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Steady-state and Transient Transport Studies of Gas Permeation Through Dense Membranes Using On-line Mass Spectrometry

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Abstract

Polydimethylsiloxane PDMS, polyethylene PE (the most used polymer in food packaging) and pectin (biopolymer potentially used as wound dressing material and in food packaging) were characterised in terms of their gas transport properties. This characterisation was performed by on-line mass-spectrometry, MS, with the upstream and downstream compartments of the membrane unit at atmospheric pressure, in order to mimic the operating conditions of the applications addressed. A simple, direct restriction was used for allowing the downstream gas mixture to reach the mass spectrometer detector. Monitoring of gas permeation by on-line mass spectrometry proved to be a highly precise and reproducible technique, which makes possible the study of multicomponent gas mixtures in dry and humidified gas conditions, without requiring sampling and additional off-line procedures and analysis. Data acquisition, with time intervals as short as one second, makes possible the comparative study of permeation processes of each gas present in different feed streams (pure gases, gas mixtures under dry and humidified conditions) during the initial transient period, allowing for inferring about solute-membrane interactions. Information about steady-state transport may also be acquired, and are in agreement with values reported in literature.

Keywords (5 words): Transient transport; pure and mixed gas permeation; Mass spectrometry; On-line monitoring; Dense membranes

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