MODIFICATION OF STIMULI-RESPONSIVE HYDROGEL NANOCOMPOSITES AND THEIR EFFICACY AS DRAW AGENTS IN FORWARD OSMOSIS

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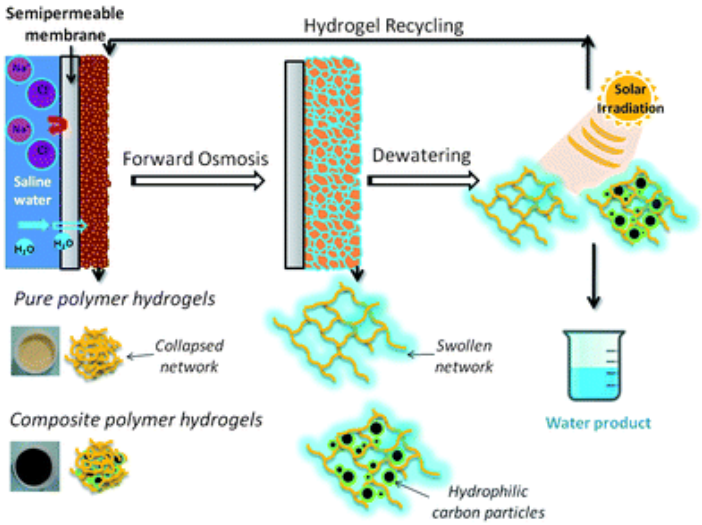
ABSTRACT

Fresh water is becoming an increasingly rare phenomenon in many countries and improved ways of obtaining water are always being sought. Methods which use membranes to separate the salt from fresh water are commonly used, particularly reverse osmosis. This is where high pressure upstream is used to force water through essentially molecular sieves, which force the water molecules through the polymer membranes, leaving the salty water on the upstream side of the membrane. High pressures and energies are required, and biofouling of the membrane can occur due the force with which the salty (and bio-containing) water is forced against the membrane.



Forward osmosis process represents a different, newer technology. In this process, salty water which has a higher osmotic pressure than fresh water, causes pure water to move through the membrane from the upstream salty side, with no need for applied pressure. CO_2 and ammonia carbonate have often been used as the draw materials. At around 60^{o}C these materials can be distilled off, and the fresh water obtained from the downstream reservoir.

Fig 1. Schema of FO with hydrogel particles

In the research to be described here, we build on our previously-reported concept of using highly water-swelling hydrogel particles to absorb the water and encourage its flow through the membrane. We are also concerned with the dewatering process, such as using pressure, temperature or other stimuli, to win the fresh water back from the hydrogel. This process is shown in Fig 1. Unlike previous FO methodologies, the fact that the hydrogel is covalently-bonded means there is less likelihood of contamination with residual chemicals.

In this talk we will look at the effect of a number of influences on the ability of the hydrogel materials to absorb water, and to be dewatered. These include aspects such as particle size, and the incorporation of various nanoparticles into the hydrogel matrix. By their polarity and their influence on the surrounding matrix, they can influence rates of water flux, both in and out of the particles.