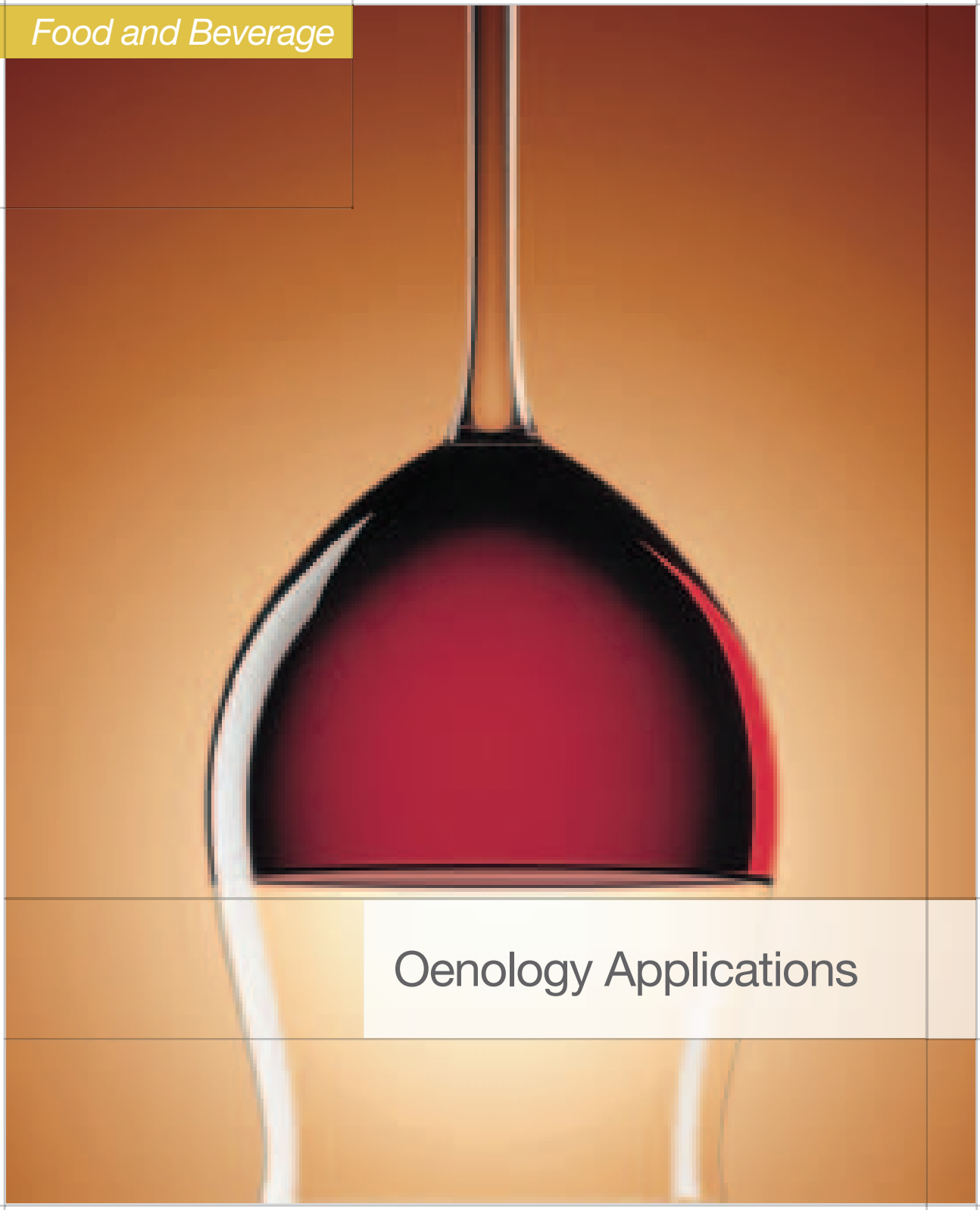
Food and Beverage



Oenology Applications

The SIAD Group

SIAD is one of the most important Italian chemical groups in the area of industrial gases, engineering, healthcare, services and industrial goods.

