Inline ketchup measurement and teamwork pays off

Block and release under control

Ketchup
Ketchup is a table condiment made of tomatoes, sugar, and vinegar, with seasoning and spices. Onions, cumin, garlic, coriander, cloves, celery, cinnamon mustard are some of the spices and flavors that can be added.

The consistency of each ketchup batch before release has to be rigorously measured. Thanks to inline viscosity measurement the quality control can be done continuously during production, saving time waiting for lab results and enabling right first time process, avoiding product losses and therefore reducing unplanned costs.

The challenge

The food producer strives to meet a consistent ketchup quality across all its production facilities. This is achieved by high standard in hygienic production practices and rigorous quality controls. One of the most important quality controls is the measurement of the ketchup consistency. Therefore, a sample from each batch is measured in the lab before release. Any product that does not meet the specifications will be blocked.

The producer is driving several continuous process improvement initiatives. One of these initiatives is finding a method to continuously monitor product quality. In this case the manufacturer was looking for a suitable inline viscometer. The scope of such process analytical technology is not to replace the lab measurement but to provide the company with continuous inline measurement, in addition to lab which could allow the company to:

- achieve reliable real-time quality control
- correlate with the lab method
- reduce the number of non-conformities
- react quickly to quality variations without waiting for the lab results
- gain process insight to better understand influence factors and implement corrective measures

The solution Ketchup itself is a fluid with complex characteristics due to its components. In rheological terms it is defined as non-Newtonian Thixotropic, meaning the viscosity changes with share stress (e.g. flow) as well as time. We can experience this effect in everyday life: we need to shake the bottle to easily pour the delicious sauce on our burger! When dealing with non-Newtonian fluids particular considerations have to be made, especially if the scope is correlation to an existing method. Several process parameters may affect the viscosity of the fluid. It is necessary to build a correlation taking into consideration the different influence factors (flow, temperature, time..), and by that reach common conclusion about product quality.

It has been very clear from the beginning that this would be an application in which subject experts need to work together in order to achieve the best possible result. The Ketchup producer and Endress+Hauser experts formed a team. The producer's Process Technologists and Automation specialists together with Endress+Hauser's Digital Solutions consultant and Process Technologist were at the core of this team.

Endress+Hauser delivered a multiparameter Promass I and a separate data collection and calculation system Memograph RSG45. Data reliability and integrity is a must before proceeding with any further process analysis. This has been achieved by integration of the Promass I in the Process Control and the population of the data into the Memograph. A Design of Experiment was agreed to by the Process Technologists; it is paramount, before proceeding to any correlation, to establish which parameters need to be collected that could affect the viscosity, and thereby affect the correlation between lab and process measurement. Therefore, several test programs were agreed upon to develop the required input factor in the correlation. For several months the Process Technologists had regular meetings to conduct critical data analysis sessions. During this sessions lab and process data have been analyzed. The information supplied by the Heartbeat Technology has provided a unique and valuable insight for the scope of this application.

The results The ketchup producer successfully implemented the viscosity meter from Endress+Hauser in the ketchup line and is in the process of integrating this technology and the acquired know-how into other sauce lines. From now on this Food producer can count on the Promass I as 24/7 guard of the quality of its best known condiment and on the value of Endress+Hauser's experts when it comes to process optimization.
The investment in such quality control has a potential return of investment of 1 year. The economic benefits are associated with raw materials, energy, labor and recall costs which are company dependent.

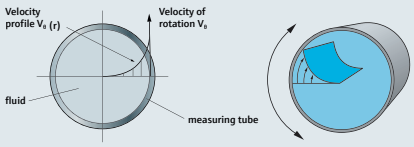
Promass I viscosity meter

The straight single-tube design of Promass I provides in-line viscosity measurement in addition to mass flow, density and temperature measurement.

Working principle in short:

Torsional oscillation of the measuring tube creates a shear rate of the fluid.

Shear force on the inside of the tube is a function of shear rate and viscosity.



Shear force defines the necessary drive power. Through measurement of the damping on the tube, the required drive power and hence the viscosity can be calculated.

Heartbeat Technology

This technology guarantees permanent diagnostics and verification of the Promass I without process interruptions.

In this project the permanent self-diagnostics has enabled the recognition of unreliable data due to unpredictable process changes. The self-verification and the trend recognition for predictive maintenance have allowed further process optimization.

Heartbeat Technology

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