^{13}C Solution NMR Study of Polyurethane/Ag+ Membranes

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Abstract: *Polyurethane/Ag^+ membranes have currently been used, as they belong to a series of membrane compounds with facilitated transport. Such a feature is normally used to improve the efficiency of gas separation when a gas mixture passes through the membrane. In the present work we have prepared these membranes according to the methodology described in the literature. The main purpose of this work is to obtain information of the polymer/salt interaction in the prepared membranes. The ^{13}C NMR spectrum of PU/Ag^+ membrane showed changes in the chemical shifts due to the splitting pattern of the aromatic region, when compared to that of PU. This fact may indicate that interaction processes could be taking part in this region, differently from what occurs in the region of the carbonyl group of the urethane link.*

Polyurethane(PU)/Ag^+ membranes have currently been used as they belong to a series of membrane compounds with facilitated transport (Figure 1). Such a feature is normally used to improve the efficiency of gas separation when a gas mixture passes through the membrane.

The usual methodology to prepare these membranes is via solution using N-methyl pyrrolidone (NMP), and after solubilization, the membrane films are dried at room temperature in a nitrogen atmosphere.[1,2]

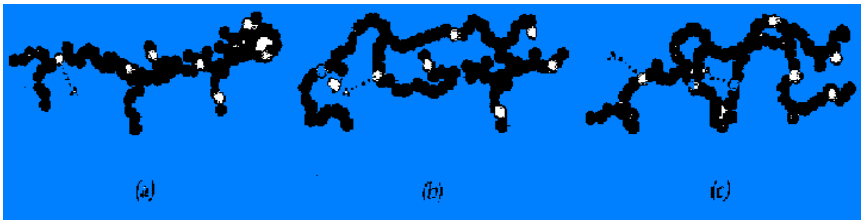

Figure 1. Illustration of membranes facilitated transport

In the present work, we have prepared these membranes according to the methodology described in the literature. The main purpose is to obtain information of polymer/salt interaction in the prepared membranes.The membrane films were prepared using 20 and 40% of Ag^+ salts in NMP PU solution. These solutions were mixed at room temperature using a rotating spinner. After that, these solutions were put onto plates and kept at 40°C for one week in an oven, in a nitrogen atmosphere, to be dried after solvent

elimination. Subsequently, we kept those membrane samples in a desiccator at room temperature under vacuum. NMR analyses were carried out on a VARIAN MERCURY 300, operating at 75.4 MHz for ^{13}C. The membrane films were prepared in tetrachloroethylene-d_4 (TCE), and the spectra were obtained at ambient temperature, using standard acquisition conditions.

The ^{13}C NMR spectrum of PU/Ag^+ membrane (Figure 2) shows changes in the chemical shift due to the splitting pattern of the aromatic region, as compared to PU spectrum.

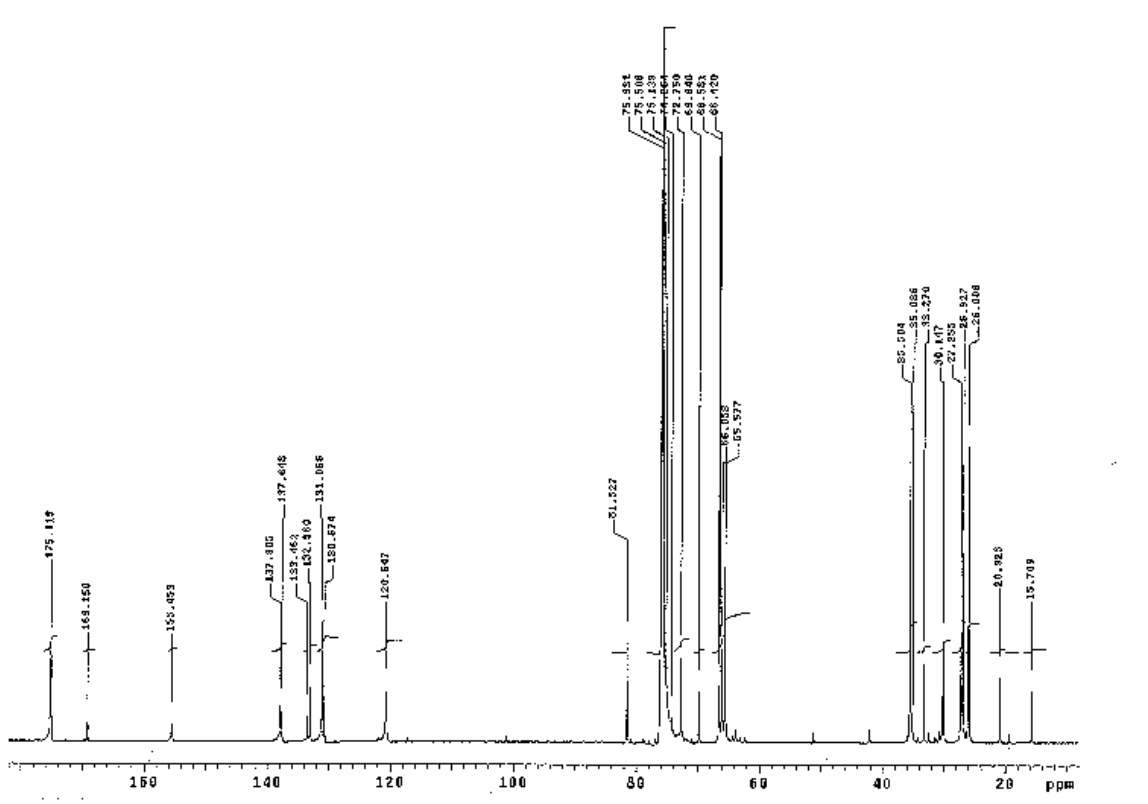

Figure 2. ^{13}C NMR solution spectrum of PU/Ag^+ membrane.

This fact suggests that interaction processes may be taking part in this region, differently from what occurs in the region of the carbonyl group of the urethane link.The NMR results obtained for these membranes indicate that the interaction process between Pu and Ag^+ is not strong. Thus, polymer/salt interaction process is probably a means whereby the efficiency of gas separation for a membrane with facilitated transport may be assessed.

Acknowledgements

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References

1. W.J. Koros, G.K. Fleming, *Journal of Membrane Science* **83** (1993) 1.
2. A.A. Khan, S.S. Sridhar, *Journal of Membrane Science* **147** (1998) 131.