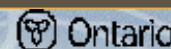




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## Science & Innovation

### Smart Nanosensors Improve Grain Quality Monitoring

By EduTransfer Design Associates Inc. & Haywire Creative

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The grains and oilseeds sector is a major component of the Canadian agriculture industry, with exports valued at over \$6 billion annually. However, post-harvest losses in quality and grade can amount to more than a few million dollars every year, cutting into the profits of farmers and the agriculture industry. Researchers at the University of Manitoba are working on a new class of technologies to help reduce these annual losses.

“Stored grain and food can spoil due to a variety of reasons, such as from insects, fungi or other microorganisms,” explains Suresh Neethirajan, EIT and Research Assistant with the Department of Biosystems Engineering at the University of Manitoba. “Currently there are no efficient quality monitoring systems available for grain farmers.” Several parameters, such as odour, carbon dioxide, moisture and temperature, can be used to detect the spoilage inside a grain bulk. However, clearly identifying what is causing the spoilage and detecting exactly where it is occurring is still difficult to determine.

“Fascination for microelectronics and nanotechnology led me to look for practical applications that would help Canadian farmers,” says Neethirajan. Nanotechnology is the engineering of functional systems at a molecular scale. One nanometer is about 80,000 times smaller than the width of a human hair, meaning that things at the nano scale cannot be seen by the naked eye. Science involving process development or building devices below 100 nanometres can be called nanotechnology. Neethirajan notes that although nanotechnology may seem to be science fiction, it is becoming a reality, with researchers around the world actively building machines and establishing processes in all aspects of food production from farm to fork using nanotechnology.

“I am currently working with Dr. Digvir Jayas on the development of an integrated Carbon dioxide and Odour sensor using microelectronics and nanotechnology for grain quality monitoring,” says Neethirajan. “This integrated multi-functional smart sensor chip, about the size of a sugar cube, will serve as a powerful early warning system.” This smart sensor chip will be able to provide specific information on the source of the spoilage, which will help farmers make well-planned and appropriate quality control measures.” For example, the smart sensor can tell whether the spoilage is caused by insects, which would require fumigation, or by fungi, which



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Neethirajan believes that the impact of nanotechnology on the agriculture industry will be tremendous, and will change the way farming is being done today.

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would require aeration as a treatment.

The smart sensor is in the development stage, and is being designed as a handy miniaturized system. "The sensors will work as a stand-alone system without a computer and software, and can be incorporated with current thermocouples inside grain bulks," explains Neethirajan. "This tiny smart sensor can be deployed either with the thermo couple wires inside the grain bins or can be scattered inside the grain bulk." Because the sensors can be deployed inside the grain bulk, the onset of spoilage will be detected well in advance of other available methods. Neethirajan is also exploring the possibility of developing this early warning system as a wireless system, which would allow farmers to monitor the quality of grain through a computer anywhere, at anytime.

"Although the new smart sensor technology is still at the development stage, we anticipate having this novel forewarning spoilage system in the hands of farmers within the next couple of years," says Neethirajan. Commercialization of the sensors will be carried out through the University of Manitoba's Technology Transfer Office. "The grain industry is expected to adopt this technology quickly, because of its sensitivity, low power consumption, low cost and online monitoring." Neethirajan adds that with a few modifications, the smart sensor technology could be very useful for monitoring quality in other industries such as dairy, fruit and vegetables.

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