

Tagatose manufacturer upscales using process automation

Bonumose successfully starts up tagatose production from starch-based feedstock with Endress+Hauser instrumentation



Bonumose is a growth-stage startup food ingredient and enzyme innovation company based near Charlottesville, Virginia USA. The company is supported by global strategic investors and “food for health” focused institutional investors and an expanding network of global collaboration partners across the value chain. The company developed and patented methods for continuously producing high-purity tagatose from low-cost, plant-based starch. Bonumose’s process can include upcycling by-product/sidestream starch left over from its supply chain partners’ food production. Beyond food ingredients, Bonumose also is developing enzyme solutions for dietary supplements, crop protection, animal nutrition and other globally significant industries. Due to the global public health significance of Bonumose’s innovations, the World Economic Forum recently designated Bonumose as a “Technology Pioneer.” Bonumose operates with a philosophy of business as a moral imperative.



Summary Charlottesville, Virginia-based Bonumose, a growth-stage startup company, primarily manufactures a rare—yet natural and healthier—sweetener option known as tagatose. Using an enzymatic reaction, Bonumose can convert starch-based materials, such as maltodextrin, grains and starches, to create a “rare monosaccharide” that tastes and functions like sugar but has positive health benefits. For example, according to the National Library of Medicine, tagatose has positively affected gut health and those with type 2 diabetes.

Building on the work of its Chief Scientific Officer, Dr. Daniel Wichelecki, and his enzymatic technology breakthrough to produce affordable, healthy tagatose, Bonumose also developed methods for making additional inexpensive ingredients, such as allulose and mannose.



Bonumose CSO Dr. Daniel Wichelecki

Bonumose will soon create this rare monosaccharide on a grander scale, thus growing the company’s production and revenue. Bonumose decided to enhance, automate and digitalize its process with Endress+Hauser instrumentation to reach its company growth goals.

The Challenge In its infancy, Bonumose produced most of its products in a laboratory setting. Since

then, the company has built and moved into its own plant. However, Bonumose needed proper instruments to upscale and optimize the amount of tagatose it produced to continue that upward trajectory.

While Bonumose faced typical startup hurdles, it also had to develop methodologies for processing tagatose due to the lack of publicly available industrial knowledge. The company had few to no use cases to study when it launched. In addition, Bonumose faced challenges gathering prudent information on densities and volumes to use in its process.



Bonumose Lead Specialist Joe Williams & Plant Manager Mike Eastwood

“The crystallization process was one of the bigger things we had to work on early because there was no literature on how to create crystallized tagatose properly at our target sizes,” said Dr. Wichelecki. “There were other challenges, like any other manufacturing startup, such as faulty pumps or programming hiccups. Refining our procedures to match our product specifications and the learning curve of operating the manufacturing plant to produce tagatose from maltodextrin in mass quantities.”



Evaporation and crystallization stage

Bonumose also must monitor the evaporation and drying stages in its process. Its process is like larger, more well-known companies in similar industries. Before the evaporation, crystallization and drying stages, Bonumose uses common purification steps. However, one significant difference in Bonumose’s process is using a patented enzymatic reaction that creates tagatose from maltodextrin.

Relying on accuracy, efficiency and reliability to upscale from a startup company to one capable of mass production in an even larger facility, Bonumose turned to Endress+Hauser instrumentation to automate and digitalize its process, optimizing its output and eliminating shutdowns and downtime.

Solution Avid Solutions, a system integrator partner of Endress+Hauser, constructed the bridge between Endress+Hauser and Bonumose after gauging the healthy food ingredient manufacturer’s needs.



Pre-designed skids help optimize each step of the process

“Without Endress+Hauser instrumentation telling us all of our operating parameters, there’s no way we’d have dialed into the point we are now,” Wichelecki said.

Today, with various Endress+Hauser instrumentation found throughout their skids and facility, Bonumose is now preparing to scale as a business.



