



**Refinement and quality preservation of foodstuffs and luxury food**



**From juice to energy- and wellness drink**

Foodstuffs and luxury food should always be available in sufficient quantity, with excellent quality and freshness. Due to sometimes long-range transportation this requirement is not always easy to be accomplished. Optimal storage and appropriate packing are of high importance.

The air is composed of mainly nitrogen (approx. 78% ), oxygen (approx. 21%), carbon dioxide, as well as some rare gases, such as argon. Only the proportion of oxygen (for animal organisms) and the carbon dioxide (for the flora) are the part of this gas mixture which is vital for the metabolism of live organisms. Nitrogen and rare gases are exhaled unaltered and remain chemically and physically neutral (inert).

### **1) Nitrogen - Shelf life extension of fruit and vegetables (CA - storage)**

Considering that fresh fruit and vegetables still take part in metabolism immediately subsequent to harvest, the composition of ambient air is of substantial importance with regard to maintaining the goods' freshness.

This principle takes advantage of the so-called CA-storage (Controlled Atmosphere), as oxygen and carbon dioxide are extracted from the ambient air as far as possible and are replaced by nitrogen. If at the same time the air humidity is set to optimal values, many varieties of fruit and vegetable are good for storage over quite a number of days without loss of quality.

#### **Nitrogen during transportation:**

The CA-process is very successfully applied for transport by sea of fruit and vegetable. Modern cargo holds are equipped with control systems adjusting the composition of gas mixture. For this reason chemical preserving agents are widely dispensable.

Due to the high amount of nitrogen required for this process, so called "Nitrogen generators" are used for producing the inert gas. Hereby nitrogen is generated from compressed air. (Indeed the provisioning of nitrogen demand by cylinder, bundle or tank would be quite difficult at sea on board of a ship). The nitrogen generation is realised by a so called gas separation membrane. The precise function of these INMATEC Nitrogen generators is explained more in detail at the end of this report.

### Nitrogen for packaging:

The CA-process is also applied for packaging of fresh convenience food. Fruit and vegetable are wrapped into an airtight packaging which is filled with nitrogen. The proportion of oxygen and carbon dioxide is hereby supplanted from the packing and the following is avoided:

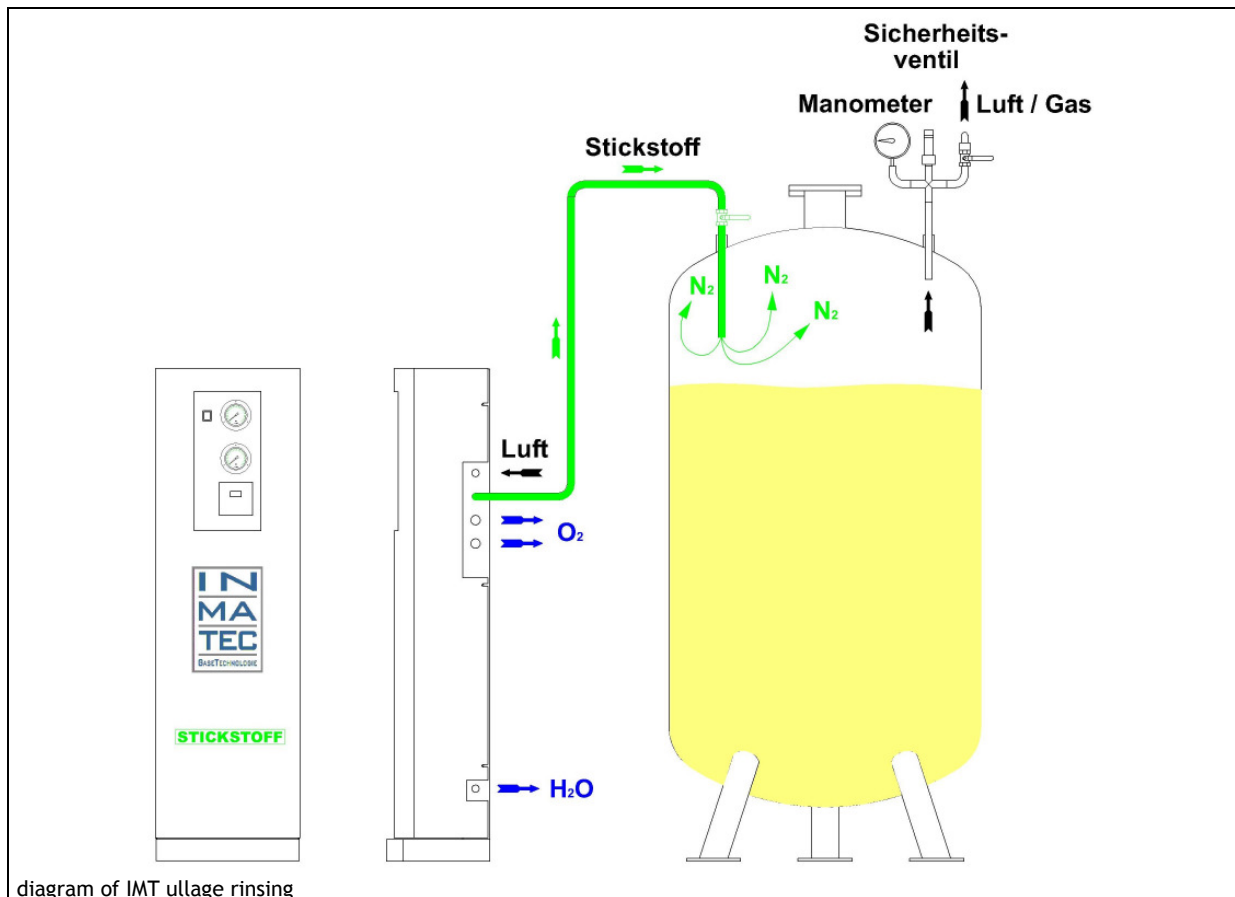
- discolouration of the product due to oxidation
- growth of microorganisms such as bacteria, mould, fungal and rancidity
- loss of flavouring agents and vitamins

