Nivedita DATTA

Institution: School of Food & Nutritional Sciences, UCC
Academic Mentor: Professor Alan Kelly
Commercial Partner: Glanbia Ingredients Ireland
Commercial Mentor: Richard White

Dr Nivedita Datta has long-held experience in dairy science research. She completed her PhD in Chemical Engineering at the Indian Institute of Technology in Delhi, and has collaborated and worked for many years at international level, including with the US Department of Agriculture. Before joining UCC, she worked at Victoria University and the University of Queensland.

Nivedita's research interests are in the area of milk and dairy processing, including thermal and non-thermal processes. She has developed methods for distinguishing proteolysis in UHT milk due to natural milk proteases in comparison to heat-stable bacterial proteases. This was a crucial breakthrough in enhancing the quality and shelf-life of UHT milk and dairy products, and highly regarded by the Australian dairy industry. Her publications and presentations include over 70 research papers, review articles and book chapters.

Nivedita also co-edited a book, *Emerging Dairy Processing Technologies: Opportunities for the Dairy Industry*, and has presented at many international conferences.

See case study overleaf

Professor Alan Kelly

Professor Kelly is professor at the School of Food & Nutritional Sciences at UCC. He leads research on the chemistry and processing of milk and dairy products. His work involves national and international collaborations and he has presented at many conferences. Prof Kelly has been an editor of the International Dairy Journal since 2005, and sits on the editorial boards of Trends in Food Science and Technology and Innovative Food Science and Emerging Technologies. He referees for most leading international food journals and several international funding authorities.

Richard White

Richard has carried out R&D work in the dairy industry since the mid-1980s initially on the stability of cream liqueurs and the development of value added milk powders. He was Research Mentor for enterprise partner, Glanbia Consumer Foods; and with Teagasc for an IRCSET project, 'Developing Next-Generation Functional Proteins Through Controlled Aggregation'. This led to the development of a heat stable calcium fortified milk. More recently he has been working on the development of UHT whipping cream, protein fortified beverages and growing up milks.

School of Food & Nutritional Sciences, UCC

University College Cork has a significant track record in dairy research, building on almost a century of internationally recognised teaching and research. While its core programme is dairy processing, it is involved in all areas of food science and technology.

Glanbia Ingredients Ireland

Glanbia's UHT facility exports to 14 markets including China, the Middle East and Africa. The company is investing in the development of a deep understanding of the parameters controlling shelf-life, stability and organoleptic properties.

Nivedita's project

UHT treatment involves heating milk and dairy products to a high temperature (~135-145°C) and holding them at that temperature for a short time (1-10 seconds) followed by rapid cooling in a continuous-flow system. This produces a 'commercially sterile' product, ie, a product in which bacterial growth is highly unlikely to occur at ambient storage conditions.

Since UHT treatment is a continuous process, it produces uniform product quality which does not depend on the size of a container, in contrast to in-container sterilisation. This attribute is especially important for products containing heat-sensitive ingredients, and highly viscous products (such as high-protein beverages) with poor heat transfer properties.

Aseptic processing consists of UHT processing followed by filling the product into sterile containers in a sterile environment and sealing the containers in a sterile manner in a continuous process. The most popular aseptic packages are tetrahedral-shaped paperboard cartons such as Tetra Pak and Combibloc products, although multi-layered plastic bottles are also now popular.

UHT-treated milk and dairy products do not contain any preservatives for extended shelf-life at room temperature, and have a clean label, a vital point for today's additive-conscious consumers.

Although UHT technology has been successfully applied in commercial dairy processing for more than fifty years, several aspects of the technology still present challenges for UHT processors.

For example, whey proteins cannot withstand temperatures higher than 65°C without denaturation and aggregation. This causes UHT processing problems at 140°C for manufacturing shelf-stable, whey protein-enriched beverages. Formation of soluble aggregates (SA) of whey proteins before or during UHT treatment is one key factor which has been identified in six-month research period for manufacturing shelf-stable whey beverages.

Use of calcium-binding salts with whey proteins is one of the strategies used for formation of soluble aggregates (SA). The following four phases are using/will be used for production of shelf-stable high protein whey beverage.

Phase 1: Screening of calcium binding salts for suitability for high-protein UHT dairy beverages

Phase 2: Simulation work of UHT treatment using the selected concentrations of salts (2-3 concentrations from the Phase 1 work) in laboratory systems.

Phase 3: UHT treatment (138°C for 8 sec) of whey protein-based beverages, comparing direct and indirect heating systems.

Phase 4: Evaluation of the impact of microparticulation of whey proteins using physical methods on stability in UHT beverages.