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Comprehensive two-dimensional liquid chromatography as a powerful tool for food applications.

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Comprehensive two-dimensional liquid chromatography is a very useful tool when the complete separation and identification of complex sample like food extracts should be carried out. 2DLC provides a very high peak capacity when the separation modes of each dimension maintain a high orthogonality degree. Therefore, 2DLC has to be employed when monodimensional techniques cannot be able to offer a complete resolution of the studied sample. In that sense, phospholipids are compounds in which different fatty acids and different polar groups (phosphatidylinositol, phosphatidylethanolamine, phosphatidylserine, phosphatidylcholine, sphingomyelin, lysophosphatidylcholine) can be present forming the molecule, hence, this mixture can constitute a huge complexity. Professor Dugo developed a stop-flow two dimensional liquid chromatography for the analysis of such a complex sample. In this approach, an HILIC column in the first dimension was coupling to a reversed phase in the second dimension. With this HILIC x RP method the separation of phospholipids by classes could be obtained in the 1D and in the 2D the phospholipids could be separates as function of the chain length and the number of fatty acid double bonds, that is, by molecular species. This developed method allowed the separation of up to 15 different species from the same phospholipid class, showing the huge separation capacity of the 2DLC technique.

Ambient Ionization with Plasmas and Charged Droplets.

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Ambient ionization mass spectrometry are relatively innovative series of techniques that open new possibilities to qualify and quantify samples that usually have not been analyzed by direct MS, as well as the analysis of the native surface of interesting samples. Two of the most common ambient ionization techniques are the ion source direct analysis in real time (DART) and desorption electrospray ionization (DESI). DART mechanism is based on the APCI pathway but in an open air format, however DART is able to carry out experiments that are not possible to do with APCI like analysis of solid or gas samples and improves the ionization reducing the ion suppression phenomena. Besides, DART offers shorter analysis time and less working flow pre and post analysis. On the other hand, DESI employs the ionization concept of ESI, but DESI can be apply to do analysis that cannot be possible to perform with ESI as the MS imaging. Therefore, both ionization techniques are complementary. As an example, these new advances on MS make possible the analysis of thousands of samples of drug tablets with the objective of detect the quality of the drug and the presence of falsifications reducing in a huge manner the analysis time. For example in Professor Fernández's laboratory, coupling an ambient ionization source to a high resolution MS they could do an analysis in seconds, whereas a typical chromatographic separation for the identification of frauds in drugs can takes hours.The interest of the fast real-time and analysis of surface of samples at open air offered by the newly ambient ionization techniques are growing in applications such important as the pharmaceutical analysis, food safety, MS imaging, proteomics, metabolomics, forensics, among others.

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