

Prof. Luigi Mondello The Pioneer of Multidimensional Chromatography



We interviewed Professor Luigi Mondello of University of Messina in Italy, who has become the leading light in the field of multidimensional chromatography. Shimadzu has been collaborating with Prof. Mondello and his team since 1996, funding and providing instruments to further advance the techniques.

Shimadzu:

Please let us know the theme and outline of your study, as well as the goal.

Prof. Mondello:

A GC×GC-MS/FID method has been developed for the elucidation of an important group of lipid compounds in vegetable oil and dairy products, namely the unsaponifiable matter. The sensitivity and the formation of group-type patterns were the GC×GC characteristics most exploited in the specific applications reported. Such a method can certainly be used to assess the quality (e.g., presence or absence of degradation products) and genuineness (e.g., vegetable oil adulteration, presence or absence of phytosterols derived from vegetable lipids) in vegetable oil and dairy products.

I now focus on ultra- and very-fast gas chromatography that allows users to perform analyses in greatly reduced times, without losing information. Fast gas chromatography units are often linked with mass spectrometers for qualitative and quantitative objectives. Such methods provide the possibility of obtaining real-time results, and are very useful when analyzing a high number of samples or when needing immediate answers.

I and Shimadzu are also upgrading comprehensive two-dimensional and multidimensional chromatography systems. I apply such approaches to the analysis of samples, ranging from plant extracts, food products, petrochemicals, pharmaceutical and cosmetic products, to various environmental substances.

In particular, the development and introduction of multidimensional instrumentation, as well as innovative software, has contributed greatly toward revealing the unsuspected complexity of many real-world samples.

Ten years from now, the comprehensive chromatography methods we are working with, such as LC×LC, GC×GC and LC×GC, will have a revolutionary effect on the chromatography community. If we succeed in making these powerful technologies more accessible, in terms of both hardware and software, then the impact will be a great one.

Shimadzu:

What stage are you now on and what comes next? What are the challenges?

Prof. Mondello:

I plan to continue developing instrumentation for fast GC, with attention focused on the injection system, and to develop simpler and more effective modulators for comprehensive chromatography. I also plan to engage in the development multidimensional chromatography software and MS spectra databases, which will make compound identification a simpler and more reliable task. Our main common goal, namely the evolution of chromatography-mass spectrometry technologies, will be achieved within the context of our intense collaboration with Shimadzu.

Shimadzu:

What do you expect from Shimadzu as a partner and does Shimadzu meet your expectations?

Prof. Mondello:

Without Shimadzu I could not have achieved all of this. I started working with Shimadzu because of the company's willingness to revolutionize instrument technology. In the last ten years Shimadzu has developed entirely new instrumentation. They did not just remake old instruments. I also like the Japanese way of solving problems—slowly but with excellent results. We tested, advised and validated these powerful devices for speed, sensitivity and selectivity. It has been a very nice and fruitful collaboration.

When I first started my collaboration with Shimadzu, fast GC and GC-MS were barely employed due to the lack of commercial instrumentation. Now, fast methods are routinely employed in many industrial and academic fields.

Comprehensive two-dimensional gas, liquid and liquid-gas chromatography hardware and software have been developed and are now exploited by a great number of analysts across the world. GC×GC methods are making greater inroads in the analysis of fatty acid methyl esters in food and biological samples, pesticides and petrochemicals, as well as flavors and fragrances, while LC×LC, linked with mass spectrometry, is increasingly useful for a range of tests related to health, biology and nutrition, including proteomics, lipidomics, and food antioxidant analysis. LC×GC methods have a demonstrated effectiveness for food contaminant analysis (e.g., mineral oil in vegetable oils). In short, analytical horizons have been extended.

Shimadzu:

Do you have any suggestions or expectations for this global technical journal?

Prof. Mondello:

Because the journal is focused on the description and presentation of modern powerful analytical instrumentation, it would also be nice to dedicate a space on how, when and by whom specific methods were introduced to the field. Some topics could be, for example, mass spectrometry in general, triple quad MS, comprehensive 2D LC, 2D GC, etc.

Shimadzu:

Thank you very much.



A GC×GC Handbook and Application Compendium authored by Prof. Mondello are available at: www.shimadzu.com/an/gcms/gcgc.html



And here are his latest publications:

- (1) Peter Quinto Tranchida, Flavio Antonio Franchina, Mariosimone Zoccali, Sebastiano Panto', Danilo Sciarone, Paola Dugo, Luigi Mondello "Untargeted And Targeted Comprehensive Two-Dimensional GC Analysis Using A Novel Unified High-Speed Triple Quadrupole Mass Spectrometer" *J. Chromatogr. A* 1278 (2013) 153-159
- (2) Peter Q. Tranchida, Simona Salivo, Flavio A. Franchina, Ivana Bonaccorsi, Paola Dugo, Luigi Mondello "Qualitative and quantitative analysis of the unsaponifiable fraction of vegetable oils by using comprehensive 2D GC with dual MS/FID detection" *Anal. Bioanal. Chem.* 405 (2013) 4655-4663