



Capacitive Deionization with Membranes for Selective Ion Removal

Jan. 2016 - 2020

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Motivation

Membrane capacitive deionization (MCDI) has been introduced to improve the performance of conventional capacitive deionization system. The MCDI technology depends critically on the ability of the ion exchange membranes (IEMs) to exclude ions carrying the same charge as the electrode charge while simultaneously allowing the transport of oppositely charged ions.

Although the MCDI technology has the potential to specifically remove ions from water, research on this topic has remained unexplored.

For industrial applications, and from an academic perspective there is need to develop ion selective membranes which allow the removal of certain ions from multi-ion systems. For instance: i) to remove nitrates from a mixed solution of chloride and nitrate ions, Fig.1, to avoid health effects on humans, ii) to reduce sodium concentration in irrigation water, which affects the optimal growth of most crop plants, and iii) to recover valuable ions, such as lithium, or unwanted ions, such as arsenic.

Research challenge

IEMs allow the concentration and separation of ionic species. However, they exhibit very low performance when the selective uptake of ions is the aim, e.g., the removal of ions with the same charge and valence.

Endowing the IEMs with selective properties or modifying them for imparting selectivity between specific ions often leads to various associated problems, such as high electrical resistance, and loss of mechanical strength.

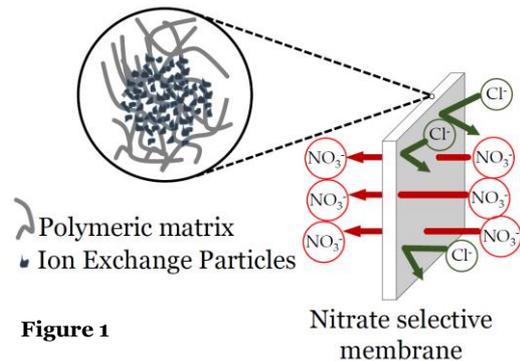


Figure 1

We intend to fabricate and tailor membrane functionalities in order to improve their physical-chemical properties and enhance the selectivity by evaluating different fabrication routes, Fig. 2. Our final aim is to use these ion selective membranes for the removal of ions using MCDI technology.

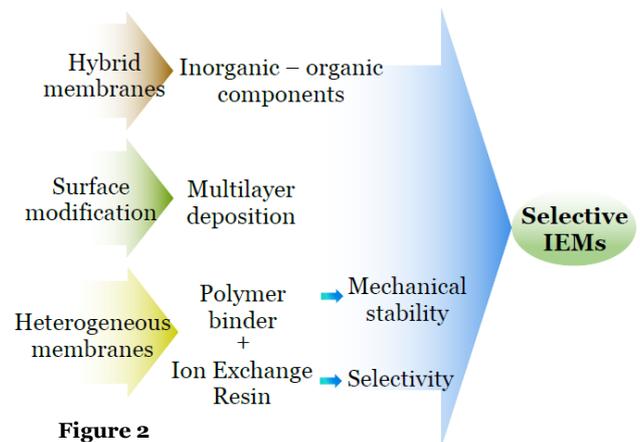


Figure 2



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