COMPREHENSIVE CHROMATOGRAPHY (GC×GC, LC×LC) TECHNIQUES COUPLED TO MASS SPECTROMETRY FOR THE ANALYSIS OF FOOD SAMPLES

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Comprehensive 2D chromatography separations are performed on two different columns, with a complementary and as much as orthogonal separation capability. The transfer system (defined as modulator), is located between the two dimensions, and enables the continuous and sequential transfer of primary-column effluent bands onto the second column. Consequently, the entire initial sample is subjected to two separation steps. Comprehensive 2D chromatography technologies produce very high capacities since the resulting peak capacity is the product of the peak capacities relative to each dimension. The comprehensive 2D chromatography technologies, which will be the object of discussion, are based on liquid (LC×LC) and gas (GC×GC) mobile phases. With regard to mass spectrometry (MS) instrumentation, a great deal of evolution has occurred over the last 15 years; in particular, ultimate generation MS/MS systems can be employed for both untargeted and highly-selective/sensitive targeted analyses. These novel MS devices are capable to satisfy the requisites of both LC×LC and GC×GC separations, with such a combination creating highly powerful and flexible four-dimensional analytical tools. GC×GC-MS investigations were directed to experiments involving the analysis of phytosanitary compounds in drinking water. The number of possible combination of stationary phases is higher in LC×LC, with respect to GC×GC, in order to maximize the gain in peak capacity, through the coupling of independent separation modes. When a class-type separation is to be achieved in the first dimension, orthogonality may be obtained by using hydrophilic interaction liquid chromatography (HILIC), coupled to reversed-phase (RP) LC; this approach was applied for the characterization of the lipidic fraction of sea organisms. Whatever the front-end separation, the use of MS/MS brings in added dimensions in terms of selectivity, specificity, and structural information. Finally, a multidimensional LC-GC application with a double detection [flame ionization detection (FID) and triple quadrupole (QqQ) MS] will be illustrated for the determination of mineral oil contamination in edible oils.

Keywords: *comprehensive chromatography, contaminants, mass spectrometry*

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