Biosensor developed to identify allergens faster

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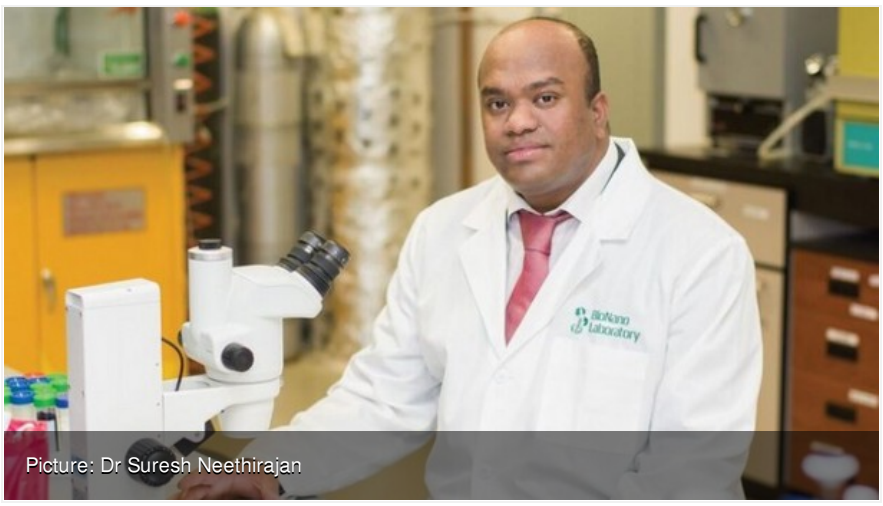

Picture: Dr Suresh Neethirajan

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Canadian scientists have developed a nanotechnology and aptamer based biosensor to detect allergens such as peanut protein and gluten.

Dr Suresh Neethirajan and Dr Xuan Weng, from the University of Guelph, said the allergen detector could expedite allergen reporting, and possibly reduce the number of reactions through more timely results.

The biosensor has been in development for two years and will soon be ready for use in the field by government inspectors and food companies.

Testing for allergens has been awkward and time-consuming. Tests can take up to four hours, and that is after the food sample has been delivered to a lab, said the scientists.

They hope to change the process into a 20-minute operation with a hand-held system that essentially takes the lab to the food source.

Canadian government regulations require that manufacturers label products that contain certain allergens, even if they are made in a facility where allergens are in another product.

How to use the device

Dr Neethirajan said in addition to being hand held, the module can be adopted for central food laboratory services instrumentation as well bringing down the time to results.

"Consumers take a small amount of a food sample, put it in

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a tiny vial or a cartridge, shake for 10 seconds and stick it into the reader. The reader will take about 45 seconds to analyze and the results can be known almost immediately," he told FoodQualityNews.

"The reader also has the capability to interface with a mobile app through a Bluetooth module and the information can be stored or sent in real time as well. From the sample processing to detection, the whole process will take a few minutes.

"We also did a customer discovery assessment and market research to understand the needs of consumers. We believe bringing down the time to results instead of shipping samples to the lab and enabling the consumers to better understand what they put inside their body is what is required here."

Neethirajan added they are looking for investment and collaborative opportunities to help to penetrate the market.

It is based on the ELISA (enzyme-linked immunosorbent assay) platform that is used in diagnostic labs to identify allergens but because of the nanomaterials and aptamers involved the sensitivity is superior.

The scientists said the instrumentation will take in to account a multiplexing approach to detect multiple food allergens from peanut, seafood, wheat as well as egg.

Technology behind system

For peanuts, the scientists have focused on an allergen named Ara h 1 because it can be identified through non-radioactive fluorescence.

The process requires a small amount of the suspected food to be liquefied in a suspension so that it can be injected using a filter syringe into a silicon-based plate, or chip, of microcapillaries that Neethirajan and Weng developed.

As the sample passes through tiny tubes of the microfluidic chip using capillary action, it travels through a beam of light from a LED source that is monitored by a specialized camera.

The image captures Ara h 1 protein particles that fluoresce when they come in contact with the chemical properties of the suspension. Currently, the camera records the data and sends it to a computer to be analyzed and deciphered.

To enable the allergen to fluoresce, Neethirajan and Weng used graphene oxide (GO) with a bio-sensing component, known as an aptamer. The aptamer acts similarly to antibodies that identify and attach themselves to foreign and hostile elements that enter the blood system.

Once a GO-aptamer mixture is attached to the allergen, the light source allows the protein particle to be detected and its image captured electronically.

By altering an aptamer's composition to identify other allergens, such as gluten, the detector can identify potentially hazardous food ingredients.

The final step in development is fine tuning the detection process for certain processed foods, such as roasted peanuts, that can alter the composition of Ara H 1 making it less obvious to be identified.

Neethirajan said they are using specific micro filters in the reader and sample module to enhance the specificity and binding towards processed food and multiple sampling points could also help to identify the allergen effectively.

Work to develop an app so results will also be available using a smartphone is ongoing.

Future targets include detecting Okadaic acid and Brevetoxin-2 from seafood such as shellfish, shrimp allergies as well as egg allergens and are expected to be ready in just over a year.

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