Safe handling of allergen-containing ingredients in food processing

Food allergies affect an estimated 250 million consumers worldwide with more than 17 million in Europe alone. It is estimated that approximately 3% of adults and 6% of children have a food allergy. Although most food allergies cause relatively mild and minor symptoms, some can cause severe reactions and may even be life-threatening. Therefore, when a food safety issue occurs due to mishandling of allergen-containing ingredients, the entire food processing industry suffers.

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Today, major allergens include wheat (gluten), crustacean, shellfish, eggs, fish, peanuts, milk, tree nuts and soybeans (United States 'Big 8'), plus celery, mustard, sesame seeds, sulphur dioxide/sulphites, lupin, and mollusks (European list), for a total of 14 important groups of allergens. Even though the US and the EU have provided guidance documents for food allergen labelling, undeclared antigens continue to be a serious problem.

Implementation of new process steps

This has forced food companies to implement new process steps to eliminate allergen cross-contact during manufacturing. Every attempt must be made to visibly identify allergens and isolate them at every step of the process, from raw ingredients and equipment to other foods housed and/or processed in the same facility.

For one major allergen, gluten, detection is even more complex. Gluten is a complex mixture of hundreds of related but distinct proteins, mainly prolamins and glutenins, and can be found in wheat, barley, rye, some rare varieties of oats and their crossbred varieties. It is mainly the prolamins (gliadin in wheat), when digested into peptides, that trigger gluten sensitivity immune reactions, including coeliac disease.

The strongest immune response is to the prolamin alpha2-gliadin fragment, referred to as the 33-mer (recognised by the G12 antibody). This fragment is highly resistant to breakdown during digestion, making it a useful analytical marker for gluten in food products.

Since the only effective treatment for coeliac disease today is a gluten-free diet, this poses challenges to the food industry, as gluten is commonly found in many food products and additives. Plus, gluten-free products can have detectable levels of gluten due to cross-contamination during milling, storage, and/or production.

To complicate matters, gluten detection is challenging because of the diversity of food matrices, protein levels or modifications, and the vast number of immunogenic sequences with differential potential immunogenicity. Therefore, it is essential to have accurate, rapid test methods for detection of gluten in all types of foods.

Historically, ELISA was the recommended method for gluten detection in food and many commercial test kits are available. However, test kits give variable results depending on the selection of antibodies (specificity differences), extraction methods, and materials for assay calibration. ELISAs can also be costly and time-consuming.

Lateral flow devices can offer similar results, but again depend on antibody specificity for detection of specific gluten antigens. While many antibodies have been developed, only a few have made it into commercial tests.

One antibody, the Skerritt antibody, was raised against wheat gliadin and recognises high molecular weight glutenin and omega-gliadins, so it can work for detection of gluten in some processed foods. However, quantitation is based on omega-gliadin levels, which differ among various cereals.

A second antibody, R5, was raised against rye, but shows cross-

reactivity to wheat gliadin. It has poor affinity to the alpha-gliadin 33-mer, the most immunodominant toxic peptide for coeliac patients. Also, when used in the commercial ELISA, it overestimates the level of gluten in barley.

The best antibody option is the G12 antibody, which recognises the alpha-gliadin 33-mer of gluten, the fragment that triggers a strong autoimmune response in coeliac patients. It recognises a distinct amino acid sequence in wheat and detects similar peptides found in barley, rye, and some varieties of oats. It does not cross-react with soy, maize, or rice, making it suitable for measuring gluten in products containing these ingredients.

Ideally, commercial gluten detection kits should utilise the G12 antibody plus contain all the necessary regents/components for testing food and food surfaces for the presence of gluten. Results should be obtained easily and quickly, so either processing can be quickly halted for cleaning or product can be released as 'gluten-free'.

One such kit is GlutenTox Pro, a quick test for precise gluten detection. It can detect down to 5ppm of gluten in wheat, barley, rye and some rare oat varieties within 20 minutes, far below regulatory levels.

Provided as a 'lab in a box', it is designed with everything needed to conduct testing and is AOAC PTM certified for multiple food matrices and environmental surfaces.

For other allergens, high-sensitivity and quick and reliable detection are essential too. One commercial product family that meets these requirements is AlerTox Sticks which can detect allergens in raw materials, final products and on working surfaces. AlerTox Sticks provide accurate results in 10 minutes with no need for special equipment. Detection levels range from 1-20ppm, depending on the allergen. When combined with AllerSnap, food manufacturers can feel confident that cleaning has removed residual protein, including potential allergens.

Responsibility of food manufacturers

Other kits must be tested to ensure they meet stringent food manufacturer allergen testing requirements, including low detection levels and no cross-reactivity to non-allergens. In the meantime, food manufacturers must be held responsible for ensuring their products are clearly labelled and free from allergens as claimed on the food labels.

It is vital that they use the most sensitive, specific immunochemical test systems available today – in the case of gluten, tests should be based on G12 antibody detection – in the case of other allergens, sensitivity and specificity, combined with ease of use, are essential. ■

References are available from the author on request