

**More profit in  
the process**

*Analytical procedures in the dairy industry are changing as the focus shifts from the laboratory towards at-line and continuous on-line process control. But what sort of business can really benefit and is it worth the time and investment in implementing a process control solution?*

*Henrik Boisen from FOSS explains the available options.*

### Process control – a great concept, but is it really for me?

That's a common question that I always answer with another one in return. Do you need to find ways to improve profit and reduce investments in your dairy process?

Assuming the answer is yes, then it is worth looking at a number of options for improving process efficiency through process analysis – options that are happily increasing in step with advances in process technology in general.

Automation has been the key word in recent decades in the drive to improve production efficiency, for instance, in standardisation with 'indirect' control (the interpretation of "indirect" is when signals other than the direct measurements provided by a component analyser form the basis for the process control/standardisation). Density and various flow-blending solutions are the commonly used indirect methods of controlling the milk composition in final or intermediate dairy products.

### Protein components

In milk standardisation, the focus has been on adjusting to the right protein level, and even different sources of protein are now widely used within a single batch.

The complexity in standardising two or more components on-the-fly is a significant challenge. This is leading to a growing interest in process solutions from forward-looking dairy producers who are seeking ways to get the standardisation results right in real time. Such solutions free up storage capacity and increase throughput and efficiency as well as ensuring top quality. Many producers want to cash-in on such advances in technology and achieve a higher profit while protecting their brands.

Analysis technology has been developed to enter the process floor and now offers options for dedicated or more versatile applications. Among the technologies we can list: light scattering, infrared (IR), near infrared (NIR) and Fourier Transformation IR (FTIR) as well as other new technologies that are targeting new interesting applications in the dairy industry. And many producers are already reaping the benefits from advances in analysis technology.

Examples in action today include the FOSS ProceScan™ FT (Figure 1 – FTIR) for liquid applications and XDS Process Analytics™ (Figure 2 – NIR) for viscous or powder applications and controller solutions referred to as ProcessTouch™ (Figure 3).

### Process control in action today

#### Powdered products

Production of powdered dairy products is one area where process has taken off in recent years. On-line process analysis and control is the key to constantly survey-

ing and recording what is running in the process pipe and potentially feeding the evaporator directly.

At the same time, the process controller takes advantage of the compositional input and automatically maintains the required target levels for the recipe in process. A dedicated controller solution will additionally compensate for process disturbances, providing a more sophisticated and flexible solution. With protein standardisation as the second component or even with more complicated special recipes, the compositional variations in the final product are narrowed significantly. The payback in saved components will pay for the installation of the on-line process control.

#### Cheese

In cheese production the twin issues of control and profitability have been a driving force for investment in on-line control and, in particular, during the last decade, protein standardisation has made it even more attractive to go on-line.

*Cont'd on page 20*



Fig. 2



Fig. 3

Fig. 1

*Examples in action today include the FOSS ProceScan™ FT (Fig. 1 - FTIR) for liquid applications and XDS Process Analytics™ Microbundle Multiplexer (Fig. 2 – NIR) for viscous or powder applications and controller solutions referred to as ProcessTouch™ (Fig. 3)*

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One thing is fat and protein standardisation which is profitable on its own. When different sources of protein and other products must be administered on-the-fly and in real time, a process solution is the answer. By narrowing the variation in the cheese-yielding protein and the fat between vats and thus the fat in dry matter variation, the cheese production manager is given more freedom to optimise fat and moisture level resulting in stable quality, constant weight and profitable revenue.

#### Whey protein concentrate

Once considered a by-product of cheese production, Whey Protein Concentrate (WPC) is now an important revenue generator too and protein content of the finished WPC products are focused on as a major contribution in an optimised production loop. Here also, several manufacturers are now taking advantage of the on-line process solution with payback periods calculated in months.

#### Fluid milk

Fluid milk standardisation typically involves fat standardisation and the process performance of a process control solution will form the platform for the tangible calculation and the pay back period. Additionally, process considerations such as flexibility, storage capacity, labour requirements and standardisation on-the-fly will also contribute to the intangible value of such an installation. In some cases, solids-standardisation and, in the future, protein standardisation or standardisation with vegetable oil, are areas where a process solution can handle the complexity with an improved performance. In most cases, payback can be calculated in months.