Proline Promag H 300 Electromagnetic flowmeter

Components From flowmeters to liquid analysis sensors to level and pressure sensors and countless others, Bonumose’s process is drenched in signature Endress+Hauser blue. One skid houses numerous Endress+Hauser Proline Promag H 300 electromagnetic flowmeters. These specific flowmeters are a staple for those within the food and beverage industry with high

operation and system integration flexibility: access from one side, remote display and improved connectivity options. As an instrument dedicated to demanding applications, such as Bonumose's, the Proline Promag H 300 is also capable of allowing the following:

- Temperature range from -4 to +302 °F (-20 to +150 °C)
- Measurement error volume flow (standard) from $\pm 0.5\%$ o.r. ± 1 mm/s (0.04 in/s)
- Measurement error volume flow (option) from $\pm 0.2\%$ o.r. ± 2 mm/s (0.08 in/s)
- Measuring range from 0.015 gal/min to 2 650 gal/min (0.06 dm³/min to 600 m³/h)
- Process pressure of PN 40, Class 150, 20K
- Energy-saving flow measurement: no pressure loss due to cross-section constriction
- Maintenance-free options: no moving parts
- Full access to process and diagnostic information: numerous, freely combinable I/Os and fieldbuses
- Reduced complexity and variety: freely configurable I/O functionality
- Integrated verification with Endress+Hauser's Heartbeat Technology



Liquiline CM442 with Memosens CPS61E digital pH sensor

In addition, Bonumose utilizes the digital pH sensor Memosens CPS61E. This sensor resists moisture and allows for calibration, improving process integrity and increasing process uptime. Furthermore, the CPS61E can allow:

- Temperature range from 32 to 212 °F (0 to 100 °C) and up to 284 °F (140 °C) for sterilization
- Measurement range from pH 0 to 14
- Process pressure range from 11.6 to 101.5 psi (0.8 to 7 bar) absolute
- Extended storage of calibration and process data, enabling better trend identification and providing a future-proof basis for predictive maintenance and enhanced IIoT services
- pH value optimization for a maximized product yield
- Autoclaving resistance (up to 284°F /140°C), offering maximum long-term stability
- Automatic storage and documentation of all relevant sensor and process data

- Process safety through non-contact, inductive signal transmission
- Reduction of operating costs due to minimized process downtime and extended sensor lifetime

Regarding its pressure measurement, Bonumose relies on Endress+Hauser's absolute and gauge pressure Cerabar PMP55. This pressure sensor is suitable for Bonumose's pressure and process temperature environments with an adjustable measuring range, allowing for simple commissioning, cost reduction and timesaving. Holistically, the PMP55 can allow:

- Process connections for threads, flanges or hygienic
- Temperature range from -94 to +752°F (-70 to +400°C)
- Measurements range from -15/0 up to +6,000 psi (-1/0 up to +400 bar)
- Process pressure monitoring up to SIL2, certified to IEC 61508 and IEC 61511
- Accuracy of $\pm 0.15\%$, "Platinum" $\pm 0.075\%$
- Minimization of ambient and process temperature fluctuations
- Easy menu-guided commissioning via on-site display, 4 to 20mA with HART, Profibus PA, Foundation Fieldbus

Finally, to optimize its level measurement capabilities, Bonumose trusts Endress+Hauser's vibronic point level detection Liquiphant FTL51. With reliable measurement, in Bonumose's process, the FTL51 is unaffected by changing media properties, gas bubbles, foam, vibrations, build-up, flow or turbulences. The instrument allows:

- Process connections: threads, flanges and tri-clamp
- Temperature range from -58 to +302°F (-50 to +150°C)
- Pressure range from -14.5 to +1,450 psi (-1 to +100 bar)
- Sensor material: 316 L, alloy
- Overfill prevention
- International explosion protection certificates
- Long operating life
- Extension tube for all liquids
- Monitoring of fork damage
- Easy startup

As Bonumose keeps its eyes set on future growth, it does so with support from Endress+Hauser instrumentation, a decision with already proven worth.



Tagatose is formed in the final stages of the Bonumose process



At the end of the process, tagatose is packaged in bulk, ready for distribution

Results After months of utilizing Endress+Hauser instrumentation, Bonumose is primed for expansion and growth.

Bonumose has successfully started up tagatose production from starch-based feedstock. The company is expected to be up to full speed soon with Endress+Hauser instrumentation and on the way to meeting its growth targets.

“Now, we need to fine-tune things—and you can’t improve something unless you measure it—like water usage and other energy usages,” said Tal Elseth, a contract engineer working with Bonumose. “We have all these instruments in place now. We’ve used them to get our plant up and running,

functioning like we designed, and getting our processes up to speed. Now, we’ll switch gears, watch where our resources are being used and ensure we’re maximizing our output. That’s where we’re heading next.”

For plant No. 1, Bonumose’s focus was on the repeatability of its process to ensure the quality of its product is consistent. Achieving that with the help of Endress+Hauser instrumentation, Bonumose can move forward confidently to a future primed for profitable growth.

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