

## COVID-19: TU Wien designs simple oxygen device

**It consists of only a few simple parts and could be ready for use in a short time: A new type of oxygen device is designed to help COVID-19 patients breathe.**

One of the biggest concerns currently related to the COVID 19 epidemic: intensive care units have a limited number of ventilators. At TU Wien, an oxygen device was therefore developed that is based on simple, approved and tested components and could be assembled in a few days. The air that comes from a commercially available compressor is enriched with oxygen using a special membrane. This oxygen-rich air can then help patients with severely affected lungs to breathe.

Such therapy, which can be started at an early stage of inpatient care, could delay or completely avoid intubation and ventilation with a conventional ventilator. This method could help to save valuable resources, especially if many patients with breathing difficulties have to be cared for at the same time. Depending on the compressor and membrane separation capacity used, a single device could supply 20 people or more at the same time.

### **More oxygen, higher pressure**

The design for the novel oxygen device comes from Prof. Margit Gföhler, head of the Research Unit for Biomechanics and Rehabilitation Engineering (Institute of Engineering Design and Product Development, TU Wien) and Prof. Michael Harasek, who has been at the Institute of Chemical, Environmental and Bioscience Engineering for many years, deals with membrane technology. They received medical advice from the specialist for respiratory medicine Dr. Alexander Aloy (intensive care physician and lecturer at TU Wien).

When the lungs can no longer supply the body with enough oxygen, support is needed. There are different possibilities. In extreme cases, there is need for intubation and use of a ventilator. In many cases, however, it is sufficient to support the lung function by providing the patient with a sufficiently strong air flow with a high oxygen content. This is exactly what can be achieved with a relatively simple concept.

"Most of the components of our device can be found in a normal hardware store," says Margit Gföhler. You need an oil-free compressor, an air filter, the piping and a container to humidify the air - and a module with a special membrane to increase the oxygen content. "This membrane is the only component that is not so common - but these membranes are also not unusual in industry today, they are commercially available in sufficient quantities," Michael Harasek is convinced.

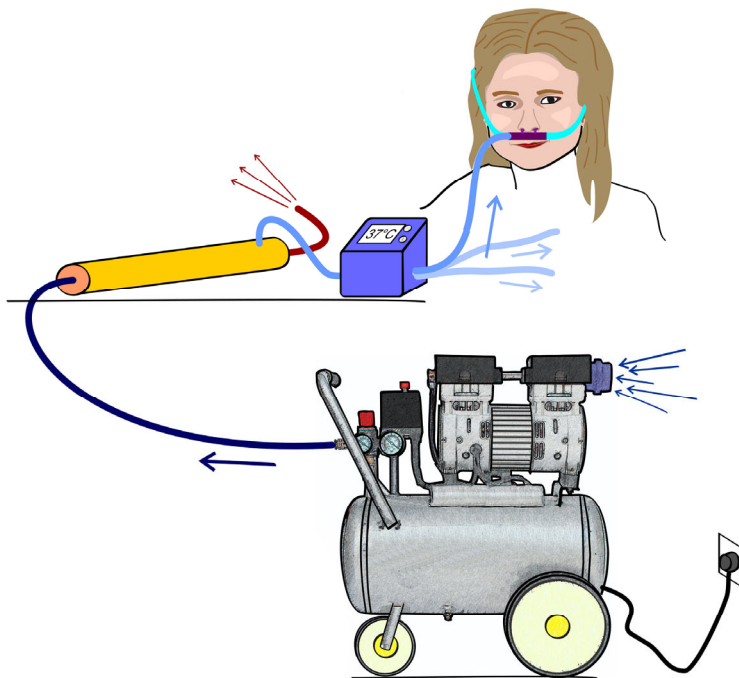
### **Membrane technology: separating oxygen from nitrogen**

Harasek has been working on membrane technologies for separating gases for a long time: "Normally, air is passed through such a membrane in order to obtain nitrogen and separate the oxygen. This is a technique that has been known for a long time. We just have to reverse this principle here: We do not use nitrogen, but rather the enriched oxygen." In this way, an oxygen concentration of approx. 40 % is achieved. The oxygen flow can be set variably for the patient at up to 60 L / min. However, excessive oxygen flow due to possible aerosol formation should be avoided. Target SpO<sub>2</sub> should be (according to a recommendation of the Robert Koch Institute from March 2010) > 90 % in adults and 92-95 % in pregnant women (WHO guidelines). The air is then thermostated and humidified and passed into the patient's nose with increased pressure via two silicone tubes or a breathing mask. A single compressor can supply oxygen-enriched breathing air for several COVID-19 persons that require oxygen enriched air treatment.

A key advantage of the device is that it does not need oxygen bottles - the oxygen simply comes from the ambient air. "This is important because it is very difficult for hospital staff to always keep an eye on which oxygen bottles need to be replaced. And supplying a sufficient number of oxygen bottles can also be difficult," says Michael Harasek.

"We are already talking to companies that are interested in this technology," says Margit Gföhler. "From our point of view, it is technically possible to put such devices into operation in a short time if it should be necessary and the technologies currently available in hospitals are no longer sufficient."

The device is new, but the effect it does is a medically recognized measure: "We know that adding oxygen-enriched air can be very helpful for COVID-19 patients with breathing problems," says Univ.Doz . Dr. Alexander Aloy.



#### Literature:

1. Physiotherapy Management for COVID-19 in the Acute Hospital Setting: Recommendations to guide clinical practice Version1.0 23 March 2020
2. Hinweise zu Erkennung, Diagnostik und Therapie von Patienten mit COVID-19“ Stand März 2020 Robert Koch-Institut: unter „Allgemeine Maßnahmen bei stationärer Versorgung“ als Empfehlung: „Sauerstoff-Gabe (nasal, Maske, ggf. High-flow)“.
3. Consensus statement: Save Airway Society principles of airway management and tracheal intubation specific to the COVID-19 adult patient group. The Medical Journal of Australia - Preprint only;17 March 2020; David J Brewster et al.

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