3D Junction Bipolar Membranes: More Efficient and Reliable Electrodialysis

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Summary

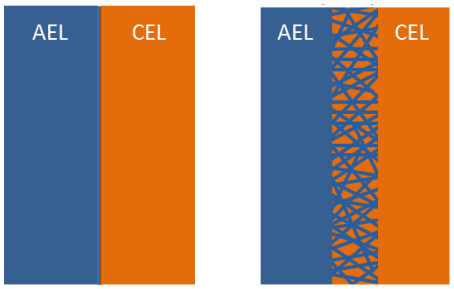
Vanderbilt researchers have developed a bipolar interface with unique 3D morphology to allow the use of higher current passage and salt concentrations during filtration, without the risk of membrane degradation. The membrane's value as a durable and effective tool for industrial scale electrodialysis separations exceeds that of current commercial membranes due to its longevity and resistance to demanding operating conditions.

Addressed Need

- Typical bipolar membranes perform more effectively with larger surface areas. Current membrane technology utilizes 2D planar interfaces between cation exchange membranes and anion exchange membranes. This morphology results in a number of structural and performance deficiencies.
- Using electrospinning to fabricate a 3D planar interface between the exchange membranes drastically increases surface area and efficacy and remedies the deficiencies inherent in 2D interfaces.

Technology Description

The expansion of the interfacial bipolar junction area between the membrane's layers lowers the reaction rate for water splitting or salt separation and prevents unwanted dehydration that can result in the loss of membrane conductivity. Due to this trait, the nanofiber bipolar membrane does not degrade or delaminate after high current passage unlike commercial 2D membranes that are currently available.



Conventional BPM | New BPM (3D Junction)

Technology Application

- The use of a 3D fibrous bipolar interface allows for higher rates of water filtration and decreased energy consumption, which applies to large scale reuse and desalination for wastewater, drinking water, and agricultural.
- Desalination is vital to the food industry, and food processing industries would prove to be a large market for a more effective membrane.
- Hydrogen and air fuel cells also employ the use of bipolar membranes. A more effective 3D morphology improves power output at reduced feed gas humidity conditions.

Technology Development and Intellectual Property Status

- A Patent Application has been filed.
- Small membranes have been made and tested, each performing significantly better than commercial bipolar membranes.
- Link to inventor's Vanderbilt page: http://engineering.vanderbilt.edu/bio/peter-pintauro
- Link to inventor's research: https://www.researchgate.net/profile/Peter_Pintauro

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