Ice-cream Production

Depending on whether milk or fruit ice-cream is produced, the ingredients for ice-cream consist of milk, sugar and fat or water, sugar and fruit juices. To ensure that flavor and quality are always maintained at the highest possible level, the various fresh ingredients are thoroughly examined and weighed before being mixed together into the so-called “premix”.

During the following homogenization process, this mixture is pressed through an extremely narrow gap with up to 140 bar. Even particles emerge that form an homogeneous and smooth mixture and later give the ice-cream its creamy, smooth texture.

This mixture is then pasteurized and sterilized. First it is heated up to 80 °C and within one minute cooled down to 4 °C. Afterwards it is taken to rest for at least six hours in storage tanks.

The mixture is then transferred into freezers and chilled to approx. -6 °C. The mixture freezes as soon as it comes into contact with the inside of the drums, where it is being scraped off immediately by rotating blades and whisked to produce a creamy texture. Depending on the recipe, additional ingredients are added, such as chocolate, fruits or nuts.

The popsicle gets its final shape in the rotary freezer, where the ice-cream mixture is filled into molds and machines automatically put wooden sticks into the filled molds.

When producing ice-cream cones, the cones are first thinly sprayed with chocolate glaze to keep them crisp and crunchy. Afterwards they are filled with ice-cream mix and topped off with chocolate sauce and chopped nuts.

Packaged in foil, the finished ice cream products are taken to cool storage warehouses. On the way, the cardboard boxes are stacked fully automatically onto pallets and shrink-wrapped. The boxes remain in storage at a temperature of approx. -30 °C, before being delivered to the customers in specially refrigerated trucks.

Requirements

At Nestlé Schöller in Prenzlau, a visualization system based on MS DOS was in use initially. This system
realized the visual display and connection to the existing Simatic S5 PLCs. When expanding the production by an additional production line, this solution no longer offered sufficient capacity. Therefore it was decided to replace it with a solution based on the Wonderware Application Server in combination with S7 controls. The introduction of a new control technology also meant to serve as a basis for connecting the factory to GLOBE, the central Nestlé ERP system on SAP basis, in the future. Special attention was paid to the application of standards according to ISA 595.

Three distributed operation and monitoring stations enable the operators to monitor the production process. The application is maintained via a central development station, which permits changes and upgrades to be made to the system online.

The Wonderware Historian is used for long-term archiving the historical production data. A particularly important aspect was the obligation to produce supporting documents for what is known as the ‘Pasteur principle’. Within the production process, the product mix is heated up for a specific period above a certain temperature. During this period, the temperature must not fall below the limit value necessary for pasteurization in order to guarantee product quality.

ISA 595

The international standard ISA 595 defines the integration of enterprise and control systems through the definition of modules and terminologies. These can be used to determine which information has to be exchanged between systems for sales, finance and logistics and systems for production, maintenance and quality.

This information is structured in UML models, which are the basis for the development of standard interfaces between ERP and MES systems. The ISA 595 standard can be used for several purposes, for example, as a guide for the definition of user requirements, for the selection of MES suppliers and as a basis for the development of MES systems and databases.

Solution

The company autec from Alt-Mölln in Schleswig-Holstein was contracted with the implementation of the technical automation solution. This involved installing the Wonderware Application Server on two computers.

This solution offered the following advantages:
• Automatic load balancing of the application if both servers are in operation
• In case one server is not working, the second one takes over all functions of the control system without interruption.

Network structure

Objects for Traceability

The Wonderware Application Server uses standard objects to provide structures for recorded events, together with the option of putting production data into the production context. The production history is stored automatically in a database. This allows the entire production process to be traced back. It is possible to reuse objects as well as derived changes and extensions from these without any problems.

The objects include the following functionalities:
• Simple MES without executive;
• What have I done, when did I do it and what did I use?
• ArchestrA-based production events;
• Simple extension of the existing application; no replacement of existing functions; nothing is lost;
• Standardized data model – 595;
• Easy integration into the existing ArchestrA structure;
• Easier integration into the business systems;
• WWEI - Wonderware Enterprise Integration.

Fundamental questions that can be answered using this system:
• How much product was produced?
• Which raw materials have been used?
• Which other products have used the same raw materials?
• When was the product produced?
• In which plant or plant section was the product produced?
• Which operator was responsible for this equipment?
• Which additional resources were required (water, power)?

More questions that can also be answered:
• Comparison of input products with raw materials (mixture comparison);
• Are there any particularly critical plant sections in the production?
• Which products...
  - ... were produced in the same plant sections?
  - ... were produced by the same staff?
  - ... have used the same raw materials?
At Nestlé Schöller in Prenzlau, the ability to trace production steps – immensely important in the foodstuffs industry – was implemented quickly and effectively through the use of standard objects. Process information is captured by objects and entered into the production database. From there, queries assign the information to the respective batch.

Furthermore, Schöller succeeded in optimizing their use of materials. By using process information, they were able to coordinate the dosing of the flow of materials with each other more effectively. This automatic quantity balancing led to significant savings in material use as well as to improved recipes. The data are evaluated by protocols on the basis of MS Access. Factory-specific reports developed by autec are used for logging.

The recipe data are processed by special software modules from autec and transferred to the process via the Wonderware Application Server.

The introduction of ArchestrA technology in conjunction with Wonderware Application Server laid the foundations at Nestlé Schöller for the future connection to the Nestlé ERP system GLOBE.

Customer Benefits

Using Wonderware software products results in a number of advantages:
• The ability to use standard software systems;
• The ability to trace production steps as is required in the foodstuffs industry;
• The ability to fulfill the obligation to produce; documents for the Pasteur principle;
• Rapid access to production data;
• Central administration and maintenance;
• Quantity balancing;
• Simple load balancing when process computer runs at the limit of its capacity;
• Safety through redundancy.

Why Wonderware?

The expansion of the production with a further production line made it necessary to replace the old control and PLC technology.

The decisive factors for the decision in favor of Wonderware were the good experiences Nestlé had already had in other projects involving products and technologies from Wonderware. The strategy of standardization is pursued here. Therefore the ability to track batches quickly and effectively using standard objects of the Wonderware Application Server was realized and implemented.

The application was developed by autec with support from Wonderware. Difficulties in the initial phase of the project were quickly resolved and the system has been running trouble-free ever since.

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