#### Butter

Butter is the most common application handled by Near Infrared process solutions in the dairy industry. The real time analysis particularly controls, moisture at the highest possible level without exceeding legal limits. Start up or restart of the continuous butter churn is eased and the target is reached quickly. Standardisation of other parameters like salt and solids and control of the fat level will also contribute to the tangible value of such an installation. These installations have, in most cases, a manual interface for adjustment of the control flow based on a visualisation system and additionally, a regulation



controller will increase the efficiency of the overall solution.

Other NIR applications include cream cheese, quark, processed cheese, mozzarella, powder among others.

#### Process control considerations

The technologies used for process analysis have their pros and cons within the applications for which they are marketed

The different technologies provide various prediction performances and calibration stabilities on the different components measured. The choice of technology and the associated technology provider is therefore an important issue to consider. What you may save at the time of installation can easily be lost shortly afterwards if, for example, the calibration stability or performance is missing.

Secondly, some process sensors are pri-

marily used for trending analyses. Here, the process control needs to be manually adjusted according to the compositional results of manual samples measured on an accurate bench analyser. Process noise and switches in raw material supply etc. can easily change the picture and thus the final process performance achieved.

A common factor that can be seen across the different application possibilities available is that process control works best when it is implemented in the big picture. It does not really help if just some of the things are in place.

So an analytical process solution means thinking big to include a dedicated analyser/sensor, the optimal control solution, PLC communication and the engineering involved in installation.

With the right solution in place, continuous process improvements then follow.



ProcessScan™ FT

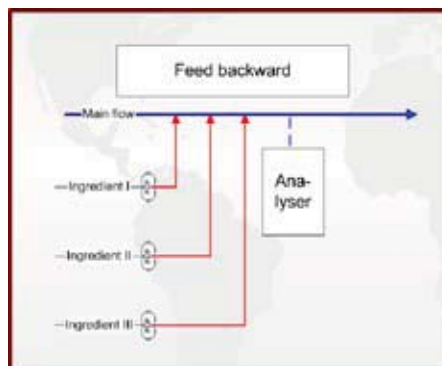


Fig. 4

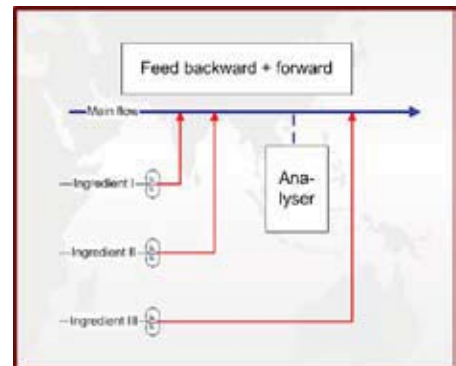


Fig. 5

### The future of process control – continuous optimisation

The major advantage of accurate measurements from a process analyser is that it will automatically and continuously provide the platform to optimise the process. You don't need to be concerned about the results after filling a batch and you avoid post standardisation, thus saving time and storage capacity. Additionally, you can avoid intermediate storage tanks in many processes.

The most accurate control set up is feed backward (fig. 4) but in some special cases you can take full advantage of a combination of feed backward and feed forward (fig. 5). Feed forward is occasionally established in the liquid process stream, but can also be administrated for dry ingredients in the powder sections of the drying process.

The ultimate advantage to be taken from a real time, process analyser is an advanced regulation control which is not programmable in a PLC. Such programming will do simple set point adjustment whereas a dedicated and customised controller solution covers the most complicated standardisation challenges you can ever imagine.

Achieving this scenario though demands dedicated process analysers combined with controller solutions to improve quality, flexibility and not least the profitability in your production.

by Henrik Boisen, FOSS ([hb@foss.dk](mailto:hb@foss.dk))

### At-line, On-line and In-line process control definitions

**At-line** process control is where a stand-alone analyser is used, close to, or directly in the process environment for making fast, manual measurements.

**On-line** process control (e.g. FTIR) includes a sensor/analyser which automatically takes a little sample from the process line for analyses. The compositional results are then made available for a controller system.

**In-line** process control (e.g. NIR) includes a sensor/analyser which automatically makes non-destructive measurements of the component concentration of a product in the process stream.