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Organic vapour sorption and permeation in polymer gel membrane containing imidazolium based ionic liquid

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The volatile organic compound (VOC) emissions mean an air pollution as well as energy and economic losses [1,2,3]. In order to capture the VOC substances, several conventional methods such as absorption, adsorption, condensation, etc. [4] might be used. On the contrary, relatively new membrane technologies based on vapour permeation have attracted attention as an alternative with the potential advantages of low operating cost, simple and compact equipment, easy operation requiring no regeneration steps, and energy efficiency [2,4,5]. Recently, membranes based on an ionic liquid have been focused as a new kind of membranes because of ionic liquids negligible volatility and their possibility to improve the transport properties [6,7].

In this work, vapour sorption and transport properties were studied for the aliphatic hydrocarbon (hexane), branched hydrocarbon (isooctane), and alcohol (ethanol) using a gravimetric sorption apparatus [8,9] and a “home-made” laboratory-scale apparatus [10], respectively. The ionic liquid polymer gel membrane based on poly(vinylidene fluoride-co-hexafluoropropylene) (abbreviated p(VDF-HFP)) was prepared by solvent casting from a solution in acetone [11]. The used membrane contains 80 wt. % of the imidazolium based ionic liquid 1-ethyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imide ([emim][Tf₂N]).

Both vapour sorption and permeation were negligible in the virgin p(VDF-HFP) whereas the sorption and transport properties were improved by the presence of the ionic liquid [emim][Tf₂N] in the membrane. The vapour sorption and permeation of n-hexane and isooctane are significantly lower than that of ethanol. The potential applicability of the ionic liquid contains membrane for organic vapour removal from air is confirmed by its organophilic character.

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