Smartphones for Allergen detection

ABOUT GEORGINA

GEORGINA ROSS is currently working at Wageningen Food Safety Research (WFSR). Her studies are aimed at the development of an affordable multiplex food allergen detection immunoassay with a smartphone readout.

Food Analysis spoke with Georgina Ross from Wageningen Food Safety Research (WFSR) about her work looking into the application of smartphone technology to the food analysis field.

Tell us about your current role at WFSR

At WFSR my role is a PhD candidate, working as part of the EU Marie Curie funded project FoodSmartphone. FoodSmartphone is an EU wide project training 11 PhDs in different scientific disciplines with the intention of developing food safety-based smartphone tests. My project is the development of an affordable multiplex food allergen detection immunoassay with a smartphone readout. Previously, I developed a lateral flow immunoassay for the detection of the mycotoxin, Ochratoxin A.

What are the main areas of research being undertaken at WFSR iwith respect to allergen detection?

WFSR is currently mainly focused on the detection of allergens in food using antibody-based screening methods such as enzyme linked immunosorbent assay (ELISA), lateral flow immunoassay (LFIA), surface plasmon resonance (SPR) and flow-cytometry. There is also work being performed based on DNA analysis such as real time PCR for multiplex allergen identification in foods as well as the development of LC-MS/MS validation methods for the complete and unambiguous identification of allergen presence.

What benefits are modern smartphones offering in this field?

Smartphones have a wide range of benefits as detectors. The portability of smartphones means that we can take analysis from the laboratory to the point of need, this means that analysis is more accessible than ever before. Smartphones have many features already embedded in them which allow them to be powerful analytical tools. They are ubiquitous systems that can be combined with multiple formats of test and then can be 'unplugged' and still used as a functional smartphone. One of the key features is the

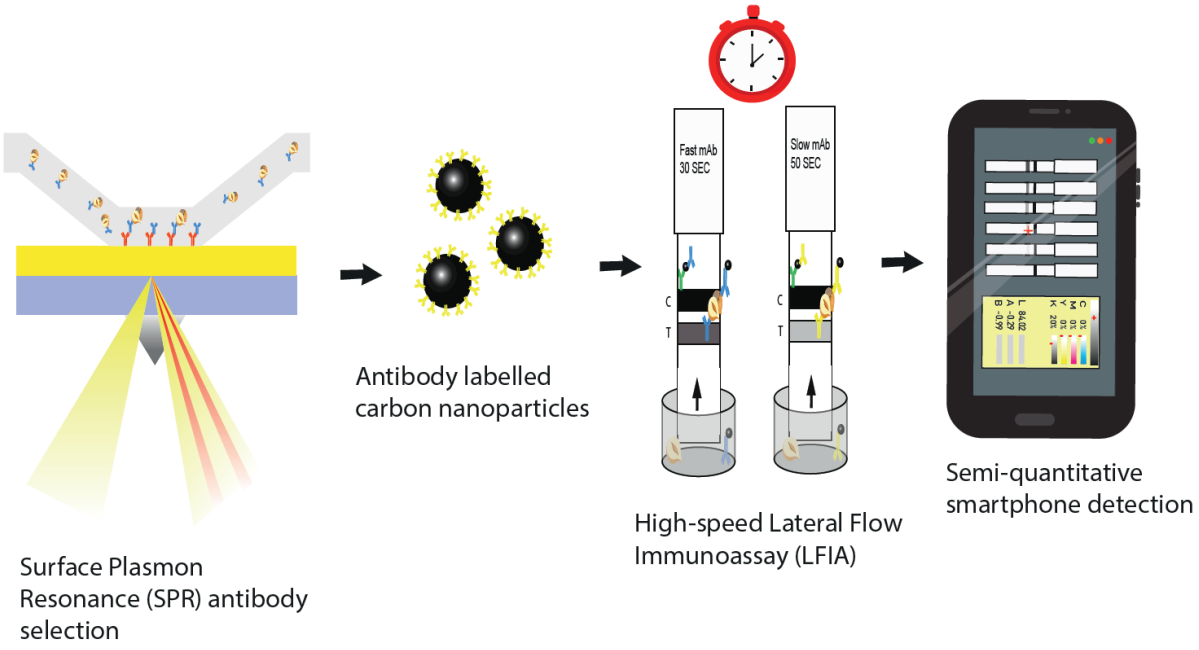

Figure 1: Graphical illustration of an SPR high-speed lateral flow immunoassay method incorporating smartphone detection.

camera which means that smartphones can be used for image and video analysis. Cameras can capture details which might otherwise be missed by the human eye, such as in a fluorescent-based test. Owing to the Global Positioning System (GPS) smartphones can provide a geo-timestamp providing information about exactly when and where a test is performed. As results can be transmitted in real time via Bluetooth or wifi, relevant stakeholders can find out results instantly and can use these to create spatial-temporal maps. This is particularly relevant when considering consumer-focused allergen tests as it means that end-users can test for the presence of harmful allergens within their food and can report this immediately. In addition, smartphones are a familiar platform that consumers feel comfortable with making them a suitable interface.

Can you summarise the key work you have performed using smartphone technology and the main findings?

I have been using smartphones for endpoint intensity-based detection in colorimetric assays. I have developed single and multiplex allergen lateral flow immunoassays (LFIAs) capable of detecting my target allergens (hazelnut and peanut) within 2 minutes (or less for the singleplex assay). As these are sandwich format LFIAs they are characterized by a reduction in test line intensity when testing samples with lower allergen concentrations. I test different concentrations of samples spiked with allergens and record endpoint photos of the developed assays. I directly measure colour values using free online colour analysis apps and relate these to a particular concentration of allergen present in a sample, such as a biscuit.

What other application areas within the food analysis sector do you think smartphones could be used?

Smartphones can be applied to a huge number of food safety needs. Within FoodSmartphone we are developing tests for: allergens, mycotoxins, pesticides & herbicides, antibiotics, shellfish toxins, microbial contamination using a number of different methods including immunoassays, aptamer-based sensors, electrochemical detection and SPR. These are just starting

points and the technologies being developed within the project can be applied to many other areas of food safety such as fraud. Smartphones will be particularly relevant in places that have limited access to analytical equipment and in areas where screening assays make up a large part of the testing regimen.

What further studies are you planning in allergen detection using smartphone technology?

The next step for me is to develop an integrated analysis system which incorporates all aspects of the allergen assay, such as homogenisation, extraction, sample delivery to test and of course smartphone readout.

For more information about FoodSmartphone please check out the FoodSmartphone website where all important updates and dissemination activities are shared and follow the FoodSmartphone weekly blog

http://www.foodsmartphone.eu/

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