### 2) Nitrogen - ullage rinsing for wine and fruit juice:

It is a long way from grape- and fruit harvest up to the beverage in your glass. The beverage must be protected in particular from unwanted oxidation. Anyone drinking wine knows the effect when leaving the wine bottle open inadvertently; you will note after a few days already that the taste of wine has changed. For this reason the wine and fruit juice needs also to be protected from oxidation when being in the storage tanks, in order to avoid the negative consequences of storage:

- growth of vinegar bacteria and yeast (*Mycoderma vini*)
- loss of dissolved carbon dioxide → dull, mouldy wine
- loss of wine-, fruity flavours
- unsavoury, odourless wine

This is effected by replacing air against pure nitrogen. The procedure is also called „ullage rinsing“. The dosage of inert gas atmosphere requires a specific process technology in which INMATEC is specialised for years. The quantity of inert gas depends on the variety of grape or fruit. It is general know-how that the nitrogen quantity needs to be 2,5 - 5 times compared to the emptiness volume. (e.g.: tank of 10.000 litres filled by 80% with wine = 2.000 litres emptiness volume x minimum 2,5 → 5.000 litres nitrogen)



### 3) Nitrogen- Inerting of tanks and piping systems

Inert substances (inert = inactive / uninvolved) are known as slow reaction materials which are not taking part in certain chemical processes, because they are not oxygen containing. In regard to viticulture and pomiculture these are gases such as nitrogen and carbon dioxide, which are quite often used as protective gas against before mentioned, unwanted oxidation of wine reservoirs and related piping systems.

Inerting the entire system of reservoirs and piping with nitrogen is a matter of course in the so called „New World“, in USA, Australia and New Zealand. For this purpose are used nitrogen generators which appropriately ensure nitrogen supply for the high and rapid demand. Regrettably the situation is not as self-evident in the „Old World“ in countries such as France, Spain and Italy.

However, this process is indeed to be recommended, as the risk of wine with yeast related film forming on the surface is hereby reduced significantly.

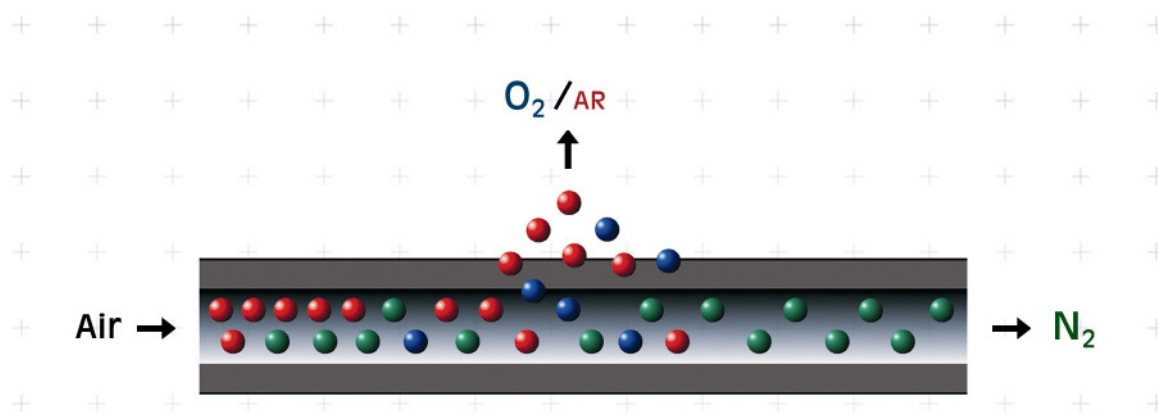
#### 4) Oxygen - From juice to energy- and wellness drink

The points mentioned before were topics of the inert gas „nitrogen“ only. Yet also oxygen becomes more and more important for the beverage industry. In the community a rethinking process is taking place. More importance is attached to health-conscious and performance-enhancing nutrition. The enrichment of beverages with oxygen is a means to enhance the consumer's performance and power of concentration. Up to now only the oxygen enrichment of mineral waters was common knowledge. However the introduction on the market of energy and wellness drinks in fruit juices has already started since long. Also for this branch there are various possibilities to provide the oxygen. Indeed, oxygen may be supplied in steel cylinders, bundles or via truck to tank installations. Instead INMATEC presents a reliable, economic and cost-efficient **alternative** to these conventional means of oxygen supply, this is the oxygen generator.

