**Membrane Flux of Representative Volatile Organic Compounds in Polydimethylsiloxane Membrane at Various Experimental Conditions**

Lenka Moravkova, Karolina Machanova, Petr Stanovsky, Zuzana Petrusova

*Institute of Chemical Process Fundamentals of the Czech Academy of Sciences, Rozvojova 135, 165 02, Prague 6, Czech Republic*

*\*Corresponding author: petrusova@icpf.cas.cz*

**Highlights**

* PDMS was chosen as representative membrane for VOC removal from polluted air
* Permeability of representative VOCs were studied in PDMS membrane
* Linear alkane (hexane) was found to be the most permeable in PDMS membrane
* Membrane flux was studied at various experimental conditions

**1. Introduction**

Gas separation technology is a mature topic, while the vapor permeation (VP) process still needs some development. It can be presumed that VP will become extensively applied in the future, thanks to its economic and ecological advantages. VP can be successfully applied for example for removal of volatile organic compounds (VOCs) from polluted air (Figure 1) [1].



**Figure 1.** Scheme of VOC separation from polluted air.

**2. Permeation experiments**

Dense polydimethylsiloxane (Elastosil PDMS, Silicones and more) membrane was prepared by casting-knife method. The membrane thickness was 100 microns. The feed stream contained either pure nitrogen or nitrogen saturated by representative VOC (hexane, isooctane, and ethanol). Permeation experiments were carried out at temperature (25–35) °C and at feed pressure (100–250) kPa while the permeate pressure was always kept at 50 kPa. The basic test apparatus was described previously in a detail [2].

**3. Results and discussion**

The influence of long-term exposure of representative VOCs was studied at various experimental conditions. The membrane flux was studied for representative VOC to simulate purification of polluted air by organic vapors (Figure 2A). The highest flux showed the representative linear hydrocarbon (hexane) while the branched hydrocarbon (isooctane) showed significantly lower flux that was less depended on VOC feed concentration. The lowest membrane flux was observed for chosen alcohol (ethanol). The flux of isooctane and ethanol depended similarly on VOCs feed concentration.

The membrane flux always increased with the VOC feed concentration as expected for PDMS membrane. The influence of temperature and trans-membrane pressure was studied for all representative VOCs (see temperature influence for the most permeable hexane in Figure 2B).

|  |  |
| --- | --- |
| A | B |
|  |  |

**Figure 2.** A) Comparison of molar flux of VOC + nitrogen in PDMS membrane as the function of VOC feed concentration at 25 °C and trans-membrane pressure of 150/50 kPa (ethanol – squares, isooctane – triangles, hexane – circles),
B) Influence of temperature on hexane + nitrogen flux in PDMS membrane at the trans-membrane pressure of 150/50 kPa (25 °C – circles, 30 °C – triangles, 35 °C – squares).

**4. Conclusions**

It was found that prepared PDMS membrane is suitable for long-term separation of various volatile organic compounds from polluted air. The influence of input parameters (such as VOC feed concentration, temperature and pressure) has been discussed. Interestingly, the membrane increased with VOC feed concentration while the decrease was observed for a thicker PDMS film.

**Acknowledgement**

The financial support of the Czech Science Foundation (Junior Project 17-03367Y) is acknowledged.

**References**

1. Z. Petrusova, K. Machanova, P. Stanovsky, P. Izak, Sep. Purif. Technol. 217 (2019) 95–107.
2. Z. Petrusová, Z. Vajglová, L. Morávková, J. C. Jansen, J. Vejrazka, P. Izak, Chem. Biochem. Eng. Q. 31(2) (2017) 145–160.