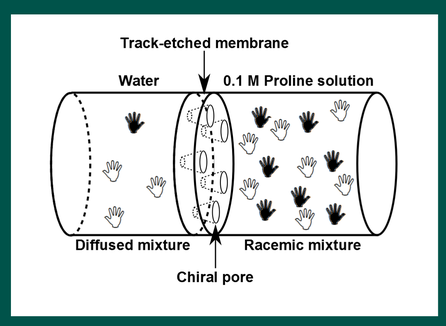
Chiral membranes – chiral modified track-etched pore film as analogs of a chiral column array.



Vitaly Raev[1], Pavel Apel[2], Henning Hopf[1], Ion Neda[1,3]
[1]Institute of Organic Chemistry of the Technical University Carolo-Wilhelmina zu Braunschweig, Hagenring 30, 38106 Braunschweig, Germany;
[2]Joint Institute for Nuclear Research, Joliot-Curie 6, 141980 Dubna, Moscow region, Russia
[3]Institutul National de Cercetare Dezvoltare pentru Electrochimie si Materie Condensata , Strada Plautius Andronescu 1 300569, Timișoara, Romania

Introduction

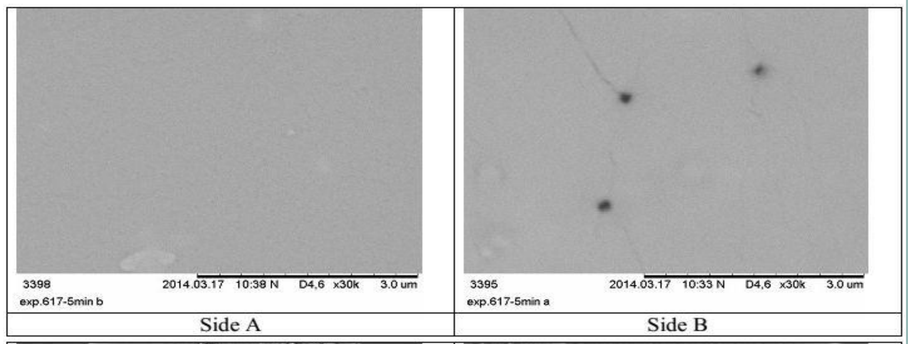
Separation of enantiomers from racemic mixtures is the very important and expensive step in some industrial (mostly – pharmaceutical) processes.
The one of common methods to separate enantiomers is the chiral chromatography. The main problem for the chromatographical separation is the small amount of the mixture which can to be injected into the HPLC column. To change the situation, it is possible to use not the single chiral column, but the column array. In this case bigger amount of the enantiomeric mixture can be used for the separation.
In our work we prepared the "nano-column array" based on track-etched membranes.

Track-etched membrane

The track-etched PET-membrane (thickness 23 μm, pore density of $1.6x10^6$ cm-2, pore diameter ≈30 nm on one side and ≈140 nm on the other side, sample diameter 30 mm) was used in our experiments.

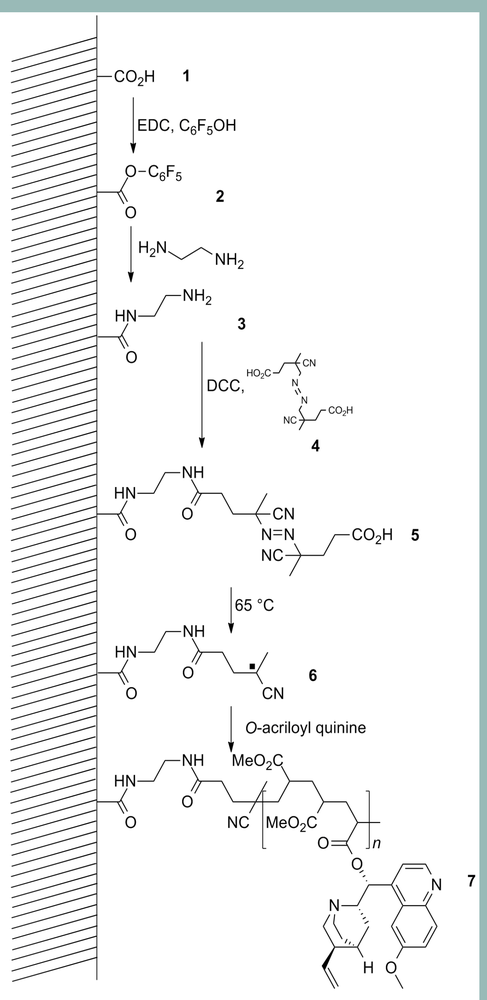
Depending on the polymer type, the walls of track-etched pore can contain carboxylic (PET), phenol hydroxyl (polycarbonate) as well as other functional groups which can be chemically modified.

