On-line monitoring of sugar colour

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Colorimetric system installed

above a vibrating conveyor

The Uelzen sugar factory, which belongs to the Nordzucker group, is one of the largest and most productive sugar factories in Europe, producing some 400,000 tons of sugar per year. In its refined-sugar line, the factory uses seven BMA centrifugals of the type G1750, and in the white-sugar line there are nine G1750 machines. In both lines, vibrating conveyors are installed below the centrifugals. So far, only the white-sugar line had been equipped with a fairly old colour analyser, which could only measure a very limited area of the sugar surface. After BMA had presented ITECA's Colobserver®, which uses image analysis, the factory decided to replace the old colorimeter in the white-sugar line with a Colobserver® for the 2011 campaign, and to fit a second unit in the refined-sugar line. These units were installed in August 2011 in close collaboration with BMA and put into service in October of the same year.

BMA Automation is ITECA's representative in Germany and other countries, and integrates colorimetric results into the centrifugal control systems.

The two measuring heads are monitored and controlled by one single PC, which communicates via Profibus with the centrifugal control systems. In the refined-sugar line, BMA software, which is installed in the control system of every centrifugal, monitors the sugar layer that is measured with an integrated radar sensor and the colour that is detected by the Colobserver®, and uses these data to calculate a new washing time.

One of the major benefits of the Colobserver® is that it supplies the operator in the control room with a real-time image of the sugar, together with all the necessary information for efficient sugar quality control. In the Uelzen sugar plant, the centrifugals are installed at a relatively large distance from the main control room. Operators monitoring the centrifugal parameters from the control room can therefore not watch the sugar colour and the sugar on the conveyor at the same time. For them, being able to keep track of the complete process is a real help.

With the imaging technology it becomes possible to store images. This is very useful when problems have to be identified and analysed. As soon as sugar of a poor quality is detected, an alarm logger in the Colobserver® program records and stores the images, which can then be easily accessed for a closer analysis. At the customer's request, the Colobserver® program in the Uelzen sugar factory was improved further, and it is now possible to watch a film of the sugar after it has been discharged from the centrifugal, simply by clicking the relevant point in the displayed graphic.

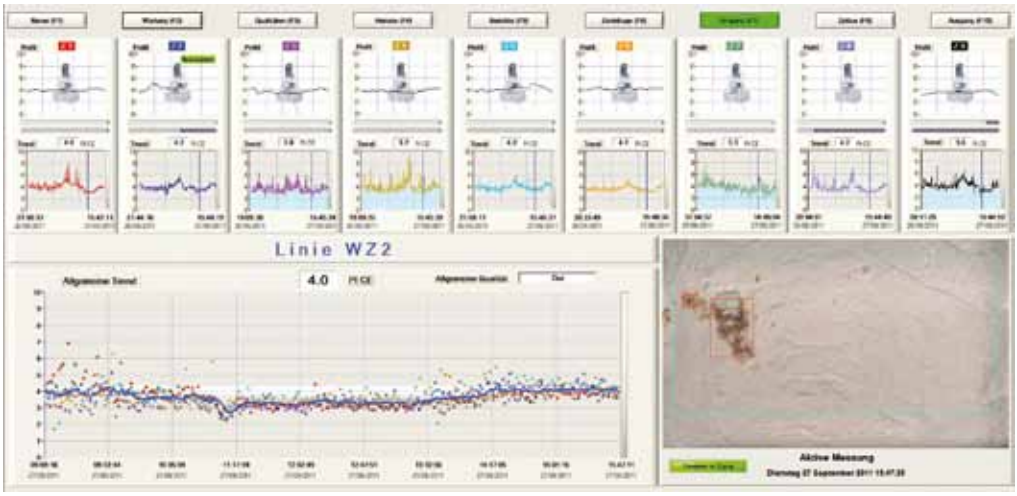
The system can record and process up to ten images per second. In Uelzen, where vibrating conveyors are used, the sugar moves very slowly. The units have therefore been adjusted to record two images per second. As soon as an image has been captured, every single pixel is expressed as an L*a*b* colorimetric space in the processing program of the Colobserver®, which has become the most widely used colorimetric system in industry. For detecting an off-spec product, the captured image is first of all analysed to exclude parts of the conveyor that might also be visible in the image and could distort the measurement.

As a next step, the system examines the image to identify spots of discoloured sugar according to their size, shape and colour, and then calcu-

User friendly

software interface of the colorimetric system

in the control room



lates the average colour in the image. The last 24 hours of sugar production are also permanently logged and encoded in a special format. These logs contain all parameters that are monitored by the Colobserver®, in addition to the sugar images. With this information, the operator is able to take another careful look at what has been going on in his or her production line. In addition, these logs can also be re-processed in the ITECA laboratory, so processes can be perfectly simulated whenever this is requested by the customer, with the image processing parameters adjusted as required without disturbing production in the factory.

The Colobserver® designed by ITECA SOCADEI is positioned directly above the sugar. It can be easily adjusted to monitor the quality of the sugar on conveyors of various widths. This is simply done by changing the lenses in the video camera. The unit is made from stainless steel and can be used in connection with conveyors that are commonly found in the sugar industry. In developing the Colobserver®, great care was taken to comply with the HACCP standard.

One of the strong points of the Colobserver® is that its results are highly representative, because it considers the entire surface of the sugar on the conveyor and not only a small area.

Its ability to interface with the control systems in the sugar factory for improved process control is a technical feature of the Colobserver® that makes it easy to integrate into the overall concept. The Colobserver® can communicate with virtually all fieldbus systems that are essential for the real-time controlling and monitoring of applications such as water washing times in the centrifugals, and therefore helps reduce production costs.

Benefits

- Reduced wash water consumption, and therefore energy savings
- Real-time evaluation of the sugar colour of every discharged batch
- Mean value calculation and representation of sugar colour developments for every centrifugal
- Sugar colour monitored across the entire width of a conveyor element
- Automatic detection and marking of brown sugar lumps