POTATO PROCESSING INTERNATIONAL

A controlling interest

How to leverage more value from optical systems by **Tim Reardon** of Key Technology, Inc.

In this age of flattened demand and increased competition, when potato processors must slash costs and yet boost yields in order to survive in an increasingly competitive environment, successful players are learning new ways to control production. They are leveraging the capabilities of existing equipment to deliver product more efficiently without spending lots of capital. I am talking about the utilisation of optical inspection systems to move beyond their original role as defect removal devices and exploit their capabilities to extract product data to control processes.

Tim Reardon of Key Technology

Many modern optical inspection systems, despite significant differences in technology and functional capabilities, have one thing in common: they capture an endless digital picture of the product on the production line. This continuous source of current information can be harnessed to provide valuable real-time data about the product being produced – data that can be harnessed to make immediate decisions that elevate raw product utilisation to new levels while reducing labour costs.

"Leveraging optical inspection systems' capabilities to control process is an emerging trend."

Imagine that you could use technology which is already on your plant floor to further increase yields, cut costs and control quality in ways that have, until now, been unattainable. Connecting modern optical sorters and automatic defect removal systems with a plant-wide network, and using the data collected, extends the value of capital and creates significant strategic advantages for those processors on the leading edge.

Early adopters are improving yields through better utilisation of raw product and they are reducing costs by minimising operator intervention on the production line. This emerging trend – leveraging optical inspection systems' capabilities to control process – is beginning to revolutionise how frozen and refrigerated potato products are manufactured.

Static or dynamic

To accomplish the fundamental task of identifying and removing defective product, optical sorters typically generate a continuous image of product flow, which is used to activate the systems' ejection or cutting systems when defects are identified. Given this traditional function, the systems are typically operated in a semi-static manner – the sort criteria is set to remove certain types of defects; the sorter operates based on that criteria until the specifications change.

But the data captured by these optical inspection systems can also be used in a more dynamic manner. The systems can be set up to tally specific product data and characteristics, which can be monitored using statistical process control techniques. If out-of-tolerance conditions are detected, the network can respond appropriately: it may automatically adjust an upstream or downstream process via control points or simply

alert an operator via alarm or pager.

In addition to an immediate event dynamically triggering an alarm or process adjustment, data can be collected over time and analysed to identify trends so that potential problems can be predicted before they occur and avoided. Data can also be collected and linked to other data from other

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sources, such as lot ID, peeler dwell time and so on, to identify correlations that are currently undiscovered – correlations that could present new, yet-to-be-defined opportunities to further increase operating efficiencies.

This powerful process control capability can be realised simultaneously while the optical inspection system continues to perform its traditional job of removing defects and foreign material from the product stream. Process control is an enormous added value.

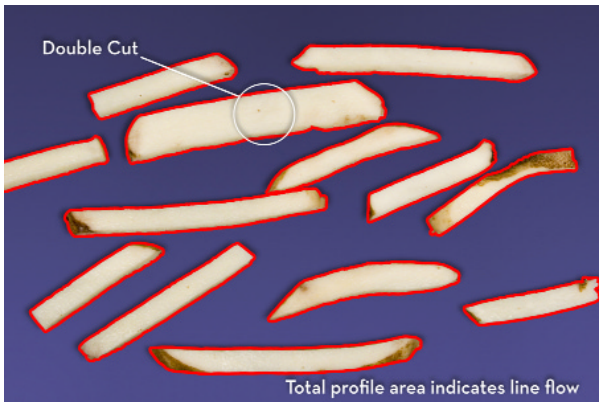
Monitoring size and shape

Recognising the size and shape of the product, an optical inspection system can monitor product length and width and trigger a variety of actions to help optimise product quality.

The length profile of potato strips, for example, can be tracked continuously during a product run. If the length profile is beginning to fall below pre-defined borderline quality, the system can alert an operator to blend different lots of raw product or adjust upstream sizers to get the results that meet length specifications. In this situation, real-time product data forecasts the quality of the product that is heading toward final packaging.

This gives the processor advance notice, enabling quick and simple corrections to a situation before problems with final product quality erupt.

