



FEDERCHIMICA  
ASSOGASTECNICI  
Associazione nazionale imprese gas tecnici,  
speciali e medicinali



# Industrial gases in the agri-food & beverage sector: a great contribution to sustainability

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The **efficiency and sustainability of food supply chain** is one of the challenges of the global society.

Increasing food preservation, developing packaging technologies and improving transportation and logistics management are some of the main areas of action that can be identified<sup>1</sup> for a sustainable food supply system and the safeguard of food security.

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## Food losses and wastes

*From the initial agricultural production down to the final household consumption, one-third of the food currently produced is lost or wasted throughout the supply chain<sup>1</sup>.*

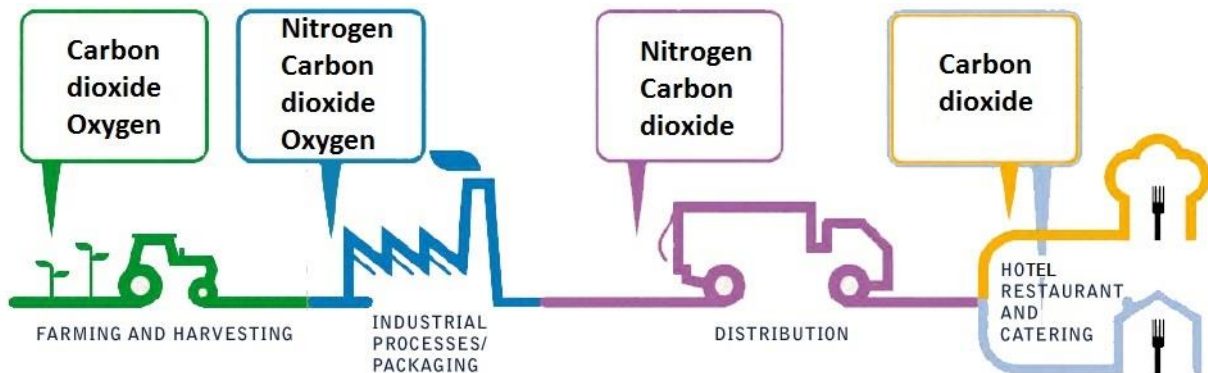
*In the only European Union, the total food loss is estimated at 89 million tons per year; this means that across all sectors it amounts to 179 kg per capita.<sup>2</sup>*

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<sup>1</sup> "SAVE FOOD: Global Initiative on Food Loss and Waste Reduction", FAO - United Nations Food and Agriculture Organisation, 2014

<sup>2</sup> Loss and waste in the food chain, Kris Roels, Dirk Van Gijsegem, November 2011

With respect to the fundamental objective of reducing food loss and waste, the **industrial and technical gases industry, with the modern food gases** gives an essential and growing contribution, providing a wide range of products and solutions to **support growth and health of plants, extend the product shelf life and manage the entire cold chain.**



### ***Food gases in the food value chain***

## **About food gases**

*Food gases - defined as food<sup>3</sup> - are used for a variety of purposes in the food and beverage industry, employed as additives, processing aids or ingredients in contact with food.*

*Food gases, in liquid, gaseous or solid form, have to meet law requirements regarding labelling, purity criteria and hygiene.*

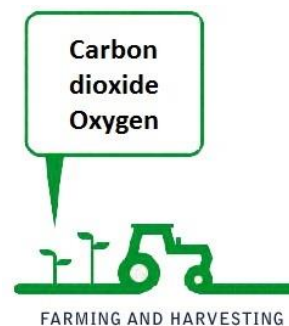
Thanks to the **food gases applications** in greenhouses, crop disinfestation, fish farming, cooling and deep-freezing processing, MAP (Modified Atmosphere Packaging), cooling transport and on-site beverage carbonation, it is possible to contribute to reduce food loss and waste along the food value chain. The use of food gases may limit in particular food loss, that is the unintended result of an agricultural process or technical limitation in storage, transportation, processing, cooling facilities, infrastructure or packaging<sup>4</sup>.

<sup>3</sup> The basis for European food legislation is regulation (EC) n. 178/2002 of the European Parliament and of The Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. Current and proposed European legislation requires that foods, including gases supplied to the food industry, have to meet increasingly rigorous standards to ensure food safety.

<sup>4</sup> "Reducing food loss and waste", World Resource Institute, UNEP (United Nations Environment Programme), 2013

## Farming and harvesting: increasing crop productivity

*An efficient and sustainable agriculture is a fundamental objective, in particular if we consider the projected growth of global population that will reach 9.2 billion by 2050. This increased population density is estimated to increase demand for food production by 70%. Today, 32% of food grown around the world is lost during crop production and a further 22% is lost during harvesting and storage (FAO estimates).*



### ***CO<sub>2</sub> enrichment greenhouse***

Greenhouses facilities allows farmers to produce fruit and vegetables all year round and meet consumer demand during extended period of production.

Enriching the greenhouse atmosphere with pure **carbon dioxide** helps the photosynthesis process and then plants health and growth. Increased carbon dioxide uptake means faster growth and more or bigger plant parts. This means additional yields (about 30-40% higher) and an important savings of cultivated areas.

### ***Crop disinfection***

The reduction of current yield losses caused by pests is a major challenge to agricultural production: pest problems and pest control are exceeding complex because of the wide array of crops, agricultural systems and more than 70,000 species of pests in the world. Global crop yields are reduced by 20 to 40% per year due to plant pests and diseases<sup>5</sup>. If every farmer stopped all pest control measures, food losses before harvest would simply the double of the actual volumes<sup>6</sup>.

