Guest Editorial

Food analysis: why and current hows

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Food analysis is a discipline that deals with the development, application and study of analytical procedures for characterizing the properties of foods and their constituents. These procedures provide information regarding characteristics of foods which include nutrient composition, structure, physicochemical properties, sensory attributes as well as toxicants, allergens, contaminants, bioactive molecules & health benefits. In addition, analysis is also required to prove authenticity of food components, characterize raw ingredients, monitor food properties during processing, assess standards of final food product so as to maintain quality. This information is critical to understand the factors that determine the properties of foods, health benefits and to economically produce foods that are safe, nutritious and desirable. Food chemists thus have an important role to play in providing a secure food supply to the consumers.

In food analysis, sample preparation techniques are crucial due to the complex nature of foods. Some such techniques used in food analysis include application of molecularly imprinted polymers, use of microextraction techniques (veterinary residues), use of QuEChERS (quick, easy, cheap, effective, rugged, and safe) for determining pesticide residues in food and agricultural samples, immuneaffinity column clean-up techniques, solid-phase microextraction (SPME) techniques for quality characterization, application of ultrasound-assisted extraction to determine contaminants and liquid phase microextraction and most recently supercritical fluid extraction (SFE) and subcritical water extraction (SWE) all of which require a knowledge base in chemistry.

Spectroscopic techniques are the most extensively used in food analysis. For example Near infrared (NIR) spectra are used to identify transgenic foods or for measuring bioactive compounds in foods. The mid-infrared region has been used to study the structure of food proteins or to study intact food systems and their molecular structure-quality relationships. FTIR is used for rapid authentication and detection of adulteration of food. NMR has found use for the quick analysis of oil and fat content in agrifood products. In addition, separations based on liquid chromatography (LC) are being used in food analyses include hydrophilic interaction liquid chromatography (HILIC), nano-LC, or high-speed counter-current chromatography. Gas chromatography (GC) still is important for the analysis of volatile fractions or fatty acids in foods. Electrodriven separation techniques such as capillary electrophoresis (CE) or microchip capillary electrophoresis have applications in detection of genetically modified organisms, nucleosides and nucleotides in foods, in analysis of contaminants and food-borne pathogens. LC-MS or tandem MS (LC-MS/MS) are extensively applied to analyze antimicrobial residues in food of animal origin, antibiotics in food samples, food allergens etc. GC-MS or capillary electrophoresis-mass spectrometry (CE-MS) have applications in analyzing essential oils or food contaminants. Tandem MS has become a tool for the identification and quantification of analytes (mainly contaminants) in food analysis. Use of triple quadrupole, ion trap, and time of flight MS analyzers coupled to uni- or bidimensional separation techniques are widely being used in food analysis. Other MS applications include analysis of pesticides and their metabolites in food and water matrices, analysis of food proteins and peptides, characterize genetically modified crops, MALDI-TOF MS analysis of plant proanthocyanidins, or multistage mass spectrometry in quality, safety, and origin of foods. These clearly indicate the importance of chemistry in food analysis.

Foodomics is defined as the discipline that studies the food and nutrition domains through the application of advanced omics technologies to improve consumer's well-being, health, and knowledge through the use of epigenomics, transcriptomics, proteomics, lipidomics and metabolomics tools. Foodomics strategy, provide an opportunity to study the effect of food ingredients at genomic, transcriptomic, proteomic and/or metabolomic level, making possible new investigations on food bioactivity and its effect on human health at molecular level thus making possible interaction of food science and nutrition with disciplines such as pharmacology, medicine, or biotechnology. Analytical methods in Foodomics include MS- and NMR-based systems highlighting the importance of Chemistry and the role of food chemists in Food Analysis.