

USE OF NITROGEN IN THE BEVERAGE INDUSTRY

N₂

TECHNICAL REPORT

AVOIDING OXIDATION DURING THE MANUFACTURE, BOTTLING AND STORAGE OF BEVERAGES

Nitrogen (N₂) is used in various process steps of beverage production. The aim is to avoid oxidation during the manufacture, bottling and storage of beverages. The properties of the inert gas have a positive impact on product quality and offer protection against spoilage. Apart from breweries, wine producers too are increasingly using nitrogen produced on site. Inmatec offers a wide range of nitrogen generators for the low-cost and environmentally friendly generation of N₂ in every quantity and purity. Simple operation and seamless integration into existing industrial infrastructure enables use in breweries of every size.

Wine lovers especially appreciate the aromatic variety of the different types of grape. It is therefore particularly important for wine makers that their wines reach the customer in the best possible quality. In the case of reductive wine making – standard practice for the production of white and sparkling wine in Germany and Austria – the wine must be protected against oxidation. Oxidation can arise through contact with oxygen during pressing, ageing and bottling, and lead to the loss of aroma. By contrast, production from press to bottle that takes place entirely under the exclusion of oxygen has entirely positive effects on varieties of grape that are sensitive to oxidation. This has also been proved by a study carried out on the Sauvignon Blanc grape at the Weincampus Neustadt wine campus. According to this study, the use of inert gas presses, which use the inert gas nitrogen, and the reductive or inert ageing of the must led to a higher level of flavouring agents. The must of the oxidation-sensitive grape contains more glutathione, an antioxidant that supports the vitality of the yeast during fermentation, protects the aromas and increases the stability of the bottled wines during storage. The wine was also shown to contain more phenols, which have a significant impact on its aroma, colour and taste. The inertly produced Sauvignon remains paler, as the phenols do not oxidise, and does not display the unwanted, vivid yellow-brown colouring. Trained wine testers evaluated the wine consistently produced with nitrogen both six



Inert gas press subjected to N₂ for the production of fresh, pale wine of improved quality

weeks and 18 months after bottling as especially aromatic, with a high minerality and described aromas of lemon and exotic fruits. According to the study's conclusions, wine that was only inertly pressed but aged in a normal atmosphere lost these characteristics again when it came into contact with air and was perceived as less typical of the Sauvignon Blanc grape.

Nitrogen protects against oxidation in the brewery

As a so-called inert gas, nitrogen is extremely slow to react (inert) and is therefore involved in only a few chemical reactions. The odourless and non-toxic gas makes up approx. 78% of the atmosphere and is used in many areas of the food industry to avoid oxidation. Oxidation comes about through contact of the food with



oxygen and leads to quality impairments such as, for example, the loss of aromatic agents and structural changes.

In breweries, therefore, several process steps take place under the exclusion of oxygen by using a protective gas. After storing the beer, all contact with oxygen must be avoided. Contact with oxygen can lead to microbial infections and oxidative enzymatic reactions. The consequences are a changed flavour, reduced shelf life and, in the worst case scenario, the spoilage of the beer. The further processing of the matured beer therefore takes place in an artificial atmosphere of inert gas. Carbon dioxide (CO₂), which is obtained during fermentation, is also popularly used for this purpose. In smaller breweries in particular, however, expensive CO₂ frequently has to be purchased. Nitrogen represents a more cost-effective alternative here.

After storage, the beer is transferred to transport tanks or bottling tanks for further intermediate storage. The storage tanks are emptied by injecting nitrogen into them under pressure from the top, so that the tank is completely free from oxygen. The transport and bottling tanks, like the storage tanks, are cleaned before filling. First, they are steam-treated to sterilise them and then rinsed and pre-charged with nitrogen. N₂ is also used in bottle filling for rinsing and pre-charging. In the carousel filling systems at breweries, each bottle is filled with N₂ via a lance. Then, in the course of isobaric filling, beer



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flows into the bottle and the nitrogen escapes. Barrels are also filled with N₂ to force out the oxygen they contain. With the help of a gas mixer, breweries can also achieve an N₂/CO₂ mixing ratio that corresponds to their individual requirements for the various process stages.

Nitrogen production directly on site

Nitrogen is needed in different quantities, depending on the amount of beer or wine to be produced, and depending on how it is used in the various processes. Generating nitrogen directly on site from the sur-



Inmatec nitrogen generator for avoiding oxidation in the beverage industry

rounding air has many advantages for wine and beer producers. On-site generation keeps pace with demand and offers protection against supply bottlenecks in the delivery of bottles, bundles and tanks. Manufacturing the protective gas on site is also up to 60% less expensive than having it delivered. Doing away with deliveries by tanker is also good for the environment and road traffic levels.

Nitrogen generators from Inmatec produce between 0.4 and 2,800 m³ of nitrogen per hour, depending on requirements. The achieved purity is between 95% and 99.999%, and supplies wine producers and beer breweries with the desired quantity of nitrogen, which has a food-compliant purity of at least 99.5%. The nitrogen generators feature so-called pressure swing adsorption (PSA) technology, in which sterile compressed air flows through two adsorption vessels filled with a carbon molecular sieve. Oxygen and carbon dioxide molecules from the ambient air are caught in the sieve, while the free nitrogen molecules flow into the product tank. Production peaks can also be managed through the use of an additional storage tank. Inmatec nitrogen generators can be retrofitted at any time. The integration is carried out by means of gas mixers and compressed air compressors, which are now present in every brewery and are used to control pneumatic flaps on various tanks and vessels, for wort aeration and yeast fermentation or for aeration of yeast propagators for yeast cultivation, for example. All functions and parameters of the generator can be read out or monitored and controlled online by means of a large touch control panel or with the aid of state-of-the-art remote control technology.