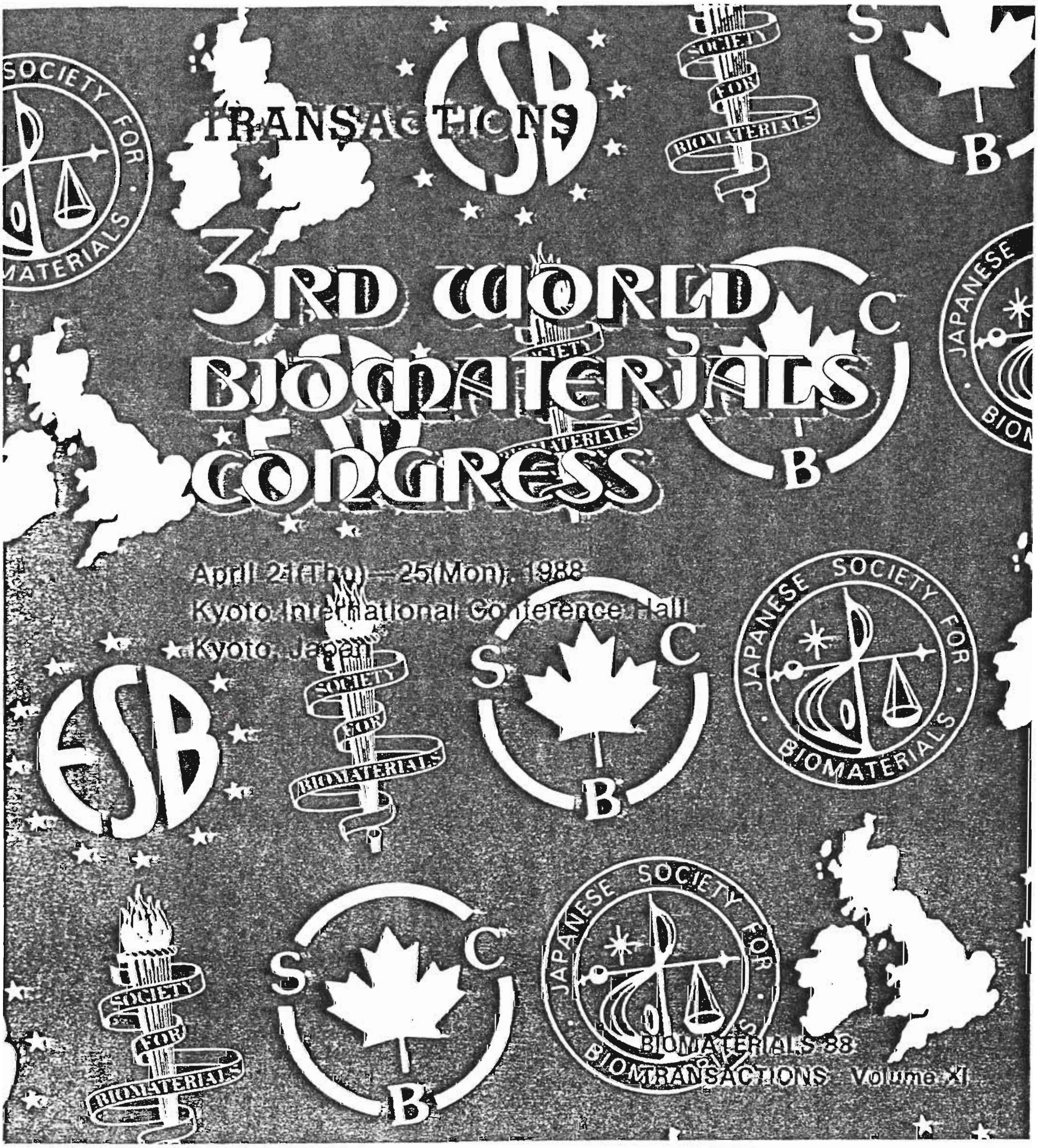

IN CONJUNCTION WITH

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3C1-13 Composite Polymeric Membranes for Hemodialysis Applications.

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Since the first application of an external device for the blood purification in diabetic patients made by Kolff in 1943 using a Cellophane® membrane, several different polymeric materials have been utilized. Although the considerable efforts made in the direction of solving the problem of a correct blood purification, the ideal material for membranes fabrication is still not available. This is certainly due to the many different characteristics that the material should possess, namely: good mechanical properties; good clearance capacity, expecially for medium molecules; sufficient hemocompatibility in order to avoid anticoagulant treatment, etc..

