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Influence of the molecular structure of polybinaphthalene on the membrane separation performance

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A chiral binaphthalene is bridged at the 2,2'-positions with methylene (CH₂), ethylene (C₂H₄), propylene (C₃H₆) and butylene (C₄H₈) linkers, with the aim to vary the binaphthalene dihedral angle and hence to study the influence of the latter on the polybinaphthalene gas separation membrane performances. It was hypothesized that different angles would induce different membrane performances. The polymer membranes with the four different linkers show average gas selectivities, CO₂/CH₄ = 22 ± 3 and CO₂/N₂ = 28 ± 2, which strongly indicates that these polymers have strongly similar macromolecular structures. This is confirmed by CD spectroscopy which reveals the same Cotton effect patterns. The similarity in the macromolecular structures can be ascribed to a smaller than anticipated change in the dihedral angle introduced by the linkers, 4° of difference between ethylene, propylene and butylene, as demonstrated by DFT calculations.

Keywords: binaphthalene dihedral angle, bridged binaphthalene, polybinaphthalene, polybinaphthalene membrane, gas separation performance

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