

# Medical oxygen

## A major evolution in the market

Oxygen concentrators can now be installed in European hospitals, a development that **Laurent Zenou** explains here.



maximal content of pollutants which are more restrictive in the new monograph.

On-site production benefits include:

- Environmentally friendly: avoids the comings and goings of trucks for oxygen delivery, and the corresponding CO<sub>2</sub> emissions
- Safety: avoids having to have a storage of oxygen, which is a highly combustible gas, in the hospital
- Competitiveness: production costs for the user are in most cases lower than the purchase cost of oxygen reloads.

### PSA technology

Oxygen concentrators for individual usage are medical devices, used for a long time

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for the oxygenotherapy of the patients attained by respiratory insufficiency.

Oxygen concentrators for central oxygen supply is based on the same PSA technology, but of course at larger scale and with more functions of control and monitoring. Oxygen concentrators are considered as medical devices by the European directive 93/42/EEC. For this reason, manufacturers must be certified according to ISO 9001 and ISO 13485 by an authorised body.

Ambient air contains 21% oxygen, 78% nitrogen, 0.9% argon and 0.1% of rare gases. The so called PSA (pressure swing adsorption) technology consists in a static separation of all these gases thanks to a specific molecular sieve whose property is to adsorb nitrogen under pressure. The oxygen concentrator is mainly comprised of two separation vessels (zeolites) filled with molecular sieve adsorbents. As compressed air pressurises one vessel, the nitrogen becomes more and more retained by the molecular sieve and the oxygen goes straight to the outlet of the generator. When the vessel is approaching nitrogen saturation, the process switches to the second vessel and the adsorbed nitrogen in the first vessel is released into the ambient air. The cycle is then repeated indefinitely.

The two monographs differ principally on the minimal content of oxygen, which shall be 99.5% for oxygen produced by cryogenic distillation and 93% +/- 3% for oxygen produced by PSA, and on the

separation process, is also available for an oxygen production at a level of 99% to 99.5%," says Zenou.

### Installation design

The manufacture and installation of an oxygen concentrator for the supply of a medical gas distribution system in a hospital is described in the European norm ISO 10083, the British norm HTM 02-01, and the American norm NFPA 99c.

According to those standards, an oxygen plant shall be composed by three independent sources of oxygen supply. The primary source is composed of an oxygen concentrator, the second source can be composed either of an oxygen concentrator, oxygen cylinders, or an oxygen bulk, whereas the third source or back-up is generally always composed of oxygen cylinders.

"We have some interesting examples where an oxygen concentrator and bulk oxygen works in a perfect harmony," Zenou adds. "Herzog Hospital in Jerusalem (Israel) is a 330-bed hospital with an impressive service of 120 beds in intensive care units. This hospital has been using one of our oxygen concentrators since 2007 for 75% of its needs. The 25% left are supplied by the liquid oxygen."

### Forecast

We can assume that oxygen concentrators will take a share of the market within the next decade. What is interesting in this story is that it's not only an innovative equipment which is entering the market.

This evolution will also have implications for the market players, to modify their business model of oxygen delivery – to include in it a model in which the oxygen is produced on-site, without delivery.

### NOVAIR GROUP

NOVAIR started its activities in the on-site gas production and compression business in 1977 as a privately-owned company.

With its head office and factory in France, located just near Paris Charles de Gaulle airport, the company supplies innovative gas solutions in more than 60 countries, all over the world, through a global network of distributors and affiliates.

Organised into two different sectors, NOVAIR's medical division focuses on the design and manufacture of innovative medical gas production for clinics and hospitals and has been a manufacturer of medical oxygen concentrators since 1995.

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Medical oxygen is a theme enjoying a major European evolution, after the implementation of a new oxygen monograph at the European pharmacopeia in April 2011.

European hospitals used to have two choices for supplying medical oxygen to their medical gas network, depending on their consumption they could either purchase liquid oxygen stored in an on-site bulk, or purchase oxygen cylinders refills.

During the past 20 years, PSA oxygen concentrators for the supply of medical gas distribution systems have appeared on the worldwide market. This third way of supplying oxygen to hospitals is by definition a complete alternative, as the

oxygen is produced on-site, without delivery and storage.

### Monograph oxygen 93%

Initially developed for remote areas, medical oxygen concentrators have subsequently convinced many city hospitals in North America, Africa, Middle East and Asia that they are able to supply medical oxygen at a competitive price compared to liquid oxygen or cylinders.

Only the European hospitals remained hermetic to this development it seemed, waiting for the position of the European Pharmacopeia. Indeed, in Europe as in the US, oxygen for medical use is considered as a drug and must get a pharmaceutical

description in the pharmacopeia.

The oxygen produced by cryogenic distillation has received in years since a monograph, but the oxygen produced by PSA concentrators did not have its own monograph in Europe, only in the US – until April 2011, when the European Pharmacopeia implemented the monograph 'Oxygen 93%'. This new monograph covers the pharmaceutical description of oxygen for medical use, produced on-site by PSA oxygen concentrators.

NOVAIR Group Project Engineer Laurent Zenou explains the significance of the new acceptance in Europe, "We were waiting for this monograph for more than 10 years."