#### Functioning of Nitrogen - resp. Oxygen generators:

The generators are fed with technically pure compressed air, as it is available at nearly any business site. The functioning principle of the nitrogen and oxygen generator is based upon a perfected membrane technology. The patented and further developed gas separation membrane divides the compressed air into two gas flows.

- **Nitrogen** having a low diffusion rate, penetrates the membrane very slowly and is thereby enriched on its path through the hollow fibres
- **Oxygen** having a high diffusion rate penetrates the membrane very rapidly



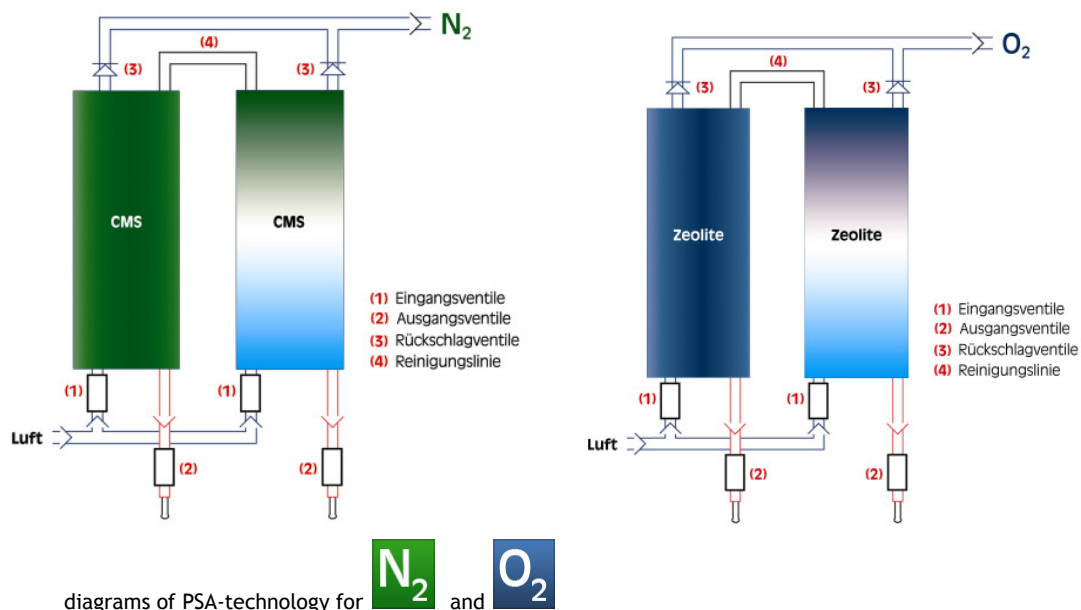
cross-section of hollow fibre membrane under pressure with discharge of N<sup>2</sup> and O<sup>2</sup>

Due to these differing characteristics it is possible to generate either oxygen or nitrogen.

The purity of both gases is adjusted by means of a control valve. If the

retention time of compressed air inside the membrane is extended, the purity of nitrogen or oxygen will be increased. The unique composition of the membrane ensures a very long service-life. As solenoid valves and manometric switches are fitted, the generators only produce the precise quantity of nitrogen or oxygen in accordance to actual demand.

The plants are designed for nitrogen purity grades and capacity in accordance to demand using membranes for purity up to 99,99 %, and under application of PSA technology (Pressure Swing Adsorption) using carbon material (CMS) for purity of 99,999 % and 10 ppm. As for the oxygen range purity is up to 99 %.



Ambient temperature should be within the range of + 2 °C and + 40 °C in regard to standard generation plants. Both wall- and floor mounted versions are available. The nitrogen- or oxygen generator only needs to be connected to the existing compressed air supply line and the valve to be opened towards the generator, immediately afterwards the in-house air fractionation plant will then start to produce nitrogen or oxygen. It is also our competence to design complete installations incl. compressor equipment for compressed air supply. These plants are customised in accordance to process requirements and applications.



Compared to conventional steel cylinders, bundles or tank installations the user holds the following benefits:

- constant high quality of nitrogen
- assured availability
- low installation- and running costs
- no handling costs and no safety hazard as for cylinders or gas bundles

Cost savings of up to 80 % compared to conventional nitrogen gas cylinders or tank installations may potentially be achieved.

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