

UNMASKING MYTHS ABOUT OXYGEN CONCENTRATORS



Intent of this white paper: To put facts in the right perspective in a very crisp manner for easier understanding, so as to differentiate between oxygen concentrators and the need of oxygen cylinders based on the severity of the infection. Additionally this paper attempts to enable the readers to understand the difference between medical and industrial grade oxygen (whilst this paper would only sensitize the readers on this topic, a detailed technical paper would subsequently be released separately).

IMPORTANT FACTS THAT NEED TO BE UNDERSTOOD WHILE APPLYING ANY HOME REMEDY AND UNDER ANY MEDICAL GUIDANCE ARE:

- **As per WHO, oxygen therapy** is recommended for all severe and critical COVID-19 patients, with low doses from 1-2 litres per minute in children and starting from 5 litres per minute in adults using nasal cannula, which could be as high as 10 litres per minute when they are suffering from acute respiratory discomfort and their saturation drops. This is about oxygen being given in home set-up. Under medical supervision, and in some acute conditions, hospital care (based on the medical protocols) may entail dispensing high-pressure oxygen of up to 80 litres per minute flow rate (Figure-1).
- **Only high-quality medical grade oxygen** should be given to patients.
- **Oxygen concentrator is a device** capable of concentrating oxygen from ambient air i.e. 78% nitrogen and 21% oxygen. It accumulates air, filters it via a sieve, releases the nitrogen back into the air and collects the oxygen.
- **This oxygen can be dispensed** through a nasal cannula using a pressure valve that regulates its flow. It can deliver oxygen typically, at a flow rate between 1-10 litres per minute.
- **Oxygen concentrator is a very useful medical equipment because of its size, portability and no requirement of any kind of refilling.**
- Oxygen concentrators could be used for non-severe conditions, or after discharge from the hospital for home care and for an interim use whilst waiting for medical guidance & supervision. **They can even be a lifesaver for cases in which a patient needs appropriate oxygen flow and concentration based upon his/her condition.** Their use also reduces the occupancy pressure in hospitals as such patients can continue treatment at home.
- **Oxygen concentrator is not a replacement for oxygen cylinder or ventilator.** Patients with moderate and severe health conditions will need higher doses of oxygen and this device cannot meet those requirements.
- **Experts advise** against the use of oxygen concentrators for patients who have oxygen saturation below 85%. In such cases, oxygen cylinders should be used because these patients require 40-50 litres per minute and oxygen concentrators can supply only 5-10 Litres per minute.

COVID-19 AND OXYGEN

Data from China suggests that although the majority of people with Covid-19 have mild illness (40%) or moderate illness (40%); about 15% of them have severe illness requiring oxygen therapy, and 5% will be critically ill requiring intensive care unit treatment. In addition, most critically ill Covid-19 patient will require mechanical ventilation. For these reason Covid-19 treatment healthcare facilities should be equipped with pulse oximeters, functioning oxygen systems including single-use oxygen delivery interfaces.

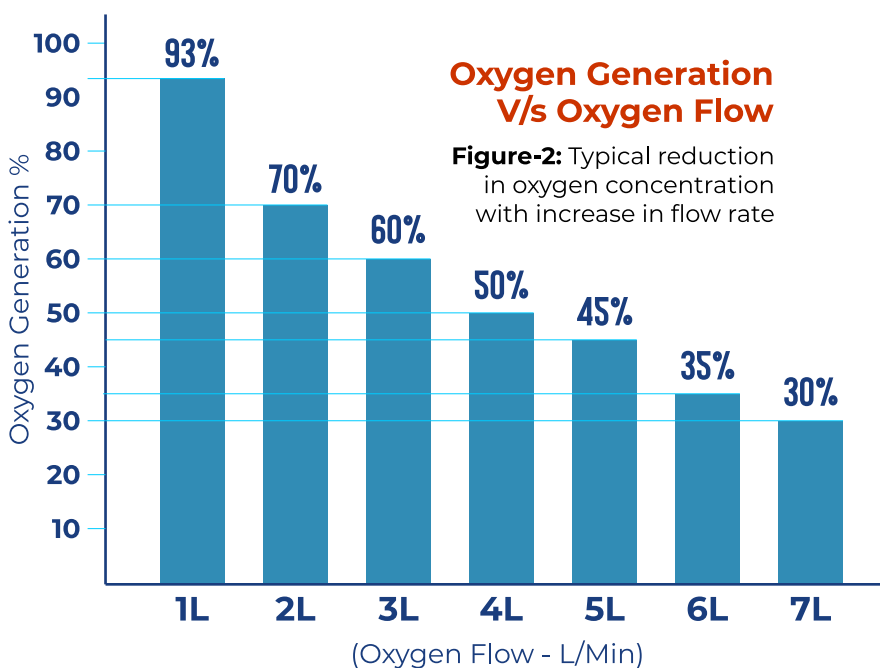
Oxygen therapy is recommended for all severe and critical Covid-19 patients, with low does ranging from 1-2 L/min in children and starting at 5 L/min in adults with nasal cannula, moderate flow rates for use with venture mask (6-10 L/min); or higher flow rates (10-15 L/min) using a mask with reservoir bag. In addition, oxygen can be delivered at higher flow rates and in higher concentrations, using high-flow nasal cannula (HFNC) devices, non-invasive ventilation (NIV) and invasive ventilation devices.

