הטכניון - מכון טכנולוגי לישראל

TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY

הפקולטה להנדסה כימית
ע"ש וולפסון
The Wolfson Department of Chemical Engineering

Wolfson Department of Chemical Engineering Special Seminar

Lecture Hall 6, Wolfson Department of Chemical Engineering,

16, November, 2016 at 13:30

Dr. Zuzana Sedláková

Institute of Chemical Process Fundamentals of the Czech Academy of Sciences

Interesting results of gas and vapour permeability with polymeric membranes

Among all possible alternatives, membrane separations offer a lot of advantages such as energy saving, environmental friendliness, easy handling, continuous process, and small foot prints. Two unique permeation apparatus were developed at the Institute of Chemical Process Fundamentals. The first one is for study of gas permeation. The apparatus is used for the separation of a raw biogas or a model mixture representing a biogas. The motivation of the study is the depleting energy sources. The biogas generally contains water vapour, 50–65 vol.% of CH_4, 30–40 vol.% of CO_2, traces of hydrogen sulphide, oxygen, nitrogen, ammonia, siloxanes and volatile organic compounds. The removal of CO_2 and other impurities is required because of the heating value of biogas is proportional to the CH_4 concentration. Promising and studied membrane materials were water-swollen polyamide membranes, ionic liquid membranes and microporous PIM membranes.

The second home-made apparatus is for study of vapour permeation. The emissions of volatile organic compounds (VOCs) causes not only air pollution but also enormous economical losses. Therefore, the separation methods are desired. The development of the apparatus will be described as well as the data evaluation. Firstly, ethanol was chosen as the representative coumpound. The aim was the comparison of ethanol vapour permeation in two different kind of membranes. The first one was widely commercially produced low density polyethylene (LDPE). The second one was the ionic liquid membrane. The gel membrane was based on poly(vinylidene fluoride-co-hexafluoropropylene), which contained 80 wt.% of the ionic liquid 1-ethyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imide [emim][Tf_2N]. This new kind of ionic liquid membrane was found to be highly permeable for organic vapours while organic vapours permeation was immeasurably low in the neat polymer. Ethanol flux in ionic liquid membrane was two order of magnitude higher than that of LDPE. Secondly, hexane was selected as a representative compound of gasoline vapours. Hexane permeation was studied in two kind of membranes, namely LDPE and thin-film-composite membrane. The unpublished data of these fundamentally different membranes were chosen to demonstrate the potential and sensitivity of the permeation apparatus.

This research was supported by the Ministry of Education, Youth and Sports of the Czech Republic (project No. LD14094).