The Group has been involved in the business of industrial gases for more than 85 years and it is also characterised by long and consolidated experience in the engineering sector.
In the area of healthcare, it serves health structures and is also present in the homecare market.
These range of activities are completed by environmental management services, the marketing of consumer goods and the distribution of industrial goods.
The diversified range of activities of the SIAD Group translate into an offer which addresses a variety of industrial markets, sectors such as healthcare and the environment and the mass market.

For further information on the SIAD Group: **www.siad.com**

Values

Experience, Tradition and Strength

Reliability, Trustworthiness and Competency

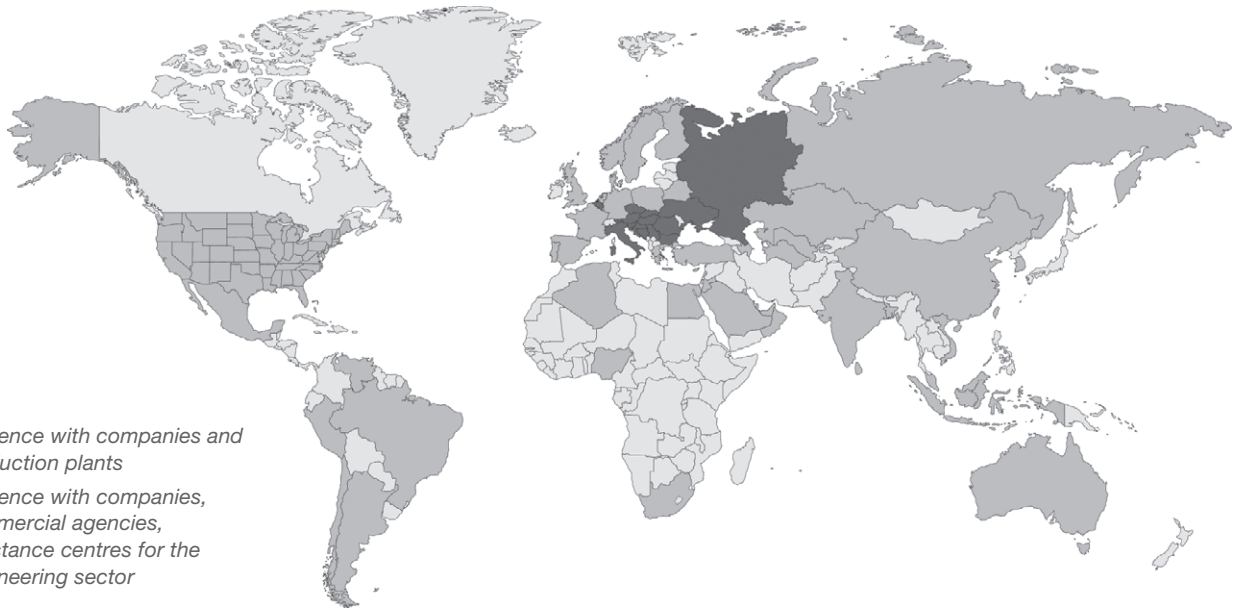
Research, Technology and Innovation

Geographical and Sector Diversification

Commitment to Quality, Safety and the Environment

Attention to Social and Cultural Issues

The SIAD Group in the world



Presence with companies and production plants

Presence with companies, commercial agencies, assistance centres for the Engineering sector

Food gases for the winemaking industry

SIAD's food gases find many applications in the vinification process.
SIAD's food gases have quickly gained widespread use in wineries everywhere on account of the numerous benefits that may be obtained from their use: improving the organoleptic properties of the wine, exalting the personality of the grapevines, protecting the product during all the processing stages, making the production process more efficient.

SIAD gases are certified pursuant to FSSC 2000 and ensure absolute food safety and hygiene.

Solid carbon dioxide in grape harvesting

The use of solid carbon dioxide (CO_2), commonly referred to as dry ice, meets the following basic purpose:

- **controlling the temperature** so as to prevent overheating and the premature fermentation of the grapes, and slowing down all the metabolic and eso- and endo-cellular enzyme-driven mechanisms;
- creating an **inert atmosphere** through the sublimation process so as to reduce oxidation and thereby prevent the distinctive characteristics of a wine from deteriorating.

