Transport properties of thermo-responsive ion track membranes

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The permeation of orange G (MW 452), methylene blue (MW 319), and bovine albumin (MW 68000), through thermoresponsive ion track membranes was studied. For this purpose, poly-*N*-isopropylacrylamide (poly-NIPAAm) hydro-gel was chemically grafted onto single/multi-pore ion track membranes of poly(ethylene terephthalate) (PET).
The *local transport properties* were studied by measuring the electrical current through single pore membranes. It was found that the incorporation of the hydro-gel into the pores does not influence the phase transition temperature. The switching of the responsive membrane was reversible over 200 switching cycles applied during 30–50 days. The closed pores represent a physical barrier excluding organic molecules larger than 2 ± 0.2 nm. This fact is based on the size exclusion method using mixtures of polyethylene glycol (PEG) of various molecular weights and 0.1 N potassium chloride.
The *global transport properties* were studied using multi-pore membranes with 5×10^5 to 5×10^7 Pores per cm^2 and pore diameters between 0.6 and 4.5 μm. For bovin insulin permeation in the open state was 35 times above the level of the closed state corresponding to the detection limit of the used permeation cell. In the open state the transport rates of the solvent and the solute were identical implying that the free space in the open pores was larger than the size of the permeating bovine albumin molecules (about 7.3 nm). The linear relation between pressure and mass current enabled to determine an effective open-pore diameter between 0.2 and 1 μm. In the open state, the membrane this is not molecular selective.