MS analysis of peanut allergens in food, what are the markers we are looking for?

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European Directive 2000/13/EC and its amendments regulate food labelling. It lists 14 allergenic foods/ingredients whose presence has to be declared on food labels. Peanuts and their derived products are included in this list.

The availability of specific and sensitive detection methods for peanut allergens is crucial for the food industry to inspect and control their production processes, for government regulatory agencies to enforce legislation, and for the allergic consumer whose health is at risk.

At the JRC IRMM, multiple technical approaches have been followed to detect the presence of allergenic ingredients. The developed methods either target an allergenic protein, or any other component that is specific for the offending food and can serve as a marker to detect its presence.

Protein-based methods are usually based on immunological techniques (eg. ELISA). In addition to this, methods employing mass spectrometric detection (MS) have been developed and allow an unambiguous identification of allergenic ingredients. In practice, either proteins or peptides are targeted for this purpose.

On one hand, a MS-based method, combining nano-scale liquid chromatography with quadrupole-time-of-flight mass spectrometry (Q-TOF MS/MS) was developed with the aim to identify a set of peptides that can function as markers for peanut allergens [1]. Emphasis was given to the detection of peanut allergens Ara h 1, Ara h 2 and Ara h 3, since these proteins are directly relevant for the allergenic potential of this food.

Food processing like roasting of peanuts is affects the stability of proteins and was shown to influence the detection of allergen sequence tags. The analysis of raw and roasted peanuts allowed the identification of peanut specific sequence tags that can function as markers of the specific allergenic proteins, and as tracers for food processing [1].

On the other hand, the combination of 2D gel electrophoresis, immunoblotting and Q-TOF MS/MS allowed the specific detection and identification of major peanut allergens and has revealed their position within 2D gel maps [2]. The characterisation of individual peanut allergens and their resolution into different isoforms, glycoforms and proteolytic products is of importance to study the effect of various thermal treatments such as roasting on peanut allergens.

For this purpose allergen-containing materials with a known processing history are used (eg. IRMM-481 peanut test material). The availability of such materials is required to analyse commercially available food products that might contain traces of peanuts, and will assist the protection of the health of allergic consumers. The presentation will give an overview of work carried out at the JRC IRMM in this field, and identify gaps in research.

References:
[1] H. Chassaigne, J.V. Nørgaard, A.J. van Hengel, J. Agric. Food Chem., 2007, 55(11), 4461-4473.
[2] H. Chassaigne, V. Trégoat, J.V. Nørgaard, S.J. Maleki, A.J. van Hengel, J. Proteomics, 2009, 72(3), 511-526.