

Potential innovations in separation technology by nature-inspired membranes: Beneath and beyond the Earth's crust

Abstract

The understanding of complex bio-mechanisms in nature is explored in this perspective as a way to effectively enable scientific advancements in membrane technology. The mechanisms of nature-inspired technological improvements are first analyzed from macroscale to nanoscale. Separation methods using membranes can be related to natural separation mechanisms such as soil filtration, when the production of groundwater is considered. Innovative nature-inspired mechanisms are presented, which include ideas in developing new methods for membrane synthesis in order to boost the vast range of applications of membrane separation processes. Future innovative applications discussed in this paper include nanoscale surface patterning, self-organization, and the control of these processes. Improvements to existing membranes through the resemblance of natural mechanisms are also aimed towards realizing sustainable and cost-effective systems.

Keywords; Membranes; Filtration; Water; Bioseparation