New Ways To Monitor Toxins

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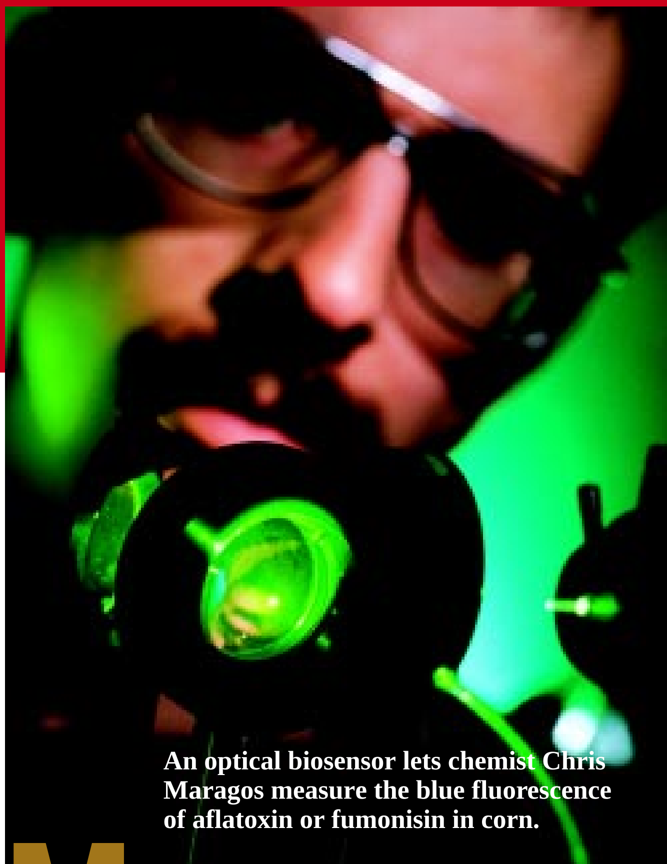

An optical biosensor lets chemist Chris Maragos measure the blue fluorescence of aflatoxin or fumonisin in corn.

Researchers are developing a new generation of detection methods.

Mycotoxins are naturally occurring chemicals made by fungi that can grow on corn, barley, wheat, and other commodities.

One of these toxic chemicals, aflatoxin, is produced by *Aspergillus flavus*. It takes its greatest toll on U.S. corn production during years when the crop has been subjected to high temperatures and drought stress.

To safeguard human food and animal feed, U.S. law prohibits the sale of corn—or any grain—for human consumption if it contains more than 20 parts per billion (ppb) of aflatoxin. For domestic non-milk-producing animals, the permissible level ranges from 100 to 300 ppb.

To detect these minute levels, purchasers, suppliers, and regulators must have accurate, sensitive tests.

"The lab tests that we now use to measure mycotoxins in corn and other field crops are expensive and take many instruments to accomplish," says Agricultural Research Service chemist Chris M. Maragos, who is at the National Center for Agricultural Utilization Research in Peoria, Illinois.

To speed up testing, Maragos has developed a new antibody for an existing enzyme-linked immunosorbent assay. Known as an ELISA test, it uses the new antibody to selectively bind to aflatoxin, thereby improving the accuracy in detecting the toxin.

Maragos explains, "If there is no toxin for the antibody to bind with, we see a deep orange color in the test solution. If there is toxin present, we get a lighter color—or no color."

Diagra, Inc., a biotech company in Long Beach, California, has entered into a cooperative research and development agreement with ARS to further develop and market the new antibody for an ELISA test kit.

A second tool Maragos uses to measure fungal toxins is capillary electrophoresis. Electrically charged samples are pulled through a thin, flexible straw called a capillary. This process separates compounds based on their electrical charge and does not require chemical solvents used by traditional analytical methods.

With capillary electrophoresis, Maragos has improved the sensitivity of testing to detect levels of aflatoxin in corn as low as 0.5 ppb.

In 1998, Maragos adapted capillary electrophoresis to measure another type of mycotoxin—deoxynivalenol, commonly called vomitoxin. This mycotoxin is associated with wheat scab, a problem that's cost wheat growers around $3 billion in losses over the last 3 years. After isolating the toxin, Maragos was able to detect as little as 0.1 parts per million (ppm) deoxynivalenol in wheat samples within 6 minutes.

He is now developing a new generation of detection methods using a biosensor, another type of immunoassay; it uses antibodies to trap and measure toxin levels. A series of lenses and small optical fibers detects the toxin's light-blue fluorescence.

Although the current instrument is large, Maragos believes it could be miniaturized and carried into the field to check crops before harvest.

"We develop the methods to accurately measure mycotoxin levels in food and feed and then turn the methods over to industry so that they can help keep these toxins out of people's food," he says.—By **Linda McGraw,** ARS.

This research is part of an ARS National Program on Food Safety, described on the World Wide Web at http://www.nps.ars.usda.gov/programs/108s2.htm.

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