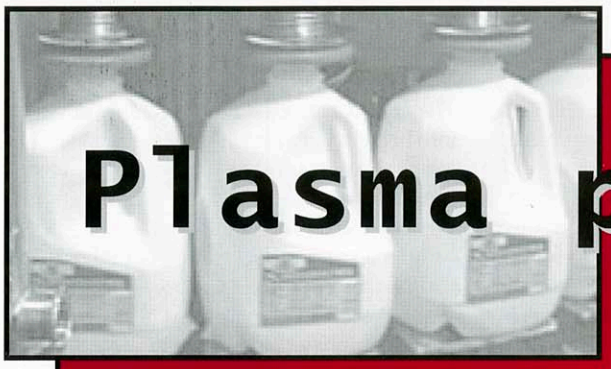
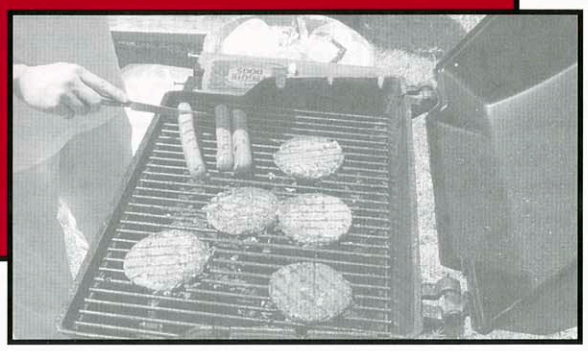


Plasma processing:

Researchers help take microbes off the menu



By Kevin Jayne

What types of thoughts cross your mind when presented with a scrumptious meal on an empty stomach?

In all likelihood, microscopic pathogens are not one of them. However, food-borne diseases caused millions of illnesses and thousands of deaths in the past year alone. These contaminants are a problem that will continue to fester until action is taken to stop them.

New technology developed at UW-Madison may be a step in the right direction.

Frank Denes, UW-Madison professor of biological systems engineering, has created a method of using cold plasma to defeat food-borne pathogens before they reach the consumer. For now, the innovative idea remains in the developmental stages, though it appears very promising and could someday have industrial applications.

Plasma is generated by passing a gas through a high voltage electric field. The electrons this field accelerates bombard the gas molecules, converting them into a mixture of ions and free radicals. Unlike hot plasma, which can reach temperatures of thousands or millions of degrees Fahrenheit in the vacuum of outer space, cold plasmas are created with the atomic or molecular species at close to room temperature and at low or standard atmospheric pressure.

"A cold plasma exists in a gas environment that is ionized and at a low temperature. The ionization degree and temperature of the atomic species is low, but the energy of the electrons is high," Denes says.

This combination of high energy and low temperature can give cold plasmas useful disinfectant properties. But researchers must first choose which gases to use in achieving the desired end-use properties.

"We are using air, oxygen and mixtures of air with moisture for our disinfection purposes. For other applications we can use different types of gas--they will produce different surface characteristics," Denes says.

New technology developed at UW-Madison could help reduce food-borne pathogens.

Denes collaborated with Amy Wong, a UW-Madison professor of food microbiology and toxicology, to develop this technology. His innovation has helped him secure two patents through the Wisconsin Alumni Research Foundation (WARF): one for a device to treat solids and another for a device to treat liquids.

Cold plasma technology has been in existence for decades. However, Denes' machines are specially designed to work at atmospheric pressure for decontamination and disinfection purposes.