By monitoring cut width, an optical inspection system can quickly identify issues with product dimensions that may be caused by upstream equipment. For example, the system can immediately stop the line if the wrong knives are put into the water cutters. The network can alert an operator to change-out a knife blade if the sorter identifies a percentage of double-width strips, which are likely the result of a broken knife in a water cutter.

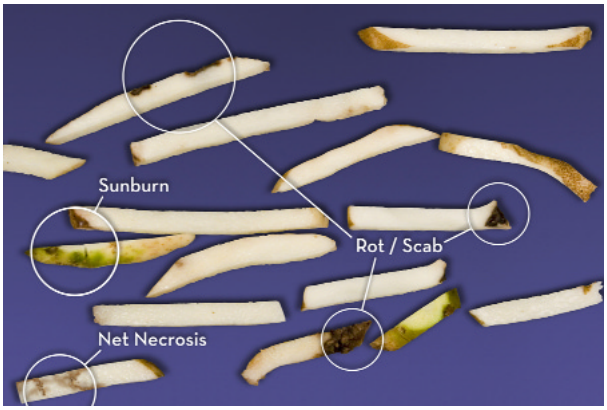


Double-width strips can trigger the network to alert an operator to change-out a knife blade. Plus, total profile area can measure line flow.

Monitoring colour

Depending on where on the production line an optical inspection system is located, colour characteristics can be analysed for the purpose of controlling a variety of conditions that could compromise product quality.

Located downstream of the cutters, the system can monitor the frequency of defects and foreign material incidents by type. Based on the colour and location of the defect on the product, defects such



Defects such as sunburn, scabs, hollow heart and net necrosis can be tracked. With this data on raw product defect rates, a processor can decide immediately to blend from another lot.

as sunburn, scabs, hollow heart or net necrosis (leaf roll) can be identified and tracked. This information allows the processor to address a range of potential problems. Armed with information about raw product defect frequencies, a processor could make

a decision to immediately blend from another lot. Or this information could trigger a processor to investigate potential problems in the storage area. Or a processor could use this information to address a quality problem with a particular field or harvest time frame. Conceivably, a processor could even develop a payment structure in which growers are rewarded for supplying high quality product.

Located downstream of the fryer, an optical inspection system can track product colour to monitor fryer performance. If product is 'trending' toward becoming too light or too dark, the system can automatically adjust the fryer, without operator intervention, depending on how the control system has been programmed. Since these actions can be taken in response to the trend toward borderline quality, before the product is actually out-of-tolerance, overall product quality is maintained.

Monitoring flow rate

The rate of product flow is an important measure that can help increase production efficiencies in countless ways. Sensing an immediate surge or drop in flow in real-time, an alarm could quickly alert the operator to investigate a problem.

Additionally, the system can track the flow rate, collect the data over time and correlate this data with a variety of product quality measurements to identify connections between the flow rate and the performance of a variety of processes. This information allows a processor to better control the processes to optimise product quality.

In practice

Although most processors currently own optical systems capable of product data collection, the industry is still in the early stages of deployment. It is estimated that fewer than 20 processing lines worldwide are controlled by sorter-generated statistics. Most of these are using the systems for potato strip length reporting and control.

Where implemented, processors have come to depend on that capability hour-by-hour to meet quality requirements. "If my network goes down, my line goes down," says one plant manager, referring to the data and control capabilities he enjoys. Thankfully, networks are quite reliable these days. "We can't run our plant without that data," says another.

Processors with older optical inspection systems may also be able to leverage their investment. Many legacy sorting and automatic defect removal systems can be easily upgraded with new electronics and optics to enable process control as well as improve sorting functionality.

The future

As the benefits of process control become more fully recognised and exploited, we expect processors will increasingly explore opportunities that can be derived from locating sensors elsewhere on the line.

Placed downstream of peelers, sizers, fryers, graders and other locations, sensors will monitor the process more completely, for increasingly complete process control. Eventually, sensors on the line will control every process, so that the potato plant of the future will be a fully automated, closed-loop, lights-out facility.

Until then, there are many opportunities available now to use existing optical inspection systems to increase yields, reduce costs and optimise quality via process control. ■