The CO_2 is used during various stages:

- **during transport** from the field to the winery, of both white and red grapes;
- **on the crushed grapes, before the pressing process**, for white grapes;
- on **destemmed crushed** grapes, both white and red, but for different purposes.

The wines produced by making use of CO_2 are characterised by **more intense and richer aromatic notes.** In **red wines** the use of CO_2 gives a more stable, more intense colour, with red and mauve hues, and the tannins appear softer and riper.
The thermal shock due to the sublimation temperature of the CO_2 (-80°C) causes a "cellular collapse" resulting in **more effective extraction of phenolic substances.**

No less significant are the benefits obtained during the various processing steps:

- need for a smaller amount of sulphur dioxide as an antioxidant;
- reduced energy consumption compared to mechanical refrigeration systems;
- a higher, faster and more homogeneous temperature gradient;
- the combined benefits of cooling and inertisation with a single product.

Thanks to the experience and the technology available, CO_2 can be used according to many different modalities, from scattering dry ice over grapes by hand to distributing it with the aid of mechanical dispensing systems, to using "counter-current exchangers" where the grapes are made to move in the opposite direction to a flow of solid carbon dioxide, for even faster and more efficient cooling.

Nitrogen for venting, decanting and bottling

Like many other oxygen-sensitive foods, upon coming into contact with the air, the wine loses some of its **organoleptic characteristics**: colour, taste, odour and vitamin content. This deterioration may be prevented by adding an inert gas (nitrogen) to the tanks where the wine is stored.
The inert gas:

- **inhibits bacterial proliferation;**
- **attenuates** the harmful effects of **moisture;**
- **protects** the entire system from the penetration of **external contaminants.**

Nitrogen in gaseous form is introduced into the headspace of the storage tanks so as to replace air and obtain an oxygen free top layer. By increasing the pressure in the headspace of the tank, the gas proves the simplest and safest way to decant the wine or move it on from one processing stage to the next. Moreover, the use of the inert gas does away with the need to use pumps, whose mechanical parts may release contaminants into the wine. Nitrogen can also be used in drops to **protect bottled wine** from the effects of the oxygen contained in the empty space above the liquid. With the aid of a **dripper**, the right amount of nitrogen is injected directly into the bottle, where the increase in temperature causes the nitrogen to evaporate and generate an inert atmosphere with an extremely low oxygen concentration (down from 21% to 2%).

Nitrogen can also be used to **remove dissolved oxygen** from the wine. This operation is made possible by “in-line strippers” with which the nitrogen is distributed throughout the liquid in the form of micro bubbles which capture the oxygen.

Inertisation with argon

Our ongoing search for new solutions to make the winemaking process more effective prompted tests on the use of another inert gas: argon.
This gas is totally inert, odourless, colourless and its wine protection capacity is even better than that of nitrogen.
The specific features that contributed to the success of the experimentation with argon are as follows.

- Being heavier than nitrogen, it forms a layer above the wine that ensures a more effective protection from oxygen.
- It **does away** with the potential phenomenon of **gas emulsion** in the liquid and the resulting removal of the substances which determine the aromatic notes in a wine.
- It has a **stronger inhibiting effect** on oxidative enzymes (tyrosinase and glucose oxidase).
- It **does not** entail the gasification of the wine.
- Its use in winemaking is permitted by the applicable regulations **without any restriction whatsoever.**

Macro and Micro oxygenation

Oxygenation is a technique with which a **carefully dosed amount** of oxygen is added to the wine during certain phases of the vinification process. This technique makes it possible to obtain several results, including **ageing** and **yeast growth.** Depending on the amount of oxygen added and how long it takes to complete the process, the terms macro or micro oxygenation are used.
Micro oxygenation consists of introducing an amount of oxygen not greater than 10 ml/litre for thirty days, starting from ten to thirty days after the end of the alcoholic fermentation stage. The oxygen is added slowly and is absorbed into the wine, attenuating reduction and undesired compound formation phenomena.
Macro oxygenation uses 3-5 mg of oxygen per litre during a one- or two-day period during the final fermentation stage.