Figure-1: WHO Interim Guidelines - 4th April

<https://apps.who.int/iris/rest/bitstreams/1274720/retrieve>

SOME OTHER FACTS THAT MUST BE UNDERSTOOD & APPLIED:

- OXYGEN CONCENTRATORs are categorised based on the flow in litres per minute with ranges of 1-5, 1-10 and larger ones.
- **It should be noted that 93% oxygen concentration is recommended for medical treatment**
- In small oxygen concentrators that usually have a variable flow rate of oxygen, 93% oxygen concentration is achieved only at lower flows rates, typically, 1-2 litre per minutes. As the flow rate is increased, the oxygen the concentration drops to a level as low as 30% as shown in Figure-2
- Due to its typical flow versus concentration relation, oxygen concentrators are suitable for **Chronic Obstructive Pulmonary Disease (COPD) patients ONLY and not for severe hospitalised COVID-19 patients.**
- The atmospheric air that we normally breathe-in, contains 21% oxygen. Hence, it is evident that a common OXYGEN CONCENTRATOR which deliver oxygen having only about 30% concentration, is practically just blowing atmospheric air with marginal gain in oxygen concentration.



Oxygen Generation V/s Oxygen Flow

Figure-2: Typical reduction in oxygen concentration with increase in flow rate



Therefore, while selecting a concentrator, preference should be given to those units that offer higher flow rate while maintaining 93% oxygen concentration.

One should carefully read the specifications and check for laboratory certificate or test reports containing oxygen concentration versus flow rate characteristics. Typically, for domestic use, oxygen concentration values at flow rates of 5 litre per minute and 10 litre per minute may be checked.



DIFFERENCE BETWEEN MEDICAL OXYGEN AND INDUSTRIAL OXYGEN

Due to various similarities between the medical oxygen and industrial oxygen, such as similar method of production, similar method of filling of oxygen tanks, and the fact that plants for both are rated for 99%+ purity of oxygen and both use liquid oxygen, people get confused about usability of industrial oxygen for medical purposes.

It may therefore be carefully noted that there is a significant difference between the medical oxygen and the industrial oxygen. In simple words, medical oxygen is the oxygen intended to be inhaled by humans. It is generated by using medical grade air compressors, transported in medical grade tankers that have very stringent requirements in terms of not allowing contaminants or impurities to be carried with the supplied high pressure oxygen.

Whereas, industrial oxygen, as the name implies, is typically a type of oxygen used in industrial settings, like manufacturing plants, for tasks that may include combustion, oxidation and even to help accelerate certain chemical reactions. **Industrial oxygen is not intended to be inhaled like medical oxygen is**, but rather serves a complementary role to create the actions that are carried out in these facilities. Steelmaking, for instance, is one of the largest users of industrial oxygen.

It is therefore very clear that industrial oxygen is not safe to breathe. In fact, purity levels in industrial oxygen are not safe for human use as industrial oxygen could also contain contaminants that are absent in medical oxygen due to the stringent regulations laid down by the Foods and Drug Association (FDA) for storage tanks and other components involved in the entire process. However, industrial oxygen can be made usable after adopting special processes as mandated by the authorities holding jurisdiction.

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Our endeavour will be to regularly update you on latest developments related to this pandemic!!

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- Rendition of career guidance and financial assistance to students of the said sciences.
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