International Spotlight on Juming Tang

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WSU Regents Professor Juming Tang is well-versed in moving discoveries developed in the lab to the marketplace. Recently, the global research journal International Innovation featured the technologies he developed through years of basic research that could revolutionize pre-packaged food. The feature also included a Q&A that gives insight into the process of getting new technologies to the public.

WSU Regents Professor Juming Tang serving up the results of new food safety technology.

Check out the interview below, and learn the history of research and development that led to the technology here: A microwaveable future: improving sterilisation and pasteurisation.

Feeling the heat

(reprinted from International Innovation with permission)

For over two decades, Professor Juming Tang has been conducting research

using microwave and radio frequency energy for food safety applications. Here, he discusses the transformative technology that he has created, and the difficulties in maintaining a steady funding stream

How did you become interested in researching microwave heating?

Microwave heating is very unique compared with other heating methods. My interest started when I was teaching an undergraduate introductory food technology course in Canada in 1993. I started the research programme on microwave heating after joining Washington State University (WSU) in 1995 as a faculty member.

Specifically, what makes food safety an interesting and dynamic area to work in?

Research into food safety affects the industry as a whole, as well as having an impact on the lives of the general public. Such research will always be necessary, and this allows me to consistently secure funding from different agencies in order to sustain and expand my research programme.

It typically takes about 15 to 20 years to bring novel transformative technologies from concept to commercialisation, and sustainable funding is required to bridge knowledge gaps and overcome technical and regulatory hurdles.

Can you outline the core aims of your research?

First of all, we aim to develop engineering design concepts that apply the unique advantages of volumetric microwave heating to inactivate bacterial and viral pathogens in pre-packaged foods. The designs can be scaled up for industrial applications. Following this, we aim to build pilot-scale systems so that we can prove the concepts and demonstrate to industry the advantages of these new technologies compared with conventional technologies, and the feasibility for commercial implementation.

Ultimately, of course, we want to develop scientific bases and build effective tools for system design, production process development, regulatory acceptance and industrial application.

We also want to support technology transfer by licensing patents for commercialisation, providing educational programmes for the food industry, and educating new generations of scientists and engineers.

What are the unique challenges that your team has overcome in developing

the technologies for commercialisation?

We had to address three main technical issues: 1) designing efficient microwave systems to provide stable and relative uniform heating patterns in foods; 2) visualising heating patterns and locating cold spots in foods and measuring cold spot temperatures in moving packages; 3) validating microbial safety of the processed foods for regulatory filing. We developed and patented a single-mode 915 MHz cavity design based on 3D computer simulation and mock-up testing. We developed an effective chemical marker method to determine and validate heating patterns, and developed a protocol for food safety validation using microbial surrogates for the targeted food pathogens.

How has your research contributed to the advancement of microwave-assisted thermal sterilisation (MATS) and pasteurisation (MAPS) systems?

Mine is the only laboratory in the world responsible for the development of MATS and MAPS from concepts to pilot-scale systems. We patented system design and temperature measurement methods, and WSU has licensed these to 915 Labs for commercialisation.

What value will your microwave technologies and processing methods bring to consumers?

We expect these technologies will provide consumers with a better standard of living through the delivery of a wide range of ready-to-eat chilled or shelf-stable meals that are safe, convenient, nutritious and available at affordable prices.

By incorporating shelf-life and nutritional information through smart phones in retail and at home, consumers will enjoy a better quality of life and also reduce their food waste.

Have you faced any obstacles while conducting your research? How have you addressed these issues?

As I mentioned, securing sustainable funding to support focused research programmes in food technology is very important – and it has been a challenge.

We have managed to maintain this research programme by obtaining competitive grants and conducting contract work with food companies. Since 2011, the US Department of Agriculture's National Institute of Food and Agriculture (NIFA) has increased funding opportunities to support breakthrough technology developments for food safety. We were able to

secure two large grants from NIFA.

Our research requires high-quality space for installation and operation of pilot-scale systems, as well as infrastructures for hygiene food preparation, packaging processing, storage and tasting, and hands-on training of industrial personnel for technology transfer. Thankfully, the University worked hard to incrementally improve food processing pilot plants and support facilities in order to accommodate our expanded needs.

Where do you see your work heading in the future?

As the food industry starts to embrace and adopt the technologies we have been working on, we will need to research scientific and technological issues emerging from industrial production practices and consumer feedback.

An area of great interest that we have not been able to address is how we could take full advantage of the new technologies (short heating time and high sensory quality of the products) to directly bring health benefits to consumers. We are extremely interested in collaborating with leading laboratories in human nutritional sciences and related organisations. We hope to systematically study the influence of nutritional retention and reduced salt requirements in the prepared meals using MATS and MAPS, in order to address diabetic and obesity problems in school programmes.

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