Oxygen enables the yeast to complete the alcoholic fermentation process, thereby preventing the formation of undesirable odours and taste. It helps restore the phenolic complex and hence preserve the original colour of the wine.

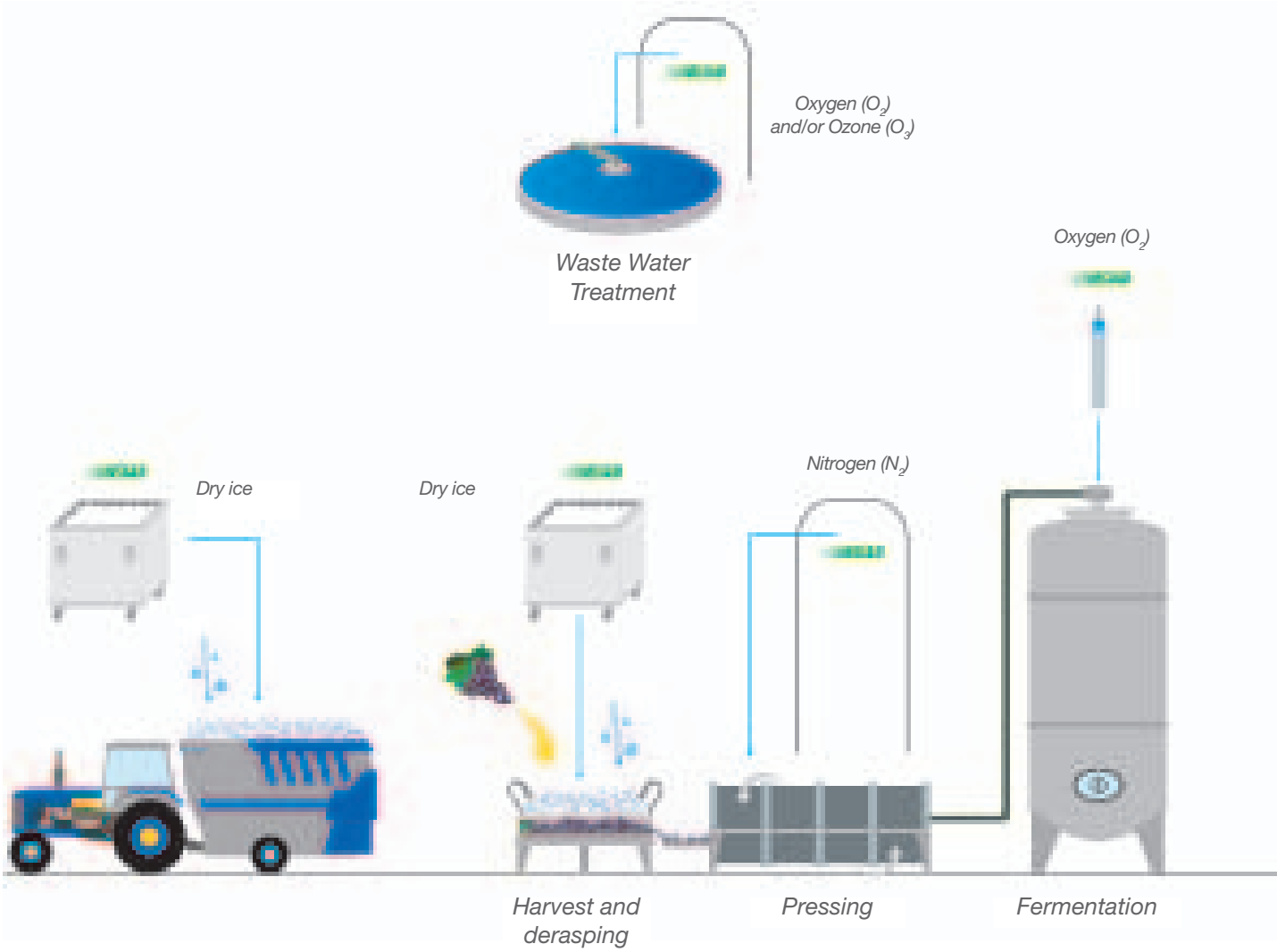
Wastewater treatment with oxygen: the Mixflo® system

