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POROUS HYDROPHILIC NANOMEMBRANES

The present invention relates to the generation and use of self-standing giant porous hydrophilic nanomembranes (PHNM). Currently available nanomembranes are mainly hydrophobic, which greatly limits their application in biotechnology and life sciences. In contrast, the PHNM is made from hydrophilic polymers and is therefore ideally suited for use in aqueous media.

POROUS HYDROPHILIC NANOMEMBRANES

Membranes are widely applied in many industrial areas. However, due to the thickness of the membranes the transport of biomolecules across a membrane is impeded by the relatively long transport times. Nanomembranes, in contrast, provide ultra-fast diffusion times and speed up the transfer of biomolecules significantly. Difficulties in production, the fragility, and hydrophobicity of current nanomembranes prevented their widespread use. However, the key characteristics of nanomembranes are very attractive for a broad variety of applications in e.g. biomedical applications, bioseparation technologies, biosensors, and membrane bioreactors.

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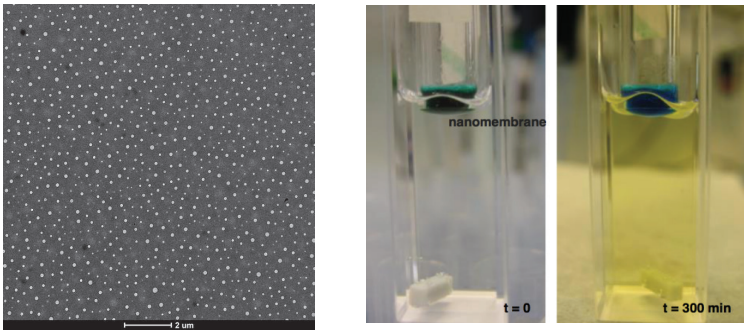
The PHNM can be easily made from hydrophilic polymers. It is insoluble in water and is therefore ideally suited for use in aqueous media, which are typical for biological systems. The PHNMs are exceptionally resistant, being able to withstand forces equivalent to more than tens of thousands times their own weight in water. They are suitable for application in a wide pH range and in the presence of a broad variety of electrolytes. The PHNM surface is planar with a thickness between 50-150 nm with entirely uniform pores and a tensile strength of at least 0.1 MPa. Pore diameters can be adjusted according to the intended application from 10 nm to 500 nm. Currently PHNM can be produced on large scale from 1 to 250 cm^2. It can additionally comprise bioactive substances (either embedded or on the surface), such as enzymes, substrate receptors, active drugs, etc. The use of PHNM allows for ultra-high speed diffusion of biomolecules, as well as selective transport of compounds.



From left to right: Picture of a PHNM taken with a transmission electron microscopy; selective transport is demonstrated by separation of a mixture of methyl red with a molecular mass of 296.30 g/mol and Patent blue V with a molecular mass of 566.66 g/mol (color = green). Only methyl red passes, while Patent blue is retained. The yellow compound can be observed in the bottom.

BENEFITS

- Hydrophilic polymers suited for biological systems
- High degree of porosity
- Ultra-fast diffusion times
- Selective transport of compounds
- Large scale production

KEYWORDS:
- hydrophilic polymers
- porous nanomembranes
- biomedical application
- membrane bioreactors

AVAILABLE FOR:
License agreement
Collaboration
Purchase

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