Chronic obstructive pulmonary disease (COPD) is a leading cause of death in the U.S. and the world. COPD counts for 43% of chronic diseases in Nepal. Lack of healthcare infrastructure and governmental funding, as well as pollution and low air quality, contribute to the problem. COPD is caused by smoking, which leads to hypoxemia: low blood oxygen level. Inadequate oxygen delivery to the tissues damages them, leading to tissue death and severe cerebral and organ damage.

Oxygen concentrators are commonly used to treat COPD. However, they are expensive ($2000+ for single patient) and impractical for patients living in low-resource countries and regions. In Nepal, oxygen concentrators are not practical due to difficulties in transportation, lack of clean energy for household use, and unstable electric power. In the U.S., they are not adequate for patients in assisted living facilities.

The need for a portable, affordable oxygen concentrator that can be used in low-resource countries is clear. The design overview includes a concentrator that packs zeolites and uses pressure swing adsorption (PSA) to concentrate oxygen from air. The adsorption process uses zeolites to trap nitrogen, leaving pure oxygen. The system is designed to be portable and affordable, with a focus on low-resource regions.

The experiment section includes testing of different zeolite adsorbents and optimization of the system. Results show that zeolite 13X and zeolite 5A are commonly used, and the device can achieve maximum purity of 24.4% at 20 psi and 50 L/min. The device also has the potential to reduce weight and improve storage capacity.

Future work includes optimizing the system for different flow rates and exploring zeolite alternatives. The design is intended to be modular, allowing for customization to meet the needs of different patient populations. The device is designed to be used in low-resource regions, and has the potential to save lives by providing affordable oxygen therapy.

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References:


