

Integrated membrane/PSA systems for hydrogen recovery from gas mixtures

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ABSTRACT

This paper is focused on the recovery of hydrogen from multicomponent gas mixtures by integrated membrane/PSA system. The paper presents the following results: computational estimation of the five-component mixture ($H_2/CO/CO_2/N_2/H_2S$) separation by means of membrane modules; estimation of the integrated membrane/PSA system efficiency; experimental results of gas mixtures separation by integrated membrane/PSA system with commercially available membranes (GENERON hollow fiber membrane module and PVTMS flat sheet membrane module). The influence of a purge to feed ratio, pressure, half cycle time and feed composition on the PSA performance was studied. The H_2S , CO and H_2O permeability through the membranes was estimated by means of the correlation analysis. It was shown that in some cases H_2 recovery degree can achieve 90–97% for bio-synthesis gas and petrochemical gas if H_2 concentration was equal 70% after pre-concentration at the membrane stage. The experiments were carried out using model gas mixtures (O_2/N_2 and $He/CO_2/O_2$ which imitate $H_2/CO_2/CO$ mixture). Obtained results could be considerably improved by application of new membrane materials and new adsorbents.

Keywords: Permeability; Hydrogen recovery; Separation of multicomponent gas mixtures; Integrated processes

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