The need to treat wastewater from the vinification process has led the winemakers to adopt **activated sludge biological treatment** systems.
The traditional methods that use air or oxygen insufflation into a “biological oxidation tank” have a limited efficiency due to the short time during which the oxygen remains in contact with the liquid.

The Mixflo® system relies on a liquid-liquid mixing principle and makes it possible to obtain a highly efficient cleansing system thanks to better oxygen diffusion.

Essentially, a fraction of the wastewater is taken from the tank, is pressurised and enriched with oxygen so as to create a liquid monophase, which is then pumped back into the tank.
This process is repeated until perfect mixing of the oxygen in the liquid is achieved. Mixflo® is an environmentally friendly system that does not release harmful aerosols into the environment. Furthermore, it is suitable for high flexibility demands, making it possible to cope with load peaks.

SIAD gases and technologies for the winemaking process



Dry ice

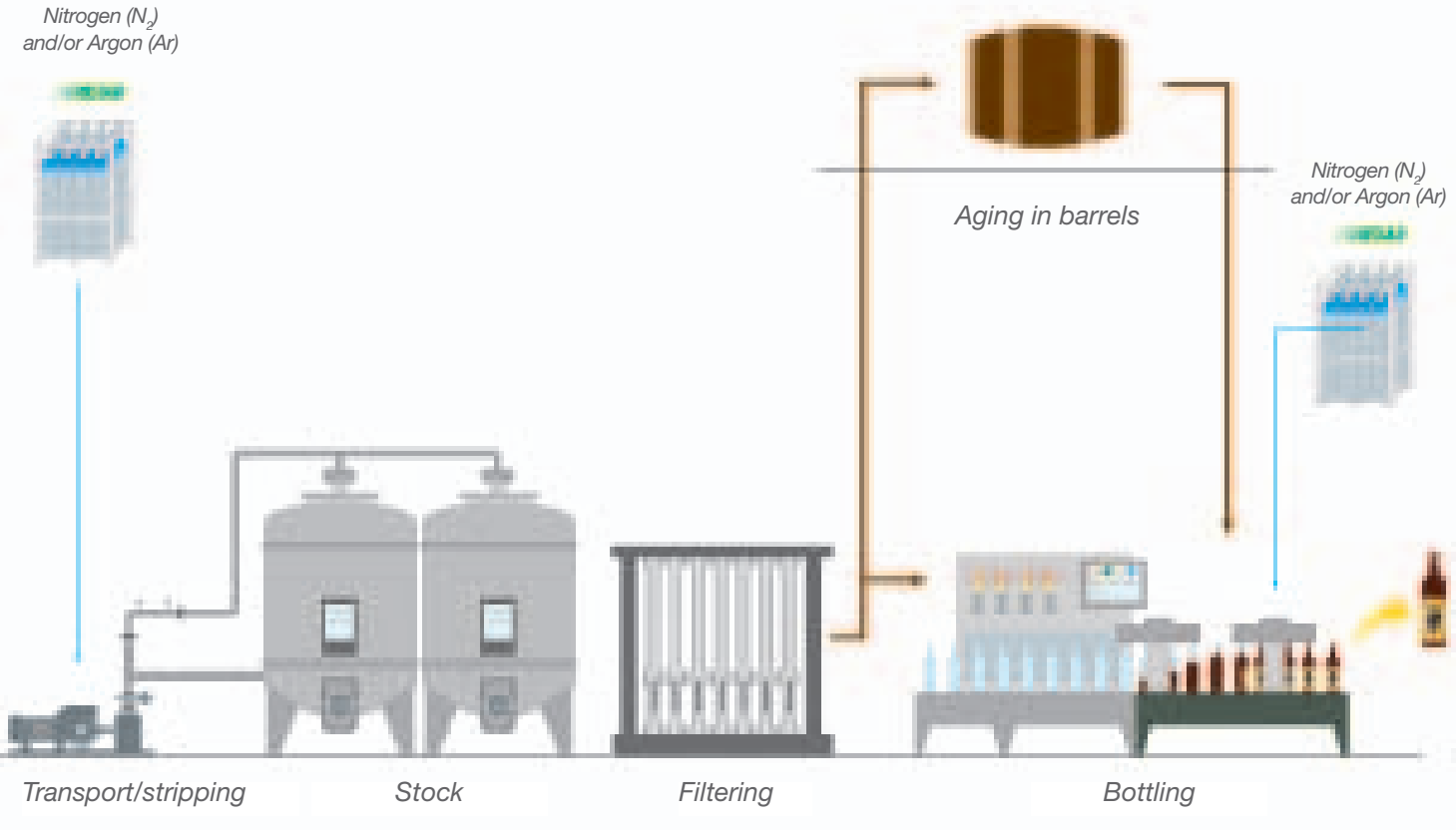
- Solid carbon dioxide: CO_2
- Temperature at ambient pressure: -78.5°C
- Heat absorbed up to 0°C: 152 kcal/kg
- Specific weight: 1.5 kg/dm^3
- Residual humidity: 0%
- Appearance: matte white
- Odour: non perceptible

