New biosensor may improve food, water safety and cancer detection

March 29 2011

A nanotechnology-based biosensor being developed by Kansas State University researchers may allow early detection of both cancer cells and pathogens, leading to increased food safety and reduced health risks.

Lateef Syed, doctoral student in chemistry, Hyderabad, India, is developing the biosensor with Jun Li, associate professor of chemistry. Their research focuses on *E. coli*, but Syed said the same technology could also detect other kinds of pathogens, such as salmonella and viruses.

"Kansas is a leading state in meat production and the poultry industry," he said. "Any outbreak of pathogens in these industries causes huge financial losses and a lot of health risks. We want to prevent these outbreaks by detecting pathogens at an early stage."

Syed's recent research poster, "Dielectrophoretic Capture of *E. coli* at Nanoelectrode Arrays," was named a winner at the recent Capitol Graduate Research Summit in Topeka. An article on this work has been accepted for publication in the scientific journal Electrophoresis.

For more than three and a half years, Syed's research has focused on developing nanotechnology-based biosensors for pathogen detection and cancer biomarker detection. He began the research as a doctoral student under the direction of Li, who has researched nanotechnology for 15 years.

"Nanotechnology is a very exciting area," Li said. "It really provides an opportunity to solve problems for health care and food safety. It can also be helpful for the environment and energy issues."

The project is a continuation of work that Li performed at the NASA Ames Research Center in California, where he spent seven years developing nanotechnology. While working in California, Li came up with the idea of developing a small chip to capture and detect pathogens.

When Li arrived at K-State in 2007 he continued the biosensor research with Syed. Together they are working on developing biosensors for cancer diagnosis and pathogen detection. To develop these biosensors, the team uses carbon nanofibers, or CNFs, because they can form an array of tiny electrodes that is even smaller than bacteria and viruses. When these microbial particles are captured at the electrode surface, an electric signal can be detected.

"A goal is to integrate this technology into a hand-held electronic device for pathogen detection so that we can use this device for in-line monitoring of water quality or food quality at industrial processing sites," Syed said. "We have some preliminary results that indicate this technology is feasible, and I'm quite happy about that."

The project is supported by a Canadian-based company called Early Warning Inc., which provided the K-State research team with $240,000 for two years as part of the developmental work. Recently, the project was also supported by the U.S. Department of Homeland Security Center of Excellence for Emerging and Zoonotic Animal Diseases, or CEEZAD, at K-State.

"We're still working with the company and trying to eventually deliver this as a product to feed the market for water quality monitoring," Li said. "You don't want people to drink contaminated water and get sick

before you can do something. This research can be very helpful in the future as it can be applied in the very early stages before an outbreak spreads.

"Nanotechnology is a diverse field, and includes such biosensor devices that we can develop in this lab at the university," he said. "As long as we look for those opportunities, we can create something that is useful for Kansas and for people living here."

Provided by Kansas State University