PORTABLE CATHODE-AIR VAPOR-FEED ELECTROCHEMICAL MEDICAL OXYGEN CONCENTRATOR

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Future space exploration missions present significant new challenges to crew health care capabilities, particularly in the efficient utilization of on-board oxygen resources. The International Space Station and future exploration vehicles require a light weight, compact, portable oxygen concentrator technology (OCT) that can provide medical grade oxygen from ambient cabin air. Current OCTs are heavy, bulky, have a narrow operating temperature range (ambient to 40 °C), and require 15 to 30 minutes start-up time to reach their full operating capacity. Lynntech has developed an electrochemical OCT that solves these issues by operating the OCT with a cathode-air vapor feed, unlike conventional electrochemical OCTs which require a liquid water feed. This is possible due to the use of in-house developed proprietary nanocomposite proton exchange membrane and catalyst technologies. Cathode-air vapor feed operation eliminates the need for a bulky on-board water supply, significantly reduces the complexity of the balance-of-plant, and greatly increases the system efficiency. The electrochemical OCT is anticipated to be significantly reduced in size and weight compared to conventional OCTs (including pressure swing adsorption systems), is capable of instant start-up, has a wide operating temperature range and delivers 4 SLPM of humidified oxygen at 60% concentration.

Potential NASA applications for this electrochemical oxygen concentrator are high pressure oxygen concentrators (up to 3,600 psi), high pressure oxygen compressors (up to 3,600 psi), and oxygen breathing apparatus for oxygen supply prior to space walk (using a liquid-anode-feed configuration).

Lynntech’s electrochemical OC unit can be used at places where the wall outlets are the primary source of energy for continuous operation. For short operating periods, such as battlefield hospitals, medical surgeons in the field will definitely find this system attractive due to its ultra lightweight and instantaneous start-up properties. Some of the most relevant applications include home therapy patients that require supplemental oxygen as a primary treatment for chronic obstructive pulmonary disease (COPD), as well as other respiratory conditions such as asthma, chronic bronchitis, congestive heart disease, emphysema, and lung cancer. In addition to home therapy patients, small medical clinics, field hospitals, and large hospitals that utilize oxygen for numerous medical treatments are also potential commercial applications for this technology. In addition, micro-oxygen concentrator units based on this technology can be used in wound treatment. Because it is based on an electrochemical cell with no need for a bulky compression system, this technology scales down for applications requiring small volumes of oxygen much better than a PSA system. Finally, the oxygen concentrator unit can also be used as an inverting system in military and commercial land and air applications for fuel tank fire suppression.