# Chiral Separation with DNA-Polyion Complex Membranes

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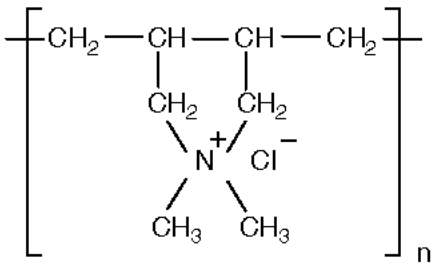
## Introduction

In Hokkaido, Japan, over 1,000 tons of DNA from salmon milt can be produced by a suitable extraction process although they are now being abandoned. DNA molecules carry an important biological information on genetics of living things with its double-stranded structure consisting of complementary nucleic acid base pairs [1]. On the other hand, DNA molecules have a huge molecular weight of over billions so that DNA was reported to be promising polymeric materials to give durable films [2], and they have been studied in connection with optical devices [3-6], electric [7-8] or ion [9-11] conductivity, ion permeation [12], capture of metal ions [13] and endcrine disruptors [13,14], and chiral separation [15]. It is an indispensable research subject to develop potential utilization of natural resources. Among many applications of DNA, the authors focused their attention on separation membranes derived from DNA because membranes will play an important role in environmental and energy related processes [16]. Chiral separation of a pure enantiomer from a given racemic mixtures is one of important membrane separation processes in connection with pharmaceuticals, foods, agricultural chemicals, and so forth. This paper reports the chiral separation of racemic amino acids with the membranes from DNA-polyion complexes.

## Experimental

In the present study, the composition of the base pairs of DNA-Na was not determined. Here 662.0, the average value of the base pairs of DNA-Na, was adopted as an average molecular weighrt of the constitutional repeating unit (base pair). Polyion complex of DNA-Na and polydiallydimethylammonium chloride (PDADMAC) was prepraed as follows: the equiv. mol of DNA-Na and PDADMAC was dissolved in 20 wt. % NaBr aqeuous solution. The mixture was filtered with a regenerated cellulose UF membrane with a nominal molecular weight limit of 1,000 at the operation pressure of 0.2 – 0.3 MPa.



PDADMAC (MW = 40,000)

## Results and discussion

Fig. 1 shows time-transport curves of enantioselective permeation of racemic Tpr's through the DNA-PDADMAC polyion complex membrane. The L-isomer of Trp was permeated in prefrence to the D-isomer through the membrane. Permselectivity toward L-Trp was determined to be 1.26. Other amino acid with aromatic side chain, L-Phe was also selectively transported from racemic Phe's. This might be due to weak interaction between phosphate group and racemic amino acids and coulombic interaction between phosphate group in DNA and amino moiety in racemic amino acids. From this, the L-isomer, which was preferentially incorporated into the membrane, and, as a result, the L-isomer was selectively transported through the membrane. On the other hand, Tyr, which is an amino acid having aromatic side chain with polar non-charge group of hydroxyl group, and Glu and Lys with very polar side group, were hardly chirally separated.

The results obtained through the present study suggest that DNA is one of promising abundant renewable polymers for membrane materials.

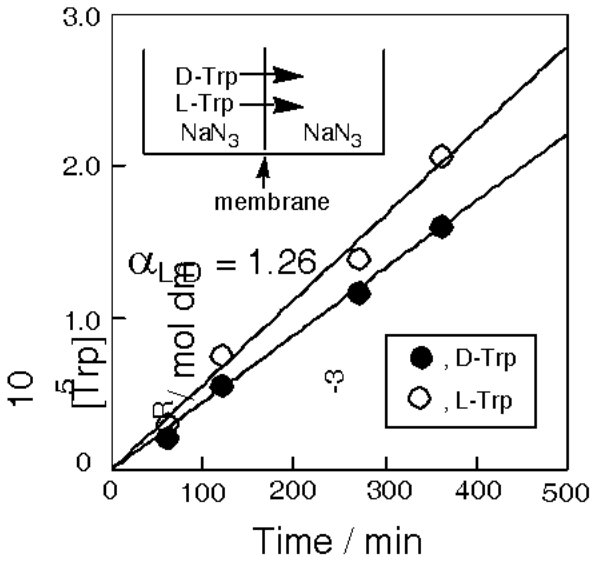



**Figure 1.** Time-transport curves of ravemic Thp's through the DNA-PDADMA polyion complex membrane.

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