

Sucrose and Total Solids Monitoring in Sweetened Condensed Milk

Sweetened Condensed Milk Quality Control with Polarimetry and Inline Refractometry

Sweetened condensed milk is a concentrated dairy product obtained by removing part of the water from milk and adding sugar, typically sucrose or dextrose. The combination of reduced water activity and high sugar concentration provides microbiological stability and extended shelf life.

The quality and stability of sweetened condensed milk depend on precise control of two critical parameters:

- Total dissolved solids (TDS)
- Sucrose concentration in the final product

Why Monitoring is Essential

The production of sweetened condensed milk consists of several process stages in which concentration and sugar content continuously change:

- Standardization of milk fat and solids-not-fat
- Heat treatment and microbial stabilization
- Vacuum evaporation to increase solids concentration
- Addition of sucrose as dry sugar or syrup
- Homogenization (optional)
- Cooling and controlled crystallization
- Filling and storage

During evaporation, water is removed under vacuum conditions, typically increasing the solids content to approximately 30–40 %. Sugar is then added to achieve the final composition, with total sugar concentrations commonly reaching 62.5–64.5 %. Maintaining these concentrations within specification is crucial because the osmotic pressure generated by the dissolved sugar acts as the primary preservation mechanism.

Variations in solids content or sugar concentration may lead to:

- Reduced shelf life
- Inconsistent texture and viscosity
- Uncontrolled lactose crystallization
- Product quality deviations
- Increased production costs through overdosing of sugar

- Regulatory non-compliance
- Compromise microbial stability

For this reason, both laboratory verification and inline process monitoring play important roles in modern condensed milk production.

Polarimetric Determination of Sucrose

Sucrose is optically active carbohydrate that rotates polarized light. This property enables quantitative analysis by polarimetry. For sweetened condensed milk, the ISO 2911/IDF 35 describe a polarimetric method based on measuring optical rotation of sucrose. Polarimetry is widely recognized as a optic analytical technique for dairy applications because it provides direct measurement of optically active sugars with excellent repeatability and reproducibility.

Refractive Index as a Process Analytical Tool (PAT)

While laboratory analysis provides precise verification of sugar content, continuous process control requires real-time monitoring. The refractive index is directly related to the concentration of dissolved solids and sugars in condensed milk. Inline refractive index measurement enables continuous monitoring of concentration changes during evaporation and sugar addition without the need for manual sampling.

Installed directly in the production line, an inline process refractometer provides:

- Continuous concentration monitoring
- Real-time process control
- Immediate detection of deviations
- Improved evaporation efficiency
- Optimized sugar dosing
- Consistent product quality

Monitoring total dissolved solids before and after evaporation allows manufacturers to accurately determine the amount of sugar required and to verify that target concentrations are achieved before the product proceeds to crystallization and filling.

Solution from SCHMIDT + HAENSCH

Using the SCHMIDT + HAENSCH UniPol V Polarimeter determines the sucrose content in sweetened condensed milk. The UniPol V is ideally suited for laboratory environments, supporting both routine quality control and product development in condensed milk production. For continuous process monitoring, the SCHMIDT + HAENSCH iPR FS Inline Process Refractometer provides real-time measurement of total dissolved solids. Installed directly in the process line, for example downstream of the evaporator or before storage and filling, the EHEDG-certified iPR FS continuously monitors concentration changes and enables immediate process adjustments. This allows optimization of sugar dosing, improved control of evaporation performance, and consistent product quality throughout the production process.



iPR FS
Inline Process Refractometer
with Certified Hygienic Design



UniPol V
Digital Polarimeter

Product type	Product
Process	iPR FS EHEDG certified inline Process Refractometer
Polarimeter	UniPol V Basic Polarimeter with touch display
Accessories	Flow through tube
Accessories	Single Quartz Control Plate

Advantages

- Highly accurate sucrose determination
- Reliable measurement according to ISO methods
- Continuous inline concentration monitoring
- Real-time process control
- Improved sugar dosing accuracy
- Reduced production costs
- Enhanced process efficiency
- Reduced sampling effort
- Consistent product quality
- Improved shelf-life control
- Reliable regulatory compliance
- Increased production reliability

Typical industries

- Dairy quality control
- Sweetened condensed milk production