The Production of Industrial-Grade Oxygen from Air by Pressure Swing Adsorption

ABSTRACT

Oxygen, an odorless and colorless gas constituent of the atmosphere, is a vital gas component for the Earth, as it makes up 21% of the composition of the air we breathe. Apart from the importance of oxygen for human breathing, its highly pure form is demanding for industrial applications. As such, several technologies have been established to increase the oxygen purity from 21% to somewhat higher than 95%. One of the competitive technologies for producing this high-purity oxygen from the air is through pressure swing adsorption (PSA), which has the advantages of low cost and energy while being highly efcient. Also, PSA is a simple and fexible system due to its ability to start up and shut down more rapidly since its operation occurs at ambient temperature, which is enabled through the use of adsorbents to bind and separate the air molecules. Te enhancement of the PSA's performances was reported through the modifcation of PSA step cycles and material (zeolite) tailoring. A simplifed complete set of a mathematical model is included for modelling the PSA system, aiming to ease the experimental burden of the process design and optimization of an infnite modifcation of PSA step cycles. Finally, some technological importance of oxygen production via PSA, particularly for onboard oxygen generation system and oxy-enriched incineration of municipal solid waste, was discussed. Continuous development of PSA will make signifcant contributions to a wide range of chemical industries in the near future, be it for oxygen production or other gas separation applications.