

Get in-line – how to take advantage of new dairy process analysis solutions

Options for process control with in-line near infrared analysis are improving every day. In focus caught up with FOSS process analysis expert Michael Sievers for an overview of recent technology developments and the considerations to be made before getting into in-line analysis.

Q: What exactly do we mean by ‘in-line’ analysis?

Sievers: In-line means that we measure directly in the process line, no sampling or bypass is needed, to get real time process data.

Q: How does in-line analysis add value to the dairy process?

Sievers: With real-time process results, you can detect trends in your process and reduce variations. This allows you to move your production targets closer to the specification, to increase your yield and to improve your quality.

Another aspect is the 100 % traceability. If you know what is happening in your process at any one time you detect process malfunctions, like a blocked valve or a leaking membrane, and react on it.

With an analyser in the lab, you'll only measure once an hour, so the production can be out of specification for a whole hour. Another consideration is that there is always a certain margin of error due to measurement error and sampling error. Of course, you still have this margin of error with in-line analysis, but because you get an averaged result every 15 - 30 seconds, it reduces the overall margin of error. For instance, if you are producing butter, with the classical laboratory setup you'll get one result per hour and you can achieve a variation in moisture down to 0,20 %. With in-line process analysis, you get 120 results per hour and you can reduce the variation to below 0,10 %.

Here's a real example from the field. A producer was making about 4.000 tons of butter per year and had a variation of about 0,25 % in the process. To be on the safe side, he set a target of 15,65 vs a spec of 16.00 %

moisture. But with in-line analysis he could reduce the variation by 0,08 % allowing him to move his target up to 15,85. His yield grew by 15.000 kg per year - an extra profit of about 40.000.

You can say this customer was able to turn 15.000 kg of water into butter.

Q: Can you give an overview of the in-line options available to dairy producers today?

Sievers: Looking at the FOSS portfolio there are four options for dairy production with the ProFoss line: for butter, whey powder concentrate, fresh cheese and milk powder. Beside the NIR- based ProFoss, there is the ProceScan for liquid milk using Fourier transform Infrared.

Q: How does the NIR solution measure different sample types directly in the process stream?

Sievers: In-line measurement is all about revealing trends in the process, so you must measure directly in the process stream. Some solutions on the market involve a bypass flow, but here you lose all the benefits of true in-line analysis because you cannot detect trends.

To measure in-line you need a dedicated sample interface and the right form of NIR technology. For powder, near infrared reflectance works fine, but for semi-solid products like butter, Greek yoghurt, quark etc, transmission is the right form as the near infrared light penetrates deep into the sample to get a representative measurement.

One interface we have developed is the so called Lateral Transmission Probe. It is a NIR transmittance probe and is especially good for measuring fresh cheese, butter and whey protein concentrate (WPC). The probe improves greatly on the classical transmission setup which, in our



experience, was difficult to implement, for example, a tailor-made flow cell was required. In contrast, the lateral transmission probe is a standard setup and as a result, people are often astonished at how easy it is to install a ProFoss.

Another dedicated interface is the powder probe. This is mounted in the process pipe and has a spoon to catch samples of powder. The sample is blown off the spoon automatically between measurements to ensure the integrity of each measurement.

Q: How do I know if in-line process analysis is for me, for example, why not stick to benchtop analysis?

Sievers: It is really not very complicated. In-line process analysis is not so much about scale of production, but more about the amount of variation in the process. Getting a significant reduction in such variation is the key to the payoff.

We have created a simple check list to analyse each individual business case. If we know the current variation, the yearly production, the targets and the product specifications, we can easily calculate a profit improvement proposal. We have been implementing these process analysis solutions for many years so you can gain from our collective experience. You don't need to think about setting up a long and expensive development project just to find out if process analysis is worthwhile.

Q: What are the typical steps involved in installing a system?

Sievers: The first thing is to use the check list to figure out the return on investment. If there is a business case

we then make a commissioning plan defining the share of responsibilities.

The installation is quite easy as we use standard dairy Interfaces. In most cases, all that is required is some welding where the interface is to be inserted. Normally, this can be done during a normal stop in the production. The next step is to make it work according to the demands of the individual businesses. This includes calibration development, integration into a PLC and training. We aim for handover within four weeks.

In the past, calibration development was particularly resource-intensive. Now the user just carries on using their existing set up, for example a FoodScan instrument, but each time they run a sample they select a software option that records the data. We then use this data to check the calibration supplied with the ProFoss.

Q: Once it is in, how can producers keep it running just right?

Sievers: This is something we have thought a lot about because users need a solution, not just a sensor. A training and support package is included and there is the option of a preventative maintenance agreement, in which case there is nothing for the user to do to keep the instrument running in terms of the hardware. With respect to calibration, the same procedures known from laboratory instruments are used and our "auto calibration" system ISlcal makes it easy to update the calibration.

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