Smart labels detect contaminated meat before it hits shelves

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Have you ever worried about getting salmonella or E. coli poisoning from meat? Researchers at the University of Alberta are working on a new way to spot spoiled meat before it hits grocery-store shelves.

Anastasia Elias and Dominic Sauvageau, professors in the Department of Chemical and Materials Engineering, are developing smart materials to detect harmful microbes that cause food-borne illnesses before products reach consumers.

"Agriculture and food production is the second-largest industrial sector in Alberta, and our smart materials will increase food safety and save time and money when testing for spoilage," Elias said.

The new smart materials, which will be incorporated into food packaging , will help improve safety at every stage of food processing, from the packaging facility, to transport to stores, to consumers' refrigerators where contaminants can affect products such as meat.

"The current swab-test method used for food contamination requires specialized personnel and equipment, and takes a long time to get the results," Sauvageau explained. "With the smart materials, food suppliers and even consumers will instantly be able to see if a product has been contaminated just by looking at the colour of the packaging."

The project involves developing and combining three technologies: the stimuli-responsive polymer that makes up the smart material, the

biological detection system, and food microbiology. The research team has been working for the past two years on these technologies. They have been programming the material to change colour in the presence of disease-causing bacteria such as E. coli, salmonella or listeria, and in response to temperature changes. The material responds by changing from blue to white, or from clear to cloudy.

"In Europe there are labels that detect temperature change, but temperature is only an indirect indicator of food spoilage. The key difference with our smart materials is that they will be able to directly indicate the presence of pathogens and help show exactly where it occurred in the supply chain," Elias explained.

In many cases of bacterial outbreak, it takes time to investigate where the problem arose. Smart materials could help pinpoint where and when the problem occurred, so action could be taken immediately to remedy the problem.

"A lot of the time, there is a reaction only after an outbreak occurs, and this puts the public in some danger. These smart materials add another layer of safety because they could detect a problem before the product reaches the consumer," Sauvageau said.

The research team is supported by funding from the Alberta Meat and Livestock Agency. Elias and Sauvageau are assisted by Preetam Anbukarasu, a PhD student in materials engineering; Diana Martinez, who has a biomedical engineering background and is pursuing a master's in chemical engineering; Zachary Storms, a post-doctoral fellow with a background in biochemical engineering; and ChanChan Wang, a post-doctoral fellow with a degree in chemical engineering and expertise in polymer characterization and modification.

"The students and post-doctoral fellows all have their own specialization,

but they all overlap in this project so it truly is an interdisciplinary team," Sauvageau said. "Our meetings are particularly interesting because everyone brings such different perspectives and ideas about food packaging and safety to the table."

The next step for the research team is integrating the three technologies and developing a smart-label design that is suitable and feasible for industry implementation.

"One of the challenges, like with any research project, is that the smart materials need to be simple and cheap in order to be commercialized," Sauvageau said.

The team is working with industry to determine how to design the materials for ease of use while maintaining visual appeal to consumers. For example, consumers usually prefer clear packaging so they can see the product. The researchers have also been careful to use non-harmful chemicals and materials because the smart material needs to be in contact with the food to detect pathogens. This will help speed the process of having their new material approved for food packaging. The team is now awaiting patent approval for their technology and acceptance of their report in a scientific journal.

"Technology is always evolving, so there is room for constant improvement and alternative applications," Elias said. "These smart labels do have the potential to become an industry standard for food safety."

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