AQUALAB
by Addium

Skala Solo Moisture/Dryer Control System

Inside the Dryer Moisture Sensing

The Skala Solo Moisture Control system consist of a model based control algorithm that allows moisture sensing of the product inside the dryer. Skala Solo uses two temperature sensors inside the dryer to sense the moisture content of the product during the drying process. The system will stop the drying cycle as the desired final moisture content is reached.

The patented Skala Solo Moisture Control System is based on a model that relates the moisture content of the product leaving a dryer to the temperature drop and drying time. The temperature is measured before and after contact with the product during drying and the difference between the two is used in the model to calculate the moisture content. Figure 1 illustrates the Skala Solo method. The Skala Solo model can be considered a soft sensor for sensing the moisture of the product inside the dryer. Figure 2 shows the product moisture calculated by a Skala Solo soft sensor versus a NIR moisture meter on a continuous rayon fiber dryer.

Figure 1: Skala Solo Model

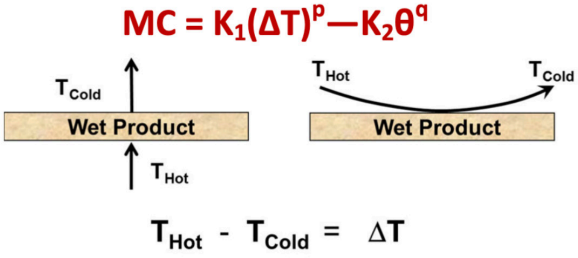
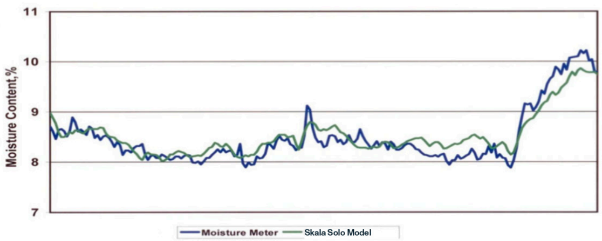


Figure 2: Skala Solo Predicts Moisture



The Skala Solo Moisture/Dryer Control System for batch dryers is a model-based control system that senses moisture inside the dryer and provides detection of the product reaching the desired final moisture.

Problems with Current Batch Drying Control

Typically batch dryers are set to run certain number of minutes at a constant inlet temperature based on the type and the weight and type of material. Variations in the initial moisture content will usually cause proportional variations in the final moisture content using the drying time method. When the material is checked and found to be under dried, the dryer is restarted and checked again. The checking and restarting the dryer causes excess drying time and lost production time. Sometimes the material is over dried. This is also a loss in production time and energy cost. Over drying also may cause quality issues such as color and finishing issues in textiles or color and texture in food products.

More advanced systems use the outlet temperature or humidity as a shutdown parameter. Depending on the steadiness on the inlet temperature, these exhaust temperature method may cause the drying cycle to end prematurely or run too long. Humidity is seemingly logical method of ending the drying cycle, however the relation to humidity of the exhaust air and the moisture content of the product is not always consistent.

Production time, quality, and energy usage can be optimized by stopping the dryer once and at the target moisture. The Skala Solo method can help greatly in narrowing the final moisture distribution and optimizing the dryers.

Skala Solo Application to Batch Dryers

The Skala Solo system is based on the relationship between drying rate and moisture content. The drying rate of a product will decrease proportionally as the moisture content decreases. The temperature drop in the dryer is mainly due to the evaporation of water, thus the temperature drop is proportional to the moisture content. This relationship between the temperature drop and the moisture content is the basis of the Skala Solo model.

The Skala Solo model will handle exceptions to the relationship such as varying inlet temperature or initial moisture load.
The Skala Solo model will continuously recalculate the final Skala Solo set point for stopping the drying cycle at the desired moisture content. Once the actual Skala Solo reaches the calculated set point the drying cycle will stop. In some cases the rate of change in temperature drop is also used in the model to handle variance in the load.

Recipes for products can be developed and recalled. It will take a few drying cycles for each product to develop the parameters and the parameters are easily updated as needed. Data for each drying cycle can be saved for later analysis.

Benefits

Most often the average moisture content of dried product is low due to lack of good control and the product is over-dried to be safe. The Skala Solo system will reduce the moisture variation, thus allowing the moisture content to be increased and safely stay below the upper control limits. This increase in mean moisture will give a better quality product, a production increase, and an energy savings. Figures 4 shows the reduction in overall moisture variance and Figure 5 illustrates safely increasing average moisture content, thus providing a production increase.

Figure 3: Temperatures and Skala Solo Profile

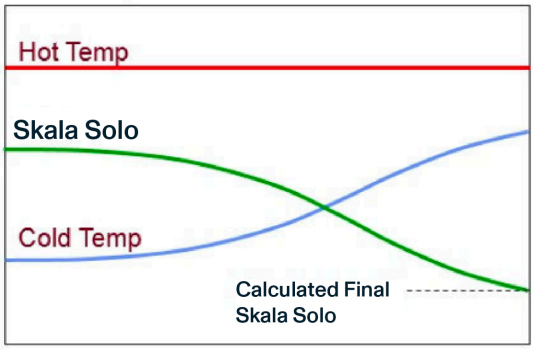


Figure 4: Reduction in Moisture Variation

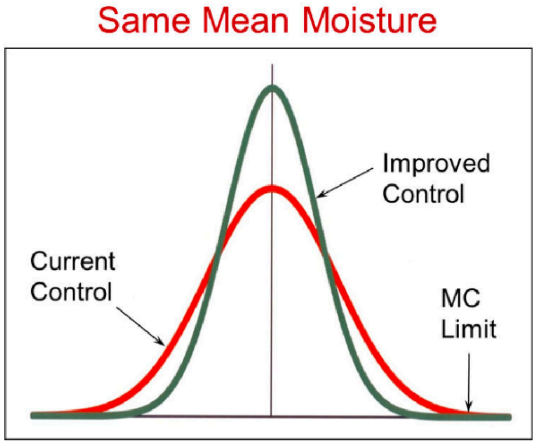


Figure 5: Possible Shift in Average Moisture with Improved Control

