Authenticity, Forensics, Metabolomics, in Prague, Czech Republic, June 2012.

Atmospheric pressure solids analysis probe (ASAP) - Instrumentation and Fundamentals at 1st European Workshop on Ambient Mass Spectrometry and Related Mass Spectrometry-Based Techniques in Food/Natural Products Control: Safety, Authenticity, Forensics, Metabolomics, in Prague, Czech Republic, June 2012.

The use of non-targeted screening to investigate markers of recycling in paper and board for use in food packaging at 13th Fera/JIFSAN Symposium New developments in food science: realising the potential of 'omics' technologies in York, UK, June 2012.

GC-MS approaches to measurement of printing ink components and other potential migrants from food packaging materials for an Agilent Webinar, November 2011.

Assessing migration from food contact materials by GC-QQQ-MS - Printing ink components at Agilent Environmental/Food Seminar, in Bristol, UK, September 2011.

The identification and implications of reaction and breakdown products from starting substances used to produce food contact plastics at an Agilent Seminar - Targeted and Non-Targeted Analysis of Food Contaminants by Mass Spectrometry, in California, USA, April 2011.

Identification of unknown contaminants in foodstuffs migrating from food contact materials at Association of Official Analytical Chemists (AOAC) Annual Meeting, in Philadelphia, USA, September 2009.

Application of LC-TOF-MS to the screening and identification of food contaminants derived from packaging materials at an Agilent Environmental and Food Mass Spectrometry Users Meeting, in Portsmouth, UK, September 2009.

Literature review, analytical screening and chemical migration studies on irradiated food packaging at the

Food Standards Agency, Food Contact Materials Working Party Meeting, in London, UK, May 2008.

Identification of unknown reaction by-products and contaminants in epoxy- and polyester-based food can coatings by LC-TOF-MS at the British Mass Spectrometry Society Annual Conference, in Edinburgh, UK, September 2007.

Determination of brominated flame retardants in foods by LC-MS/MS, at the International Conference on Analysis of Emerging Contaminants in the Environment, in York, UK, March 2007.

Determination of brominated flame retardants in foods by high performance liquid chromatography with tandem mass spectrometric detection, at 3rd National Meeting on Environmental Mass Spectrometry, in Chester, UK, April 2006.

Chiral Stationary Phases for HPLC based on dendritic branching, at 14th International Symposium on Chirality, in Hamburg, Germany, September 2002.

High-performance liquid chromatography applications of optical rotation detection with compensation for scattering and absorbance at the laser wavelength, at 23rd International Symposium on Chromatography, in London, UK, October 2000.