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Chefredakteur: Peter Gölitz
Boschstraße 12, 69469 Weinheim

Telefax: +49 (0) 6201/606-331
Telefon: +49 (0) 6201/606-315
E-Mail: angewandte@wiley-vch.de
www.angewandte.de
www.angewandte.org

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For Clean Water

Chlorine-tolerant membranes for desalination

One of the most pressing needs of our time is safe, sustainable access to fresh water. The dominant technology for desalination of water is membrane-based desalination, an energy-efficient, environmentally friendly process. Scientists have now developed a new membrane material that, unlike current polyamide membranes, tolerates chlorinated water. A team headed by Ho Bum Park (University of Ulsan, South Korea), Benny D. Freeman (University of Texas at Austin, USA), and James E. McGrath (Virginia Polytechnic Institute, Blacksburg, USA) reported in the journal *Angewandte Chemie* on a membrane that is made of sulfonated copolymers.

Chlorine is the most commonly used biocide in water treatment because it is both inexpensive and very effective in small amounts. The disinfection of water headed into membrane-based desalination facilities is crucial to hinder the growth of biofilms, which reduce efficiency. Polyamide membranes do not tolerate chlorine. This means that the water must first be treated with chlorine, and then the chlorine must be removed before the water comes into contact with the membrane. Before being fed into the supply network, the water must be chlorinated again. This is a complex, costly procedure.

Membranes made of polysulfone, a sulfur-containing engineering thermoplastic, are being considered as an alternative. They are highly tolerant to chlorine. However, polysufones are hydrophobic and do not allow enough water to pass through them. By attaching additional charged sulfonic acid groups, the researchers hoped to make the polymer more water friendly without affecting its other valuable properties.

Whereas previous efforts focused on modification of the polysulfone after polymerization, the team now took a different route: the simultaneous polymerization of disulfonated monomers (a building block containing two hydrophilic sulfon-

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ic acid groups) and another type of monomer led to the formation of a copolymer. Undesired side-reactions, cross-linking or breaks in the polymer chains do not occur by this method. Most importantly, it is possible to precisely control how many water-friendly, charged sulfonic acid groups are in the polymer chain. This allows the targeted generation of chlorine-resistant membranes whose permeability for water and salts can be tailored to specific applications (e.g., nanofiltration, reverse osmosis).

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Benny D. Freeman, University of Texas at Austin (USA)
http://www.engr.utexas.edu/che/directories/faculty/freeman.cfm

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