

Environmental Challenges and nano-technology: the vital role of membranes

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Abstract

There are numerous environmental challenges and their intersection with nano-technology is examined. Today the cutting edge of chemical engineering is probably found within the domain of molecular engineering and the case is made for considering most if not all membranes processes as being in this domain. Three areas will be addressed. Firstly there are those membrane processes where the active layer can be considered to be 2-D in nature such as those formed through interfacial polymerisation. This is an exemplary example of molecular engineering. Secondly why shouldn't we view the formation of nanofiltration and ultrafiltration membranes as examples of the application of molecular engineering? The structures formed are certainly in the range encompassed by 'nano', as commonly understood. These areas are linked to membrane processes that have gained a significant footprint in a number of markets with very significant year-on-year increases.

Thirdly there are those membranes where nano-materials, such as graphene oxide, have been added to the active layer to inhibit biofouling. Now in all designs, a balance needs to be struck between keeping the flux relatively high and inhibiting fouling. There is tension between operating at high permeate fluxes, which enhances fouling but reduces capital costs, and operating at lower fluxes which increases capital costs. Will the advent of nano-materials change the optimal flux? The presentation will also address the question as to whether graphene membranes have been overhyped or not?