MEMBRANES BASED ON "SMART" POLYMERS

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Abstract

To develop polymeric membranes having ionic selective properties under control of external stimuli is a challenge of the membrane and material scientific community. Intrinsically conducting polymers swell and shrink under electrochemical control, so they are good candidates to prepare such smart membranes. Other types of polymers are hydrogels responsive to stimuli like pH, ion concentration or temperature. However, electrochemical and mechanical stability of these types of materials have to be improved to develop membranes with real applications in industrial or medical fields.

In this work, the literature about "smart" polymers is revised looking for some possible applications of these materials to membrane processes. Two types of strategies for making synthetic membranes have been selected: the formation of free-standing dense films of responsive polymers, and the loading of an inert porous support with colloidal or nano-particles of the responsive polymer. Different smart polymers and supports have been used in order to study and compare its real possibilities as ion exchange membranes in aqueous solutions.

As an example of the first route, the ionic transport through a polypyrrole free-standing film is investigated. The second approach is realized by means of a polymeric porous membrane loaded with 2-vinylpyridine hydrogels. Whereas the membrane ionic conductivity and diffusion coefficients are controlled via an external electric potential in the former case, the latter is expected to be dependent on pH. Usual membrane experiments, such as salt diffusion and membrane potential measurements, are performed for electrolytes containing different ions and concentrations in both types of membranes.