PET foil. Thickness 23 um.
Pore density $1.6x10^6$ cm^{-2}.
Small pore diameter ~30 nm (side A)
Large pore diameter ~140 nm (side B)



Chiral modification

The inner surface of pores were modified with *O*-acryloyl quinine using a modified known protocol.
The carboxylic groups of the terephthalate moiety **1** were converted into amide **3** through pentafluorophenyl ester **2**. Coupling of this amide with 4,4′-azobis(4-cyanopentanoic acid) **4** as a radical initiator gives an activated surface, which can be covered with chiral polymer brushes by heating up to 65 °C in the presence of *O*-acryloyl quinine. The influence of the length of polymer brushes and its surface density was not investigated.



Diffusion experiments

The diffusion experiments show that the speed of diffusion is different for proline enantiomers. This result offers the possibility to separate/enrich amino acids in industry

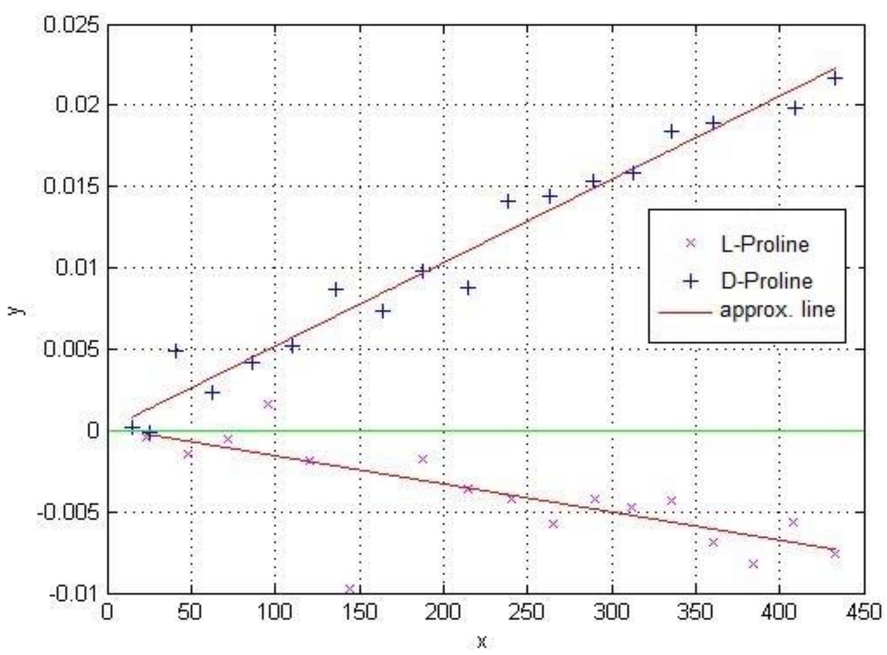


Figure1:
x-axis: time in h;
y-axis: optical rotation of solution in the water chamber, grad.

Conclusion

In our non-optimized experiment with model substrate (proline) and model modifier (quinine) we obtained, that the diffusion speed differs for D- and L-isomers of substrate with factor ≈3. If the single membrane can enrich permeate to enantiomeric ratio 3:1, the system of 5 consequential membranes can provide enantiomeric enrichment up to 99.6% and even more in optimized conditions.

Acknowledgements

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