The Implementation of a Pressure-Regulated System to Increase the Efficiency of the OxyCART System

Srinivasan, Anirudh (School: duPont Manual High School)

A pressure-regulated system was developed for the OxyCART oxygen concentrator that utilizes a pressure swing adsorption mechanism, which provides an efficient and cost-effective solution for oxygen deprived patients in developing countries. Unlike medical-grade ventilators or commercial oxygen concentrators, which can cost up to $50,000 or $4,000 respectively and may malfunction in harsh conditions, this system costs approximately $400 and is designed to operate efficiently in challenging environments like, high altitudes and low pressures. The OxyCART system separates oxygen from ambient air using Zeolite LiX and stores in a tank before passing it through a HEPA air-filter prior to administering to patients. Two pressure transducers and two Arduino microcontrollers were attached downstream of the zeolite columns to measure pressurized air and the pressure values were displayed. Experiments were conducted to determine the optimal production and flush delay values at five different flow rates and the pressures in both columns were recorded. Oxygen concentration increased with the increase in production/flush delay then plateaued off at higher production/flush delay values indicating an optimal production/flush delay value at each flow rate. A linear relationship was observed between pressure and total time at each flow rate, indicating the pressure was only influenced by time hence internal pressure of the columns remain constant. Regression equations were obtained between the total time, timing ratio and flow rate which will provide a truly individualized experience for each patient. Additionally, a user interface was developed that connects to the Arduino and allows users to input either the flow rate or the production and flush delay values, pertaining to their needs.

Awards Won:

Central Intelligence Agency: First Award: $1000 award

Fourth Award of $500