
“Dairy Industry 4.0”: the future is now

In China’s dairy industry, Mengniu is the first to achieve information management of quality control, which, in combination with its enterprise resource planning (ERP) system, enables automated management of production processes. The company has therefore achieved quality data traceability to ensure food safety and make management of the entire industrial chain more efficient and standardized.

In a clean and bright quality control lab of Mengniu Group, Zhang Huiping wearing a white lab coat and a sterile cap was meticulously checking various test instruments and samples. Mengniu is located in the southern suburb of Hohhot, Inner Mongolia.

Zhang joined Mengniu in 2000 after graduating from university. She has since grown from a frontline quality inspector to a quality control expert of the dairy conglomerate.

“At Mengniu, quality control has undergone radical changes. The job has become easier while the efficiency and accuracy have increased in leaps and bounds,” said Zhang, with a smile. “For example, in the past, test data were all transcribed manually, which resulted in a lot of overtime work. It was very tiring for the hands and eyes. Now this can be done with just a click.”

Personally engaged in the entire transformation process, she attributed such progress to the revolution of digitization.

“Thanks to digitization, quality control is no longer a stressful job, allowing us more time and energy to do other work that is more meaningful and able to create more values,” she said.

The dairy giant is experiencing a significant digital transformation. It is gradually building intelligent and efficient digital factories, leading the new trend of “Dairy Industry 4.0”.

Safeguarding food safety

Mengniu was founded in Hohhot in 1999, with a dilapidated rented room of 53m² as its office space. The then small workshop has now emerged as a leader in China’s dairy industry.

Currently, Mengniu has 71 factories across the nation, delivering more than 400 kinds of products in five categories – room-temperature liquid milk, low-temperature liquid milk, ice cream, milk powder and cheese – to more than 70 million consumers at home and abroad.

For a dairy company, food safety is the lifeline. Safeguarding the lifeline requires a quality control “firewall” as solid as reinforced concrete, which ensures all quality

indicators adhere to the established standards.

With the rapid development of the company, the growing productions and strict quality standards have put heavy pressures on the quality inspectors. Mengniu has long been aware that there is an urgent need to upgrade the traditional manual quality control to a digitized system. It is within this context that Mengniu's cooperation with Siemens got on the fast track.

Data: a new ingredient of milk

In 2013, Mengniu began to implement Laboratory Information Management System (LIMS) via Siemens' Simatic IT Unilab platform. As of 2015, the system had fully gone live, covering the company's 34 labs at production factories and two R&D-oriented central labs.

From raw material warehousing and processing to delivery and circulation, a bag of milk goes through 35 steps involving 105 test items before reaching consumers. In this process, the "sharp-sighted" LIMS verifies the identity of each raw material or semi-finished or finished product and stores the complete identity information.

With the LIMS, Mengniu has made a scientific test plan containing sampling points, sample size, test items, test frequency and test instruments, etc. This can minimize possible deviations from manual scheduling in the past.

In a typical test in the past, a quality inspector needed to transcribe the test results on an original record paper, calculate them with formulas and artificially determine if the samples are qualified. In addition, massive data were entered and summarized manually. At present, test instruments are highly integrated with LIMS. After the quality inspector completes a test, the data is automatically collected and transmitted to the LIMS for automatic calculation and determination in compliance with national standards. This can not only reduce the workload of staff but also avoid errors caused by human factors, thus making quality control more scientific, accurate and efficient.

"Mengniu has thereby set a new benchmark in terms of IT-based laboratory information management in the country's dairy industry," said Hu Xinhui, Senior Consultant on Laboratory Information Management Systems, Siemens Industry Software (Shanghai) Co., Ltd.

"In China's dairy industry, Mengniu is the first to achieve information management of quality control, which, in combination with our enterprise resource planning (ERP) system, enables automated management of production processes. We are also China's first to fully integrate quality safety management with information system. Implementation of the LIMS also involved many of our patented technologies," said Song Xiaodong, Head of Quality Safety Management System of Mengniu.

Thanks to the LIMS, Mengniu has achieved quality data traceability across the industrial chain. For each batch of products, any quality problem can be traced to any step of production such as raw milk receipt, warehousing, pre-processing, filling, packaging or storage. Such intelligent full supply chain management ensures that each finished product can be thoroughly tempered like a special force to achieve stable and reliable quality.