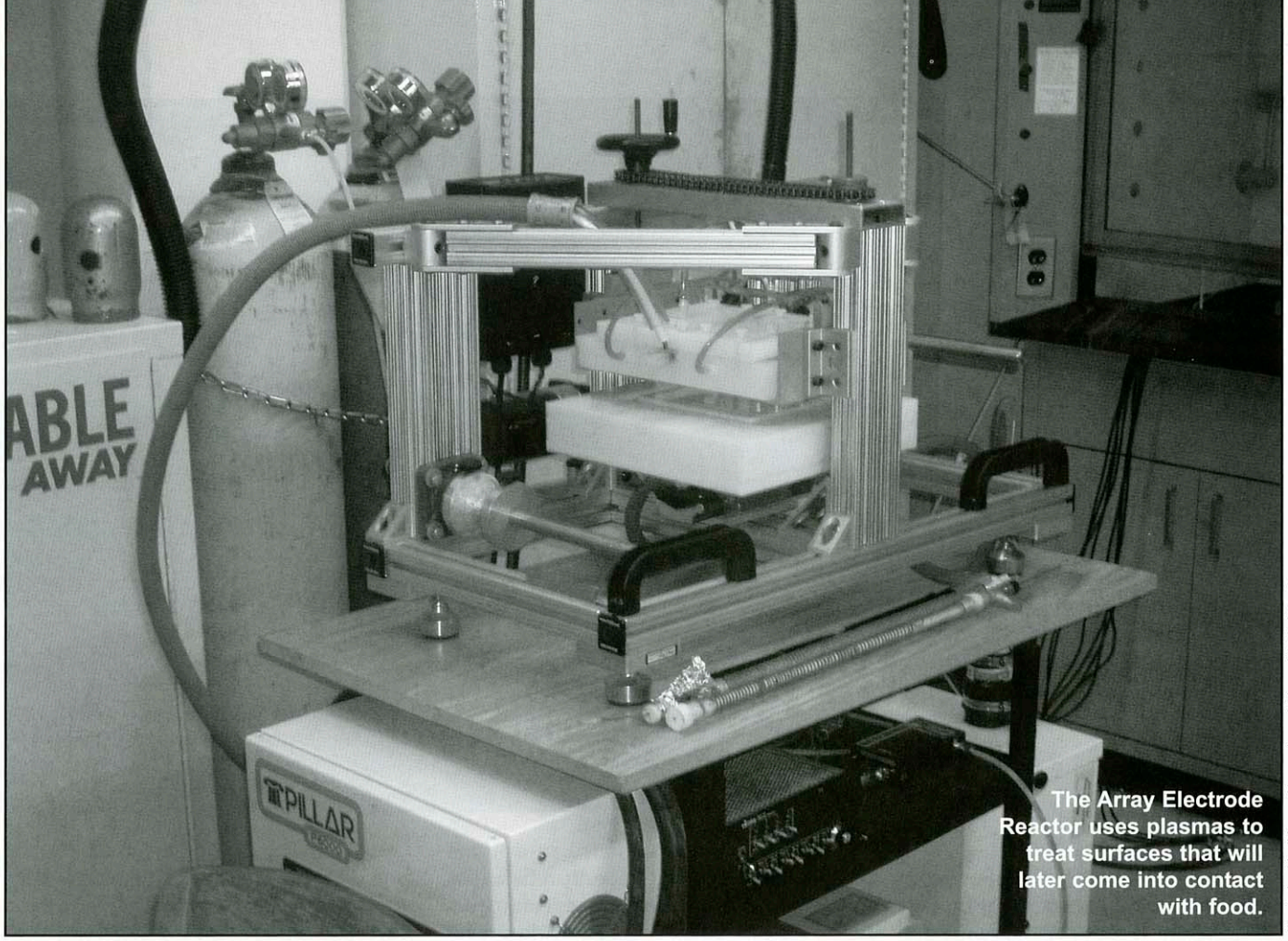
Capable of generating and releasing cold plasma species at a steady rate, Denes' first piece of equipment is the Array Electrode Reactor. This device is composed of over 200 closely spaced cylindrical wire electrode chambers. Arranged in a grid, these chambers control the distribution of plasma over the surface to be treated.

"Individual plasma reactors are working [in] parallel and generate reactive plasma species which are blown over surfaces that are contaminated. Using this technique, we found that disinfection is fairly efficient," Denes says.

With only a few minutes of cold plasma treatment, this apparatus decreases the number of bacteria by a factor of thousands. Researchers suspect plasma kills pathogens by altering the surface of their cell membranes, interfering with necessary metabolic processes.

"The plasma species are already energetic. Their energy levels are comparable to other common bonding energies found in organic compounds. By applying the plasma to the surface, the action interrupts these chemical bonds, causing them to decompose and killing the bacteria," Denes says.

Denes' second invention achieves a very similar goal, but this device treats liquids. Approximately one liter of the substance to be treated is enclosed in a container. The device



The Array Electrode Reactor uses plasmas to treat surfaces that will later come into contact with food.

Photo by Norikhwan Hamzah and Ahmad Ariff Juhari

then introduces plasma into the mixture, eliminating bacteria and decontaminating the sample.

While these devices are very efficient at removing unwanted bacteria, they will not replace current market tools for ensuring food safety.

"This is not an alternative to regular cleaning and sanitizing. This is just another safeguard in case there are some bacteria left behind," Wong says.

Though no definite plans exist for cold plasma technology to make the jump into industry, the researchers' efforts have not gone unnoticed. Denes and Wong currently are working on a project funded by the Department of Homeland Security, which anticipates their work will have useful public safety applications. In the meantime, diners can hope the technology gets picked up by the food industry, letting them satisfy their hunger without worry of any microorganisms on the menu. We

Author Bio: Kevin Jayne is a junior majoring in mechanical engineering and technical communication. This is his second semester working with the magazine.