Biofilms Have a New Foil

Listeria monocytogenes—a foodborne pathogen—has been found in some ready-to-eat meats. It causes serious illness in about 2,500 people each year, resulting in 500 deaths.

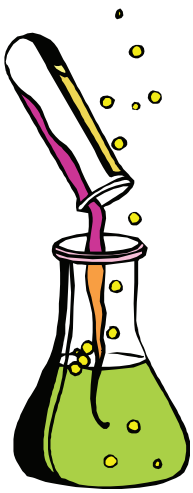
Though *L. monocytogenes* is killed by cooking or pasteurization, it can survive many chemicals used in in-plant sanitation programs. Thus, food can be contaminated during or after processing. The pathogen's ability to grow at low temperatures may allow its growth in or on raw or improperly processed ready-to-eat foods even when they are refrigerated.

One source of contamination is work surfaces of processing plants where meat products are made. ARS microbiologist Judy Arnold at the Poultry Microbiological Safety Research Unit in Athens, Georgia, has been looking for improved methods to control biofilms containing *L. monocytogenes.* Any method needs to be acceptable to the U.S. Environmental Protection Agency.

Biofilms are protective layers of proteins and polysaccharides that surround bacteria and stick to equipment surfaces. "These protective shields trap spoilage bacteria and other pathogens that contaminate food during processing, and they resist cleaning and sanitizing," says Arnold. "Today's longer production runs provide more opportunity for biofilms to establish themselves, and today's longer shelf life adds to the risk of biological contamination."

In collaboration with Sterilex Corporation of Owings Mills, Maryland, Arnold has tested a proprietary formulation—based on alkaline peroxide and phase-transfer chemistry—that appears to be a cost-effective disinfectant for use in environments for poultry and meat production and processing. The formulation uses multiple chemical and physical actions to penetrate a biofilm, kill the microorganisms, and remove the biofilm from surfaces. It was tested against multiple disinfectants for killing and removal of *L. monocytogenes* biofilm.

"Results showed that the formulation was 100 percent effective, providing total kill and more than 90 percent biofilm removal," says Arnold. "This disinfectant is more effective than currently used disinfectants in reducing *L. monocytogenes* biofilm growth, thus minimizing the risk of pathogenic contamination. Test evaluations also resulted in instructions for use that will meet USDA 'zero tolerance' regulations for *L. monocytogenes*."—By **Sharon Durham,** ARS.



Judy Arnold is in the USDA-ARS Poultry Microbiological Safety Research Unit, Richard B. Russell Research Center, 950 College Station Rd., Athens, GA 30605; phone (706) 546-3515, fax (706) 546-3068, e-mail judy.arnold@ars.usda.gov. ✷

Using Doppler Ultrasound To Understand Fescue Toxicosis

Tall fescue is the predominant grass used for grazing in the U.S. "Fescue Belt," the transition zone between the temperate north and the subtropical south. Direct farm receipts for animals produced annually in the region are about $3.7 billion for cattle and calves, $620 million for horses and ponies, and $38 million for sheep and goat products.

Despite these impressive economic numbers attributed, at least in part, to this high-yielding grass, producers must be concerned for the safety of their animals when they consume it. That's because more than 80 percent of the tall fescue in the transition zone is infected with an endophytic fungus—one that grows inside the plant, between the cells. This fungus imparts hardiness to the plant, but it also produces ergot alkaloid toxins that cause fescue toxicosis in grazing animals. Fescue toxicosis costs the livestock industry nearly $1 billion annually in lost production.

Though some partial solutions exist, few tools have been available for the real-time research needed to develop a complete solution to the fescue toxicosis problem. Now, Doppler ultrasound technology is being used by researchers at the ARS Forage Animal Production Research Unit—led by animal scientist Glen Aiken—to help better understand the causes of fescue toxicosis and to expedite development of management approaches to alleviate it.

Doppler technology is perhaps best known for its use by meteorologists to track thunderstorms. The "Doppler effect" is the change in the frequency of sound waves reflected by a moving object, and it can be used to estimate distance and speed. In this way, Doppler ultrasonography can estimate how fast blood flows in animals.

The ergot alkaloids in tall fescue constrict blood flow. Using Doppler technology, the ARS scientists found that blood flow decreases within 24 hours of feeding cattle ergot alkaloids. Results show that in cattle consuming diets containing ergot alkaloids, blood flow through the caudal artery, which supplies blood to the tail, can be reduced by as much as 50 percent relative to cattle on alkaloid-free diets. Constricted blood flow to peripheral tissues, such as the tail, reduces the animal's ability to dissipate body heat, making it vulnerable to heat stress.

"This research has helped us better understand ergot alkaloids and the mechanisms by which they cause toxicosis," says Aiken, who was assisted by research leader Jim Strickland during the project. "This knowledge will lead to improved forage and animal-management protocols that decrease exposure or enhance tolerance to the alkaloids of endophyte-infected tall fescue."—By **Alfredo Flores,** ARS.

Glen Aiken is in the USDA-ARS Forage Animal Production Research Unit, Agricultural Science Building North, Room N-220-F, University of Kentucky, Lexington, KY 40546; phone (859) 257-1647, fax (859) 257-3334, e-mail glen.aiken@ars.usda.gov. ✷