

WHITEPAPER

THE ROLE OF AERATION IN OPTIMAL YEAST AND ENZYME PRODUCTION



AERZEN



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Yeast and enzymes are key ingredients in most wine, beer, and production-line bakery products, which includes bread, snack cakes, and anything else meant for grocery store or convenience store shelves.

Installing the most appropriate blower equipment in the process can enhance yeast and enzyme production.

Production of both yeast and enzymes requires multiple tanks that are filled with water and precursor ingredients used by each as a food source. Oxygen is also introduced in the pre-fermentation stage. The tanks operate in sequence, a process that lasts 16 to 18 hours. And while many factors go into maximizing yeast and enzyme production, proper aeration is essential.

Installing the most appropriate blower equipment in the process can enhance yeast and enzyme production, minimize energy costs, guarantee food safety, and avoid costly failures. Consequently, Aerzen's vast experience in aeration for the water/wastewater market is now successfully being applied to the food and beverage market as well as other industries.

BENEFITS OF ADVANCED TECHNOLOGY

Aerzen's portfolio of blowers and other aeration solutions offers proven reliability in the most demanding conditions.

Air supply in the pre-fermentation stage is critical. As the tank is filling and the pressure increases, overall pressure levels need to be maintained. Additionally, when the tank is filled and the water density is at its greatest, aeration equipment is often pushed to its limits. Therefore, there is a high risk for failure in this step, which can lead to significant monetary losses and time needed for recovery.

In addition to reliability, energy efficiency should be a primary consideration because these blowers operate continuously. Aeration is typically the highest energy cost in the yeast and enzyme manufacturing process – similar to how aeration is a major factor in wastewater treatment costs – so even small increases in energy efficiency can generate big savings.

Aerzen's portfolio of blowers and other aeration solutions offers proven reliability in the most demanding conditions, so costly failures are less likely, and its energy efficiency compared to conventional aeration equipment is often in the double digits.

- This includes:**
- Delta Blower:** With the positive displacement Delta Blower, air and neutral gases are conveyed oil-free. It is suitable for a large-volume flow range from 30 to 15,000 m³/h. The series includes different sizes for negative and positive pressure operation.
 - Rotary Lobe Compressor Delta Hybrid:** With seven patents or patent applications, the rotary lobe compressor is one of the most innovative solutions in compressor technology. It forms a synthesis of positive displacement blower and screw compressor. The series comprises various sizes for negative and positive pressure operation in the volume flow range from 110 m³/h to 9,000 m³/h and is particularly suitable for air conveyance and its energy-efficient generation.
 - Aerzen Turbo:** Aerzen High-speed Turbo blowers are one of the most efficient technologies available in the market. Based on air foil bearing technology, high-speed turbos don't contain oil or lubricants, so they can provide longer service life with lower operational costs while being resistant to malfunctions even at extreme operating conditions. The series comprises various sizes for negative and positive pressure operation in the volume flow range from 360 m³/h to 16,200 m³/h.



Because each yeast and enzyme production operation is unique, including varying water densities, it is critical to understand the complete process behavior before selecting the most appropriate solution and technology based on the application needs. Aerzen is one of the few technology manufacturers that offer three different product solutions and provide a complete analysis based on real needs instead of focusing only on the technology offered. With its expertise, Aerzen can support the design process for a complete system as well as thoroughly analyze existing technologies to improve operational efficiency and reliability.

CERTIFIED FOR FOOD APPLICATIONS

Pure process air is essential in the food industry to prevent contamination of the products. Since the air comes into direct contact with the medium to be pumped during the production process, it must also meet high quality standards. Contamination in the compressed air such as dust, moisture, oils, or microorganisms affects the product quality.



To avoid this, complete and carefully designed and installed compressed air generation and treatment is necessary. This includes, for example, the use of oil-free compressor stages, reactive silencers that do without absorption material, and perfectly matched filter systems.



Only a few manufacturers, including Aerzen, meet these requirements and are certified according to ISO 22000. ISO 22000 certification – from the International Organization for Standardization – lays out strict requirements to ensure that food is safe. Aerzen is one of the first companies in the compressed-air industry worldwide to comply with ISO 22000

With the uniform framework for action, risks in the direct and indirect environment of the food production chain can be safely identified. The structured identification of potential hazards, then, forms the basis for effective risk management. As already successfully practiced in other management standards, the continuous improvement process (CIP) is an essential tool for sustainable process improvements in ISO 22000.

