Oxygen concentrator

An oxygen concentrator is a device used to provide oxygen therapy to a patient at substantially higher concentrations than available in ambient air. They are used as a safer, less expensive, and more convenient alternative to tanks of compressed oxygen. Common models retail at around US$800. Leasing arrangements may be available through various medical-supply companies and/or insurance agencies.

Oxygen concentrators are also used to provide an economical source of oxygen in industrial processes.

How they work

The simplest oxygen concentrator is capable of continuous delivery of oxygen and has internal functions based around two cylinders, filled with a zeolite material, which selectively adsorbs the nitrogen in the air. In each cycle, air flows through one cylinder at a pressure of around 20 lbf/in² (138 kPa, or 1.36 atmospheres) where the nitrogen molecules are captured by the zeolite, while the other cylinder is vented off to ambient atmospheric pressure allowing the captured nitrogen to dissipate.

Typical units have cycles of around 20 seconds, and allow for a continuous supply of oxygen at a flow rate of up to approximately five liters per minute (LPM) at concentrations anywhere from 50 to 95%. This process is called pressure swing adsorption (PSA).[1] Since 1999, concentrators providing up to 10 LPM have been available for high flow patients, in sizes not much larger or heavier than 5 LPM concentrators.

Portable oxygen concentrators

Since 2000, a number of manufacturers have introduced portable oxygen concentrators. Typically, these produce less than one liter per minute (LPM) of oxygen and use some version of pulse flow or demand flow to deliver oxygen only when the patient is inhaling. However, there are few portable oxygen concentrators that produce 3 LPM of continuous-flow oxygen. Also providing pulse flow available to either provide higher flows or reduce power consumption. These portable concentrators typically plug into a wall outlet like the larger, heavier stationary concentrators.[2]

Portable oxygen concentrators usually can also be plugged into a vehicle DC adapter, and most have the ability to run from battery power as well, either for ambulatory use or for use away from power or for airplane travel. The FAA has approved portable oxygen concentrators for use on commercial airlines, although it is necessary to check in advance whether a particular brand or model is permitted on a particular airline.
Historically, demand or pulse flow concentrators have not been used for nocturnal use—sleeping. If the nasal cannula moves such that the concentrator is not able to detect when the patient is inhaling, it is unable to deliver the pulse while the patient is inhaling.

Military uses
Oxygen concentrators are currently being used by the US military in the conflicts in Iraq and Afghanistan as part of the equipment complement of forward surgical teams.

Safety
In both clinical and emergency-care situations, oxygen concentrators have the advantage of not being as dangerous as oxygen cylinders, which can, if ruptured or leaking, greatly increase the combustion rate of a fire. As such, oxygen concentrators are particularly advantageous in military or disaster situations, where oxygen tanks may be dangerous or infeasible.

Oxygen concentrators are considered sufficiently non-volatile to be leased to individual patients as a prescription item for use in their homes. Typically they are used as an adjunct to CPAP treatment of severe sleep apnea. There also are other medical uses for oxygen concentrators, including emphysema and other respiratory diseases.

Used, refurbished, and temperamental units are worthless to the medical community since an individual's health frequently relies on the constant extended operation of the unit. However, such units are valuable to metal and glasswork hobbyists. Oxygen is one of the more expensive bottled gases. Medical oxygen concentrators or dedicated industrial (non-medical) oxygen concentrators can be made to operate a small oxy-acetylene torch quite easily, if only at lower pressures.\[^3\]

Industrial oxygen concentrators
Industrial processes may use much higher pressures and flows than medical units. To meet that need, another process, called vacuum swing adsorption (VSA), has been developed by Air Products. It uses a single low pressure blower and a valve which reverses the flow through the blower so that the regeneration phase occurs under a vacuum. Generators using this process are being marketed to the aquaculture industry.\[^4\] Industrial oxygen concentrators are often available in a much wider range of capacities than medical concentrators.

Industrial units are sometimes referred to as oxygen generators within the oxygen and ozone industries to disambiguate from medical oxygen concentrators. The distinction is used in an attempt to clarify that industrial oxygen concentrators that are not FDA-approved medical devices are not suitable for use as bedside medical concentrators. However, applying the oxygen generator nomenclature can lead to confusion. The term, oxygen generator, is a misnomer in that oxygen is not generated as it is with a chemical oxygen generator, but rather is concentrated from the air. The use of the oxygen generator terminology can also be a problem for shipping logistics in the wake of the ValuJet Flight 592 crash. Non-medical oxygen concentrators can be used as a feed gas to a medical oxygen system, like a hospital oxygen system, although FDA (or other region-specific regulatory, like CE) approval is required, additional filtration is generally required, and there may be other regulatory requirements as well.
See also

- Portable oxygen concentrator
- The section on Storage and Sources of Oxygen in the Oxygen therapy article.

Notes

- 5. Airsep Website (http://www.airsep.com/)
Article Sources and Contributors

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