Chemical Engineering Dissertation Defense

Polysulfones for sustainability related applications

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Abstract

This dissertation investigates the pressing issue of climate change, identifying carbon dioxide (CO2) as its main driver and introduces Direct Air Capture (DAC) as a crucial technology for achieving significant reductions in net global emissions. Through an extensive review of existing literature on DAC, it examines various methods and materials developed for this purpose, highlighting the ongoing efforts, advancements, and potential for real-world application. A novel sorbent, quaternary ammonium-functionalized poly(arylene ether sulfone) is explored for DAC via the moisture swing process. This sorbent exhibited the ability to capture and release atmospheric CO2 by a swing in moisture. Effects of form factors of powder, free standing dense membrane and thin film composite membrane were also evaluated for DAC. Furthermore, the dissertation explores modifications to poly(arylene ether sulfones) – polymers primarily used in desalination processes – to enhance water scarcity solutions by improving desalination membrane hydrophilicity and reducing fouling. This enhancement is achieved through the incorporation of zwitterionic groups into the polymer structure. Additionally, it investigates the synthesis of polysulfone polymers from lignin-derivable monomers, offering a greener alternative to traditional polysulfones used in desalination due to their environmental and health concerns. Polysulfones derived from lignin exhibited comparable thermal properties and enhanced hydrophilicity compared to petroleum-derived polymers, showing considerable promise.

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Zoom Link: https://asu.zoom.us/j/85942989302

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