The fumigant effect of **carbon dioxide** allows a post-harvest treatment of organic crops thus increasing the food safety and the product quality, reducing waste products without producing any impact on the organic status of the products.

### ***Fish farming and aquaculture***

Fish farming has become increasingly important in recent years, filling the gap between global supply and demand for fresh fish products which may have devastating consequences for the world's natural fish population.

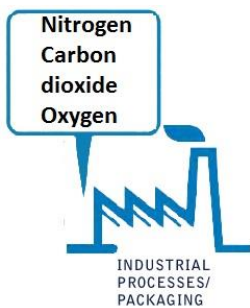
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<sup>5</sup> Estimates the FAO-based IPPC Secretariat

<sup>6</sup> Pesticide productivity and food security. A review, József Popp, Károly Pető, János Nagy, Agronomy for Sustainable Development, 2013

Fish farming is the main form of aquaculture, a cultivation in an environment where the right gas composition of water is important to ensure that farmed fish stay healthy. The injection of pure **oxygen** plays a crucial role as this gas is vital for ensuring healthy fish growth. This means not only an improvement of the health of the aquaculture livestock but also a major flexibility in site selection, reduced water usage, lower effluent volumes, better environmental control, and a double productivity compared to production without oxygen.

## Food conservation along the food chain: increasing the shelf life



*For the food industry, the capacity to provide high quality products, with constant features along the time, to far geographic areas and in an efficient way has become an essential factor not only in terms of competitiveness but also for a more important eco-sustainable development of the modern food industry.*

### ***Cooling and freezing***

One of the key challenges in the food industry is the effective control or – even better – elimination of bacterial activity. And one of the most effective weapons in the fight against bacteria is cooling and freezing.

Cooling a food product reduces the risk of bacterial growth. Rapidly chilling a product mitigates this risk even further. Cryogenic freezing also maintains the natural quality of food. The smaller and more evenly distributed the crystals, the better the quality and taste of the frozen product. The only way to ensure that small crystals form uniformly throughout the food product is to quick-freeze the food at cryogenic temperatures.

Cryogenic freezing of food with liquid **nitrogen** and **carbon dioxide** is a well-established practice that relies on those gases' extreme cold temperatures as they come into contact with food.

### ***MAP (Modified Atmosphere Packaging)***

Unlike most food products, fresh fruits and vegetables continue to 'breathe' or respire after they have been harvested. This process consumes oxygen and produces carbon dioxide and water vapor. The key to keeping these packaged

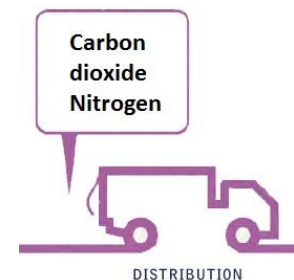
products fresh for as long as possible is to reduce the respiration rate without harming the quality of the product – its taste, texture and appearance.

Modified Atmosphere Packaging (MAP) is the practice of modifying the composition of the internal atmosphere of a package introducing a gas or a gas mixture of **nitrogen**, **oxygen** or **carbon dioxide**, which replace the air inside the package and eliminate or reduce any product damaging deterioration. Thanks to MAP it is possible to:

- extend the shelf life of fresh or minimally processed foods (from 2 to 5 times that under air)
- lower the use of some additives by reducing the main processes of deterioration in the product
- protect the product against crushing
- retain taste, texture and appearance of the foodstuff
- enhance production and distribution efficiency.

## Storage and Transportation: preserving the cold chain

*A cold chain is a temperature-controlled supply chain. An unbroken cold chain is an uninterrupted series of storage and distribution activities which maintain a given temperature range. It is used to help extend and ensure the shelf life of products such as fresh agricultural produce, seafood and frozen food.*



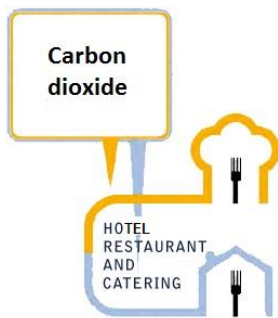
### ***Cooling transport***

Among the major cold chain technologies, dry ice, that is solid **carbon dioxide**, and liquid **nitrogen** are capable of keeping a shipment fresh and frozen for a definite period of time.

The use of these gases represents an alternative to existing mechanical cooling system and assure important benefits such as:

- fast temperature pull-down and accurate temperature control
- silent cooling system
- no greenhouse gas (GHG) or other particular emission
- improving product integrity
- longer distances and logistic advantages
- reducing wastage and returns of expired stock.

## Food gases for the on-site application: a great environmental benefit



*Food gases applications are an effective and natural way of meeting arising demand for quality, efficiency, sustainability and environmental care of the near consumer. An example of this contribution is provided by the on-site beverage carbonation mainly applied in the Horeca sector (Hotel, Restaurant and Catering). This application allows a great environmental benefit in terms of minor transport and final disposal of bottles.*

### ***Beverage carbonation***

Carbonation, that is the process of dissolving **carbon dioxide** in beverages to obtain a sparkling drink, is also a natural method to get a healthy beverage thanks to the bacteriostatic effect of the CO<sub>2</sub>.

This application is growing in the Horeca sector where hotels, restaurants and caterers founded an efficient and economic way to obtain sparkling beverages with an important environmental benefit in the management of bottles and related costs.

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## **Food gases helping sustain food supply chain**

*From farm to fork, food gases contribute to the sustainability and efficiency of the entire food supply chain.*

*The European food gases industry provides many important solutions with innovative products and processes which are fundamental in the global challenge of reducing food loss and waste.*

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