With the LIMS, Mengniu has realized digital documentation and calculation of about 1,400 quality test methods, with more than 90% of test data collected and uploaded automatically. This enables test time savings of 10%-25%. Moreover, the LIMS has greatly streamlined the quality control process, thereby improving the efficiency by more than 15%. In addition, the LIMS also plays a pivotal role in equipment management, quality control cost management and staff optimization.

It is estimated that more than 1GB of data flows in the LIMS of Mengniu every day. The potential for value creation is beyond imagination.

“For quality control, we hope to closely follow trend of the times. We aim to make quality inspection more intelligent and flexible in the future,” said Li Mei, General Manager of Manufacturing System Quality Management Center of Mengniu.

Intelligent and automated operation

A digital factory is empowered by not only a “smart brain” like software systems but also “strong muscles and bones” like intelligent hardware. At Mengniu, Siemens’ Totally Integrated Automation (TIA) solutions have made a great contribution to stable operation of the production lines.

In pre-processing, Siemens’ programmable logic controller (PLC) precisely regulates such parameters as fluid temperature and pressure by controlling pump valve and dairy liquid flow. In addition, Siemens’ flowmeters are widely used in such equipment as filling machines, sterilization machines and boiler rooms for measurement of pure and soft water flow. On the filling production line, precise positioning of filling boxes, liquid flow and filling capacity are controlled by Siemens’ PLCs and driven by 1LG0 motors. An operator can monitor the system’s operating parameters and give orders through Siemens’ HMI.

Boxes of packaged products are carried with a conveyor belt to a robot palletizer. Siemens’ PLC controls conveying speed and steering, and sends task signals to the robot palletizer in a timely manner to ensure that cargos can be neatly and efficiently stacked and quickly transferred into the warehouse.

Mengniu’s stereoscopic warehouse has truly achieved fully automated logistics. Through intelligent control with Siemens’ PLC, the flexible stackers can accurately store goods in the specified location and fetch goods therefrom. On the track next to

the warehouse, the delivery wagons operate in an orderly manner, keeping a safe distance from each other to avoid “rear-end collision” or “crashing”. The Profibus is used for communication between various equipment. Meanwhile, with powerful data management functions, Simatic WinCC archives large amounts of operation data of the warehouse.

Seamless integration of hardware and software brings tremendous efficiency improvement. For example, when the LIMS completes the test of a batch of finished products, the result “conformity” will be passed on to the ERP system and then transmitted to the PLC via the warehouse management system. When necessary, the PLC can automatically “command” the stackers and delivery wagons to immediately deliver the finished products out of the warehouse.

Road to “Dairy Industry 4.0”

Mengniu’s digital factory is like a “battle field” without gun smoke. The upper information management system is a “general” who devises strategies while automation equipment on the production lines are “soldiers” who charge forward. Mengniu is just making a blueprint of digital factory, in the hope of creating an invincible elite force.

The rosy vision of “Industrie 4.0” has a profound impact on all sectors. In the dairy industry, Mengniu is the trendsetter. It is the first company to put forward the concept of “Dairy Industry 4.0”.

Mengniu hopes that a factory of the future can achieve connectivity among the five major systems – Product Lifecycle Management (PLM), ERP, Manufacturing Execution System (MES), production automation and logistics automation. Only in this way can the entire industrial chain be optimized, and this is the basis to reach the goal of “Dairy Industry 4.0”.

A factory of the future enables dialogue among the major systems, self-learning of the management systems at different levels, rational arrangement of the processes, flexible production of customized products and predictive diagnosis of the production equipment, as well as pre-warning of the quality control system during the production process.

Just imagine a scenario of the future. When a Mengniu factory receives an order for a customized product, the ERP system will automatically send the customer’s needs to the R&D department and ask the relevant departments to get ready. The R&D department will pass on the R&D results and production requirements to the production department via the MES. The MES will provide a summary of information of special materials required to the suppliers. Then the MES will release a production order and bring the production lines into play. Highly coordinated and automated field devices support flexible production through standardized control. Massive data flows

between the systems at all levels, which maximizes the resource efficiency and ensures product quality.

Batches of customized dairy products will reach the consumer via an efficient logistics system. Prior to this, the consumer can monitor online how the order progresses and when he can receive the product.

The dream of such a scenario may come true soon. On the road to digital factory of the future, Mengniu is moving forward hand in hand with partners like Siemens.