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SMART MOISTURE MEASUREMENT

How technology is continually optimizing product and process quality

By Del Williams

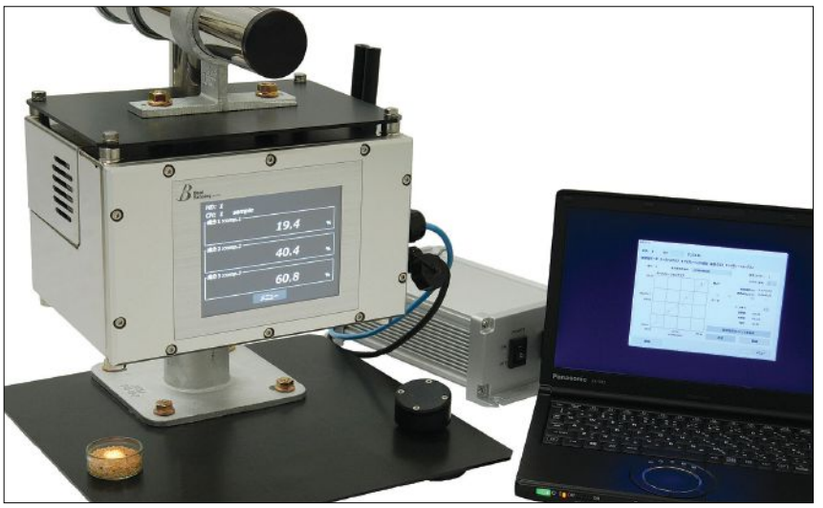
In a world full of "smart" devices (smartphones, smart watches, and smart appliances), such technology is increasingly entering manufacturing and processing in forms like condition monitoring, advanced robotics, and Industrial IoT.

On the production floor, "smart" equates with the ability to continually monitor conditions such as product and input moisture content in real-time to optimize quality. Assessing proper moisture level in products and processes is essential for many reasons such as meeting regulatory standards, ensuring proper chemical reactions and drying, maximizing shelf life and deterring mold, as well as increasing selling price and decreasing shipping cost.

"Whether manufacturers are mixing, blending, homogenizing, or drying, non-contact, smart inline technology enables the rapid, automatic measuring of moisture in 100 per cent of product or inputs, along with the ability to instantly fine-tune the process. This can optimize quality as well as minimize waste and corrective re-processing," says John Bogart, managing director of Kett US, a manufacturer of a full range of moisture and organic composition analyzers.

According to Bogart, the technology is smart because all the calculations are performed inside the sensor and measurements are sent on a 24/7 basis to smartphones, PCs, and other devices without having to be connected. If desired, these instruments can prompt operators and managers with alerts as needed. He notes that smart technology enables taking multiple precise moisture measurements each second, sorted within integrated software. This enables not only real-time analysis and error detection, but also more accurate results in products subject to variable, fast-changing conditions and processes.

Continuous moisture monitoring by such smart technology, which is cost-effectively available for about $10 per month when leased, allows the tracking of historical performance trends, cyclical rhythms, and periodic failures, so corrective adjustments can be made to enhance production. Such capability also provides product quality and compliance documentation when required.



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PHOTOS COURTESY OF KETT US

BREAKING FROM CONVENTIONAL LIMITATIONS

Unleashing the full potential of smart manufacturing and process technology in terms of moisture measurement, however, is not possible using traditional techniques. Conventional testing methods that require time-consuming weighing and drying are often too time and labor-intensive to be practical, and laboratory testing faces the same drawbacks.

"With typical testing, by the time results come back from the lab, any off-spec product can already be processed, packaged, and shipped. If manufacturers are not measuring in real-time, inevitably there will be some variation in inputs, process, and quality," says Bogart.

Traditional data collection, in fact, is usually too slow, cumbersome, and chained to cords and cables. Manufacturing floors are already crowded with equipment. So, dealing with bulky cords and connections to PCs, keypads and external switches to transfer data can be too restrictive.

"Fitting inline testing equipment into space-restricted production lines can be difficult when wires, cables, etc. must be run to a variety of peripheral instruments. In such cases, the cost of labour, installation, and system integration can be as much as the device itself," says Bogart.

In response, industry innovation has developed smart inline technology that can rapidly measure moisture in samples multiple times per second. The approach utilizes Near-Infrared (NIR) light in a highly accurate, non-contact secondary measurement method that can deliver immediate, laboratory quality moisture readings without the labor, cost, or delay of conventional techniques.

According to Bogart, NIR moisture meters allow very accurate instant measurement of solids, liquids, and slurries without contact or sample preparation, so there is no contamination. Once the meter has been calibrated against the lab or production standard, the calibration is stored in the device so no additional calibration work is required, and measurements are fully traceable to the original measurement method. Because the process is non-destructive, samples remain unaltered so they can be used for additional tests or put back into the product stream.

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"NIR moisture and organic composition meters follow the principle that water and other organics absorb certain wavelengths of light," says Bogart. "The meter reflects light off the sample, measures how much light has been absorbed, and the result is automatically converted into a moisture (or organic component) content reading."

One example of such smart technology is the Kett KB30 in-line NIR moisture meter system. The device, which utilizes smart sensor design and is approximately the size of a car battery, enables measurement without connection to controllers, PCs, or other cumbersome I/O devices. Its connections enable local process control and remote integration, and converters are available for wireless, IP, DeviceNet, and other interconnection and communications protocols.

Such connectivity not only cost-effectively eases installation, integration, and maintenance, but also enables moisture monitoring and necessary corrective action on 24/7 basis. The corrective action, according to Bogart, can be set up to be accomplished either automatically or via alert and action taken by plant operators, managers, or engineers.

With a response time of 0.2 seconds, +/- 0.01 per cent accuracy, and a moisture measurement range of 0.00-100.0 per cent, the device can be used to assess extremely variable and rapidly changing products, as well as processes where quality is critical. The quick response time enables faster production line rates with superior moisture measurement. It has been used in various industrial production lines to test pharmaceuticals, chemicals, foods, textiles, minerals, lubricants, pulp/paper goods, and personal care products.

When its monitoring capabilities are integrated with accompanying Kett Tracker data collection and analysis software, improved error detection, defect analysis, and product quality result.

As an example, when two smart sensors were used to run different production lines at a manufacturer, the devices' real-time capability detected periodic, wildly fluctuating moisture values that caused their extrusion process to go out of control. After investigation, it was determined that the manufacturer's electrical circuits had not been adequately isolated from the effects of a nearby power plant's operation on shared power lines.

Because moisture control and temperature are closely linked, such smart moisture meters also have a temperature compensation loop on the instrument, and provide local temperature as part of the data output, according to Bogart.

Where ambient temperatures change dramatically, this allows simultaneously monitoring of temperature and moisture content to see if process modifications are necessary, depending on daily (i.e.- day/night) or seasonal changes (i.e.- summer/winter).

"Ultimately, smart moisture measurement technology translates into superior process control, quality, and production without the inherent drawbacks of slower, labour-intensive lab or batch testing," says Bogart.

Smart devices already dominate the consumer market for good reason and have begun to gain prominence in process manufacturing. IPP&T

About the author:
Del Williams is a technical writer based in Torrance, Calif. He writes about business, technology, health and educational issues.