Applications of LC-MS and LC tandem MS to determine pesticide residues in food

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Pesticide residue determination in food is a priority objective to ensure quality and to prevent risks for the human beings. These compounds are widely used to the control of pests that affect agricultural crops and livestock. They can reach population via food-chain [1]. Nowadays, the analysis of pesticide residues in food represents a basic instrument not only for the protection of human health, through risk assessment studies and prevention strategies, but also for routine monitoring and official control purposes [2].

Besides food screening methods like immunoassays or biosensors, an extensive amount of research is carried out to develop new and improved methods for confirmation. To this end liquid chromatography coupled to mass spectrometry (LC-MS) has been given a lot of attention. LC offers the advantages that a fairly simple sample preparation is sufficient and complex food samples can be easily handled. MS, on the other hand, is known for its selectivity and sensitivity. The pass five years have shown a considerable increase in the number of applications of LC-MS to control pesticide residues for ensuring food safety, which seems to corroborate its great possibilities in this exciting field of research. The conventional LC-MS using single quadrupole technique, frequently used for pesticide control in food three years ago, has increasingly been replaced by the two tandem mass spectrometers, triple quadrupole (QqQ) and quadrupole ion trap (QIT). Although LC-QqQ MS has been used in the majority of the applications, QIT based mass analyzers show great potential in routine analysis [3-5].

This presentation examines the applicability of LC-MS to determine pesticide residues in food by means of a number of specific applications. The optimized analytical parameters, like eluent composition, flow, gradient programs, column types, and API interfaces will be discussed in detail for each method. Data on

the commonly used mass analyzers (single quadrupole, QqQ, and QIT) will be presented paying especial attention to the aspects regarding with (i) unequivocal identity confirmation, (ii) number of pesticides simultaneously determinable, and (iii) sensitivity enough to determine these compounds at levels lower than the maximum residue limits (MRLs) set by governing authorities. The gradual introduction of ToF instruments with their distinctly enhanced selectivity and the possibility to calculate elemental composition as well as the implementation of most recent approaches in LC-MS/MS, including linear traps, and hybrid instruments, Q-ToF and Q-linear traps will be commented since it is expected that they improve performance even more in the near future.

Furthermore, appropriate sample preparation methods will be described and the adverse influence of matrix effects on the accurate quantification of pesticide residues, a problem that still causes concern, will be analyzed and discussed. Finally, complete validation data for each analysis will be presented and examples of real food samples will be shown.

References

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