

BioDetection Systems' detective revolution

Cells with a light switch

by Marc Mijer

BioDetection Systems has developed a quick and relatively inexpensive method of detecting contaminants in food and animal feed. In fact, the method is so clever that it is turning out to be useful in other areas, for example doping tests and dike reinforcement.



The Amsterdam Science Park consists of brand-new buildings occupied by universities or companies and institutions allied to a university. The 17-employee-strong BioDetection Systems (BDS) has an academic background as well, but it has been operating as an independent commercial entity for the past five years. And successfully, too. It has developed a method that revolutionised contaminants testing. The traditional way of detecting contaminants in food is to search for the specific structure of the contaminant. The problem is that you don't know whether the contaminant is in the food in the first place, and you might also overlook other contaminants with a different structure. To rule out that possibility, you have to perform a different test for every possible substance. BDS has changed all that. It concentrates not on the structure of the contaminant, but on its effect. No matter what contaminant is causing the problem, the BDS method will detect anything that is having a negative effect on a food product. The advantage is that you only need to perform one test to detect all the contaminants that have the same effect. The speed of this method makes it easier to assess – and avoid – any public health risks.

Fireflies

How does the method work? Professor Abraham Brouwer, toxicologist and BDS's CEO, explains. "We culture cell lines in our lab in seed trays. These are cells that multiply permanently. We use liver cells, because they are already capable of recognising substances. But we add something: a firefly gene. This gives the cells a light switch. The cells switch on the light as soon as they detect a contaminant. The brighter the light, the higher the concentration is." It sounds incredible and too simple to be true. But in fact, it is a highly sensitive system. The seed trays and the substance being investigated are placed in an incubator for an entire night at a temperature of 37° C. The next morning, a light meter is used to see whether the firefly gene has been activated. "We're talking about figures with eleven zeros after the decimal point. Very precise, in other words. There's also the risk that the result is incorrect owing to outside influences. The process must be sterile. We've drawn up our own instructions to guarantee that the test runs smoothly."

The BDS method requires little investment. All that is needed is a basic laboratory, the cells, a sterile seed tray, an incubator and a light meter, as well as a few weeks of training for laboratory staff. "The whole thing can be up and running in two months. And the total cost is about EUR 50,000." That is a far cry from the cost of a mass spectrometer, which detects the structures of substances. "A device like that costs between 500,000 and a million euros,"

says Brouwer. "And it's out of commission a quarter of the time for servicing. That's not something that cells require."

Inspection = Quality

The BDS method sounds ideal, but are there any disadvantages? "Of course", Brouwer replies. "We can carry out a lot of tests very quickly, but for a precise identification of the substances we've detected, we still fall back on the traditional method. Also, companies that use our method have to be licensed by us. Some of them might consider that a disadvantage."

With respect to the licensing, companies can send in the substance that they wish to have tested. BDS signs a service contract with those customers. Other companies want to perform the tests themselves. BDS will set up a laboratory for them, train the employees, provide the manuals and set up a testing system. In exchange, the customer pays BDS an annual fee plus an amount for each analysis/test. "One customer that recently chose this option was Nutreco. They are using our method in their fish hatchery to inspect their product. They're using it as a kind of quality mark, because they can demonstrate to the authorities and consumers that they don't market products that contain contaminants."

Smart soils

BDO has dozens of other customers, including government organisations and businesses in Vietnam, Australia and New Zealand. "Europe has strict requirements when it comes to contaminants in food and animal feed. Countries that want to trade with Europe have to meet those requirements. And that means that they have to conduct tests. Many of them haven't invested in expensive mass spectrometers yet, and now they can opt for our method."

BDS is growing more interested in sectors other than food and animal feed. In the environmental sector, the BDS system is a statutory criterion for research on silt dredged from the Port of Rotterdam. The International Olympic Committee wants to use the BDS method for doping tests. Brouwer : "Our method now detects dioxins and hormones, but we're working on getting it to test a growing list of effects .If we succeed, we might even be able to offer an alternative to laboratory animals." The BDS method also works with bacteria, opening up opportunities in the "smart soils" field. For example, dikes could be impregnated with bacteria that force grains of sand to bond into sandstone, so that they can be reinforced from the inside out. It should be possible in a couple of years' time, Brouwer estimates. There appear to be no limits to what BDS can achieve.