What's new at **UP Food Science?**

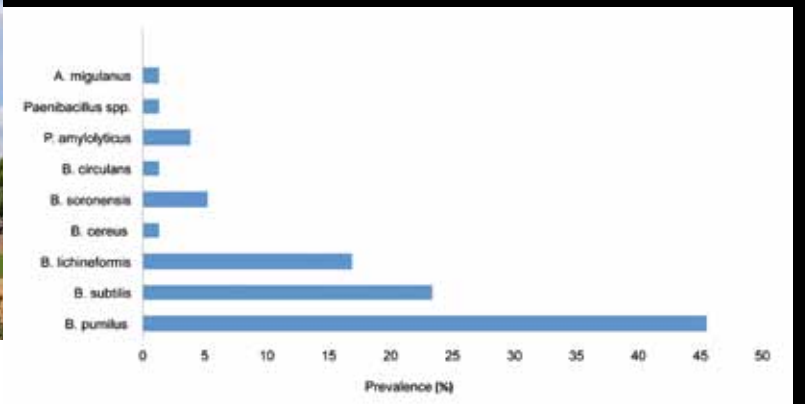
The Department of Food Science at the University of Pretoria originated in 1920 as the Department of Dairying, made possible through a sponsorship of the Union Castle Shipping Line. This article serves to highlight two current research projects at the Department of Food Science.

During the 1960s, the name of the department was changed to Dairy Science, and in 1980, training was extended to cover the broader field of food science. In 1993, the curriculum was redesigned to provide a full programme in food science, plus courses in all the major food processing technologies. During 1995, two new study programmes were introduced: a three-year BSc degree in food science, and a four-year BInst(Agrar) degree in food production and processing. These developments were followed in 1997 by a regional MSc programme in food science and technology for the SADC region, presented jointly by the Department of Food Science and the CSIR. In 2001, the curricula of all the study programmes were redesigned to conform to SAQA (South African Qualifications Authority) requirements. Today, the Department of Food Science resides in the School of Agricultural and Food Sciences in the Faculty of Natural and Agricultural Sciences. The academic staff complement is small by international standards, but represents the highest concentration of NRF-rated food science academics in South Africa and has a very strong research-based postgraduate programme. Visit **www.tuksfost.up.ac.za** or scan this QR code for more information.

BACTERIAL DIVERSITY IN ESL MILK

by Desmond Mugadza and Prof Elna Buys

Figure 1 Prevalence of endospore-forming bacteria in ESL milk.



Despite advances in food preservation techniques, bacterial spoilage remains the leading cause of global food loss. Research estimates that about one-third of all food produced worldwide is lost post-harvest. Dairy products constitute one of the leading sectors affected by food loss.

ESL milk fills the gap between high-temperature, short-time (HTST) and UHT methodology. Over the past years, several processing alternatives for ESL milk production were developed. The objective of these processes is achieving similar sensory characteristics as pasteurised milk, as well as extending the shelf-life. Currently, the widely used method is a combination of pasteurisation and a non-thermal method that reduces microbial load. Endospore-forming bacteria are microorganisms that are able to exist as a dormant, non-reproductive structure. They use the endospore form to survive harsh conditions and, as soon as conditions become favourable, they revert back to their normal vegetative form in a process called germination. After germination, these bacteria can cause spoilage to milk owing to enzyme activity. Researchers hypothesise that the recent emergence of some heat-resistant strains of spore-forming bacteria can be attributed to increased adaptation of these microorganisms to processing conditions. Some members of *Bacillus* spp have been identified as psychrotolerant - able to grow at temperatures below 8°C. This means that after surviving heat treatment in processing, these microorganisms will germinate during refrigeration, causing spoilage, as well as safety concerns due to toxin production. The approach of this study was to determine the microbial diversity of ESL milk during processing as well during chill storage (4°C and 7°C). Samples were collected from raw, pasteurised and packaged milk from a dairy processing plant in South Africa. The samples were analysed for mesophilic, psychrotrophic and thermophilic bacteria. Figure 1 indicates that, overall, *B. pumilus* had the highest isolates in ESL milk. The ability of *B. pumilus* to dominate at both 4°C and 7°C shows that the species has some psychrotrophic strains and can adapt well to cold environments. To improve shelf-life, understanding the adaptation mechanisms of endospore-forming bacteria is important. It is also vital for ESL milk processors to understand the extent and mechanism of spoilage and pathogenicity potential of each individual microorganism.

BIOFILM AND ESL MILK

by Sandile Khoza and Prof Elna Buys

The closed systems in dairy processing environments such as pipes, valves and pumps are regularly found to be contaminated by *Bacillus* spp, *E. coli, Micrococcus* spp or *Listeria monocytogenes.*

A biofilm may be defined as a community of microorganisms attached to stainless steel surface, producing extracellular polymeric substances (EPS) and interacting with each other. Bacteria in biofilm formed in dairy processing environments are more resistant to cleaning and sanitisation procedures. The closed systems such as pipes, valves and pumps are regularly found to be contaminated by *Bacillus* spp, *E. coli, Micrococcus* spp or *Listeria monocytogenes*. Therefore, dairy processing equipment surfaces are recognised as source of microbial contamination.

There is limited information available on factors limiting the shelf-life of extended shelf life (ESL) milk. Biofilms are of concern in dairy manufacturing plants, as bacteria with biofilms are more difficult to eliminate than free-living cells and, once established, can act as a source of contamination of product and other surfaces. The increased ability to adhere to the surface by new bacteria is not the only advantage of biofilms. It also provides a protective barrier for the bacteria within it by providing a physical barrier from stresses, as well as a chemical barrier.

This study was performed on bacteria associated with biofilm in aseptic filling machines. Isolates from swabs taken from nozzles were studied for their ability to form biofilm on stainless steel surfaces. Among the isolates, *Bacillus, Staphylococcus* and *Micrococcus* bacteria were encountered and showed the ability to form biofilm. Therefore, we can say that *Bacillus cereus* and *Micrococcus luteus* detached from the nozzles of aseptic filling machines and contaminated the final milk product as it passed through the filling machines. Our findings indicated that *B. cereus, S. epidermidis* and *M. luteus* can attach and form biofilm on stainless steel surfaces, indicating that these strains can be the main source of contamination of ESL milk.

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