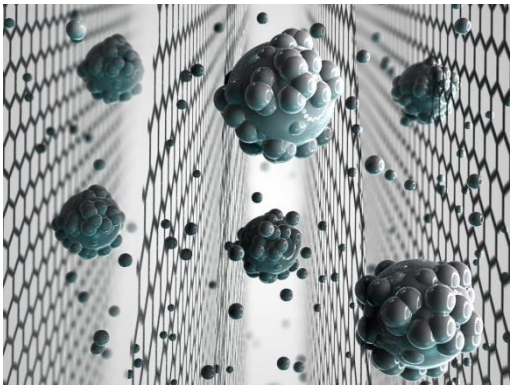
Graphene Oxide Forward Osmosis Membrane

BACKGROUND



Graphene oxide membrane

Desalting brackish water or seawater is often discussed as one solution to the earth's growing need for water in the face of dwindling resources. Cost reductions and technological improvements have fueled the growth of the desalination industry but the quest for lower energy intensive operations continue. Forward osmosis (FO) is hailed as the solution to the energy intensive use of hydraulic and thermal desalination processes. It uses osmotic pressure as the driving force and the technique promises significant energy and cost reductions compared to both membrane and thermal desalination methods. In addition to this energy saving FO offers higher water recoveries and can be considered more environmentally benign due to the reduction in brine discharge. Another advantage of FO is that its ability to cope with highly fouling feed solutions that would challenge traditional membrane filtration technology.

FO refers to a technique that is used to draw water through a semi-permeable membrane using an osmotic gradient and is implemented by the employment of an osmotic pressure gradient across a this tailored membrane. Semi-permeable membranes manufactured from graphene oxide laminates have recently been highlighted as an alternative to traditional membrane materials. These laminates show promise due cheaper, simpler production methods when compared to current commercial membranes.

THE TECHNOLOGY

An academic team at The University of Manchester have produced a graphene oxide FO membrane with a strict pore size. Any species larger than the defined pore size will be unable to permeate the graphene oxide membrane and will be retained. This strict size cut off ensures that the draw solution remains confined and thus the osmotic pressure is consistent. Graphene oxide laminates form a structure that is impermeable to most gases and liquids but will allow the rapid transport of water molecules. When graphene oxide laminates are exposed to water a network of nano-sized capillaries or pores are formed that facilitate the swift permeation of water molecules through the membrane.

PUBLICATIONS

- Precise and Ultrafast Molecular Sieving Through Graphene Oxide Membranes. Joshi et al., Science, 752, 2014.

KEY BENEFITS

- Graphene oxide membranes allow rapid transport of water which is advantageous in FO applications which traditionally suffer from a slow flux
- The membrane has a very specific size cut off which enables retention of the osmotic pressure as no draw solution is able to transfer across the membrane
- Graphene oxide membranes are small and compact and are easily transportable
- The system can be optimized over the pH range
- Graphene oxide laminates have an uncomplicated production method utilizing readily available materials.
- The membranes are robust and readily scalable

APPLICATIONS

- Desalination
- Waste water treatment – particularly good for highly fouling feed sources
- Potable water production e.g. for disaster relief where the water purified into the draw solution which can be comprised of essential electrolytes and sugars
- Production of water for irrigation
- Osmotic power generation

INTELLECTUAL PROPERTY

Patent application (WO2015/075453A1)

OPPORTUNITY

The technology presents an excellent licensing and development opportunity to companies working in the water purification space.

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