The essential FILTER

Orla Nissen, sales director at DSS, a Tetra Pak company, discusses how changes in dairy are making filtration key to new products

Q. How has the filtration industry in dairy changed over the past few years?

Membrane filtration has further cemented its position as a natural part of dairy processing. Membrane filtration plays an important role in nearly every dairy plant of significant size and diversity, either in primary processing like whey protein concentration or milk protein concentration, or in secondary processing like water polishing for reuse.

The increased utilisation has also increased the general understanding in the industry of what membrane filtration can do in terms of improving overall processing economy and creating new products.

Q. What has been the driver from a research point of view?

The driver has been improving processing efficiency to minimise the environmental footprint, examples being lower water consumption for plant flushing and water reuse. Also, it is the ability to make more sophisticated products ie, splitting milk components into pure and defined specifications and fractions driven by the industry's move towards increased value-adding in order to meet new market trends. We have long-term research projects in private-public partnerships for developing and pioneering new applications, systems and materials. The aim is to develop more efficient separation and more environmentally friendly processing.

Q. How has the growth of whey affected filtration systems?

Whey has moved from being a cheap source of animal feed involving no or very little processing to being a high

value raw material for nutritional/functional ingredients requiring sophisticated processing. Much of the development in membrane filtration in general has been driven by the whey-based ingredients industry and its need for efficient separation, fractionation and concentration.

Some of the world's whey is still not being processed, typically from small sites with small volumes, which would not justify establishing a complete processing line. In order to utilise them, these small volumes must be transported to centralised whey processing facilities. This transport can be a cost challenge, but by pre-concentrating the whey by means of a simple RO plant on site, the transport cost can be reduced by as much as a factor five to six times.

Another issue in collecting whey concentrate is the preservation of quality, as the high value, whey-based ingredients require raw materials of high quality. Here we can also utilise membrane filtration to reduce bacterial load and improve overall quality.

Q. What about the fractionation of dairy powders into more sophisticated products?

Fractionation is growing. For instance, extracting and isolating specific fractions of proteins is now an established industrial process based on membrane filtration, in particular microfiltration. We believe, however, that this is by no means a matured process yet, and ongoing development will open up many new possibilities.

In addition, membrane filtration in combination with other separation technologies is widely used, examples being whey demineralisation and lactoferrin extraction. Again, these possibilities have not been fully explored.

Q. What about microfiltration of milk? What challenges are there in microfiltration versus other types of filtering?

Microfiltration of milk has two general applications:

One is bacteria and spore removal. This application has been on the market for many years and is a standard part of cheese milk preparation in many countries. For example in Scandinavia, most cheese plants are using microfiltration. Another and more recent application is extended shelf life (ESL) milk, which is growing fast in many countries as a process to preserve milk and ensure longer shelf life without compromising flavour.

Fractionation of proteins into casein-rich and serum protein fractions has also been available for many years, mainly based on ceramic systems. Within the last decade, other systems based on organic membranes have been developed for this application. The challenge for particularly organic systems, ie, spiral-wound, is process control. A microfiltration membrane is a relatively open membrane and as such prone to fouling, unless the process is controlled very accurately. Proper separation only occurs when a controlled, secondary 'membrane' has formed, which means the desired separation characteristics are the result of a combination of the actual physical membrane and the secondary membrane.

The secondary membrane is removed by normal cleaning, which in most cases is done on a daily basis, and therefore needs to be re-created at each production start.

Q. On the yogurt side, how has the increase in Greek-style yogurts affected what types of filtration systems are used?

Greek-style yogurt has grown tremendously, along with other products within the same family like the Icelandic skyr and various types of Middle Eastern products like labneh. Common for all are that they are normally based on acidification before concentration. Originally, concentration was done by draining in bags, later by centrifugal separation, and in recent years mainly by ultrafiltration.

Ultrafiltration can be based on systems such as spiral-wound, plate and frame or ceramic. Each of those systems will result in different product textures and as such needs to be chosen based on the desired market and product characteristics. We see a continued development in the understanding of texture control and believe we will see this in combination with development of new cultures with new features.

Q. What other issues are you dealing with when looking at dairy processing?

We have our eyes on a number of issues, some are direct market driven and some are technology driven. Of the market driven issues we see water as being a main concern – water preservation in general, but more interesting and challenging is water reuse without compromising food safety. Here, legislation is an important element, and legislation will have to acknowledge the technological development and adapt accordingly.

The technology driven issues are generally more long-term and not driven by one organisation alone but in cooperation among the dairy industry, universities and other public institutions, and system suppliers. Dfi