Carbon dioxide

- Chemical formula: CO_2
- Titre: 99.5% (alimentary additive E290 specifications)
- Temperature in liquid state: -79°C
- Density (kg/m^3): 1.814
- Solubility in water (cm^3/cm^3): 0.870
- Molecular weight (g/mol): 44.0
- Appearance: colourless gas
- Odour: odourless gas

Nitrogen

- Chemical formula: N_2
- Alimentary additive: E941
- Temperature in liquid state: -196°C
- Density (kg/m^3): 1.147
- Solubility in water (cm^3/cm^3): 0.0156
- Molecular weight (g/mol): 28
- Type: Inert
- Appearance: colourless gas
- Odour: odourless gas



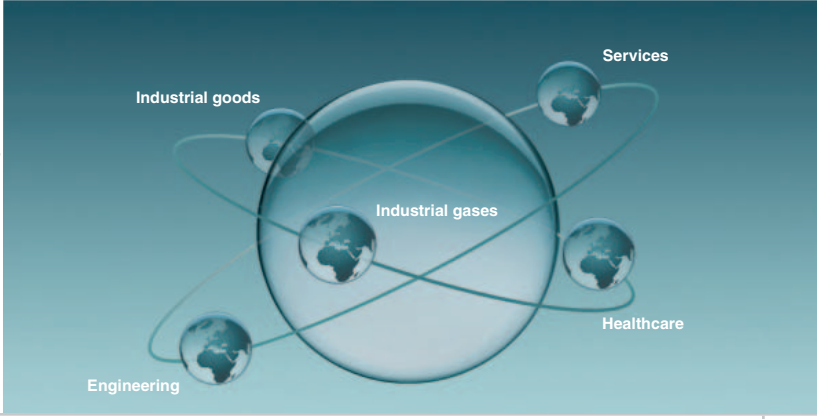
Argon

- Chemical formula: Ar
- Alimentary additive: E938
- Temperature in liquid state: -186°C
- Density (kg/m^3): 1.636
- Solubility in water (cm^3/cm^3): 0.0340
- Molecular weight (g/mol): 39.9
- Type: Inert
- Appearance: colourless gas
- Odour: odourless gas

Oxygen

- Chemical formula: O_2
- Titre: 99.5% (alimentary additive E948 specifications)
- Temperature in liquid state: -183°C
- Density (kg/m^3): 1.311
- Solubility in water (cm^3/cm^3): 0.0310
- Molecular weight (g/mol): 32.0
- Type: Oxidant
- Appearance: colourless gas
- Odour: odourless gas

The SIAD Group



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