Recently polymethymetacrylate (PMMA), due to its characteristics of good hemocompatibility and its extremely versatility, has been introduced by biomedical industries as biomaterial for manufacturing devices to be used in dialysis procedure. In fact PMMA can be made in a variety of forms under a variety of conditions; but a disadvantage of this material is its high brittleness which makes difficult its use in membrane dialyzers production. The machining of extruded membranes requires a care process, since their mechanical properties are very poor, fracture is easy to occur.

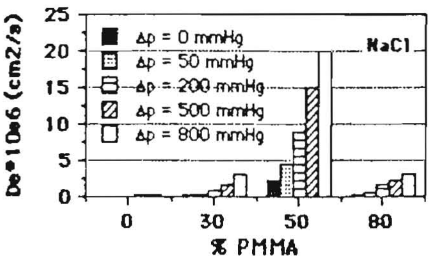

Fig.1a. De* values vs. % PMMA at ≠ Δp, for NaCl.

Therefore, PMMA is preferentially shaped in hollow fibers form to use in hollow fibers dialyzers production. With the aim to enlarge its application, improving efficiency and hemocompatibility, our approach is based on the idea to produce composite membranes blending PMMA and segmented polyurethanes (PU).

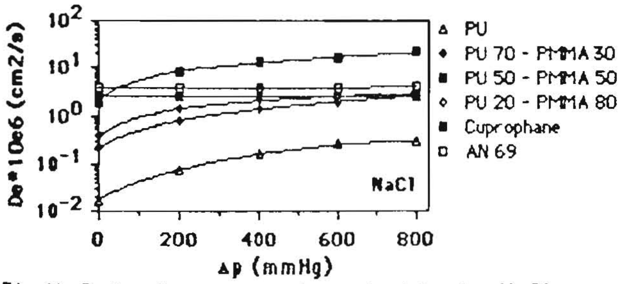

Fig.1b. De* values vs. Δp of ≠ materials, for NaCl.

As working materials for our membranes fabrication we used PMMA sheets (Perspex®) and a 16% solution of PU in 2:1 THF/1,4 Dioxane (Cardiothane 51®, Kontron Inc., Everett, Ma, U.S.). The fabrication of porous membranes with different porosity requirements was performed modifying a combined spraying and phase inversion technique previously used for microporous small diameter vascular prostheses production (1). The preparative procedure and the mechanical characterization has been described elsewhere (2). The membranes transport properties were evaluated for three different mixtures of PMMA and PU: 30/70, 50/50, 80/20, with a dialysis apparatus previously described (2). We used water as solvent and NaCl and Vitamine B12 as solute.

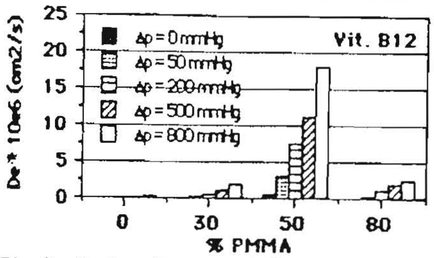

Fig.2a. De* values vs. % PMMA at ≠ Δp, for Vit. B12.

From Fig. 1a-b and 2a-b it appares how is possible to modulate in a wide range, by varying the % composition of our membranes, the apparent effective diffusivity value [De* (cm2/s) (3-4)], above and below the value of Cuprophane® and AN 69. In addition, such new membranes can be easely formulate in order to present higher permeability to small solutes and middle molecules in comparison with the commercial ones, particularly in convective diffusion. Especially for the PMMA 50-PU 50 mixture, the hydraulic permeability resulted about one order of magnitude higher than PAN. In conclusion, our preliminary results show an improvement in molecular sieving capacity with respect to PMMA. The high hydraulic permeability characteristics make these membranes potentially utilizable also for hemofiltration.

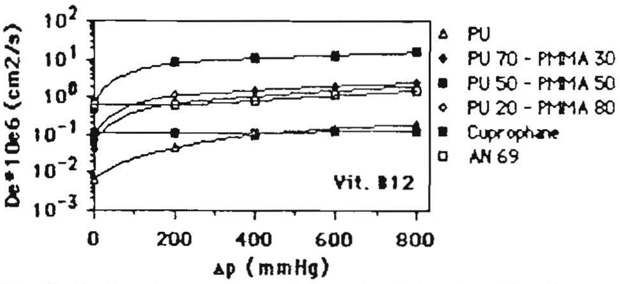

Fig.2b. De* values vs. Δp of ≠ materials, for Vit. B12.

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