USE CASES

In 2020, a South American bio-ingredient producing plant (which includes yeast) with a 2,000 ton/year production capacity was planning an expansion that would triple its capacity to 6,000 tons/year. The plant contained three bioreactor tanks with a 38-ton batch capacity operating in sequences of two with a volume flow requirement of 142 m3/min per tank at a differential pressure range that starts in 300 mbar and reaches 950 mbar or greater at the late stage of the process.

The process time duration is 16 hours in total, of which the last couple hours are critical because a large portion of the bio-ingredients are produced in that late stage. Aerzen model GM150S blowers with 315-kW motors were driving operations at the three bioreactor tanks. Part of the expansion project included the addition of two more bioreactor tanks so that three tanks could operate in sequence and the plant could reach a new maximum production capacity.

Engineers at Aerzen, which became a partner on the project in 2017 to support the customer in the planning and process requirements, realized that the existing tanks had 20 percent more capacity available that was not being used because of a lack of differential pressure capacity. The engineers determined that Aerzen's Delta Hybrid "H" version, which can reach 1,200 mbar of differential pressure, could increase the customer's production capacity by 20 percent with its existing tanks.

In the end, the plant needed to add one small bioreactor tank (instead of two) to reach its production capacity target of 6,000 tons/year. Avoiding that capital expense saved the company several hundred thousand dollars.

A bakery yeast production site in Ukraine that had been operating with multistage centrifugal blower technology was struggling with high maintenance costs and keeping the blowers in operation. Its pre-fermentation process started by filling the ingredients and a minimal water level to the tank, representing a differential pressure of about 550 mbar, which required minimal air flow. As the water level increased, air flow and pressure also increased. The highest water level represents around 1,000 mbar when considering the water density increase and water column of the tank. Externally, the tank has a total height of 10 meters, which leaves some room for the foam that is created in the process.

In addition to the high maintenance costs and difficulty keeping the blowers online, operational costs for refrigeration and bearing lubrication were significant.

Aerzen engineers analyzed the performance curve of the process to determine that when the process reached the last hour, as pressure reached 1 bar and air demand for the process was 265 m3/min, the multistage blower couldn't meet the demand. As a result, the process was inefficient. To compensate, Aerzen engineers suggested swapping the multistage centrifugal blower with an Aerzen High-speed Turbo Blower model AT400 1.0 that can reach max 1 bar and deliver the mass flow required in the last stage of the process, which is the most critical.

Not only did this move guarantee uptime so the site could meet its production levels, but there were also no longer any water costs for refrigeration or oil costs for bearing technology. Customer savings for energy, water, oil, and

maintenance costs from implementing the Aerzen High-speed Turbo exceeded \$35,000 annually.

Aerzen has all the technologies available that may be needed in a food and beverage operation, including blowers, compressors, turbo blowers, and hybrid equipment. Aerzen's support for the industry comes at a critical time, as the global trend is toward natural ingredients made of custom-developed yeasts to replace synthetic and artificial ingredients that in some cases are genetically modified.

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AERZEN. Compression - the key to our success.

AERZEN was founded in 1864 as Aerzener Maschinenfabrik. In 1868, we built Europe's first positive displacement blower. The first turbo blowers followed in 1911, the first screw compressors in 1943, and in 2010 the world's first rotary lobe compressor package. Innovations "made by AERZEN" keep driving forward the development of compressor technology. Today, AERZEN is among the world's longest established and most significant manufacturers of positive displacement blowers, rotary lobe compressors, screw compressors and turbo blowers. AERZEN is among the undisputed market leaders in many areas of application.

At our 50 subsidiaries around the world, more than 2,500 experienced employees are working hard to shape the future of compressor technology. Their technological expertise, our international network of experts, and the constant feedback we get from our customers provide the basis for our success. AERZEN products and services set the standard in terms of reliability, stability of value and efficiency. Go ahead – challenge us!



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