GAS PERMEATION STUDIES OF THE COVALENT ORGANIC FRAMEWORKS(COFs) BASED MIXED MATRIX MEMBRANES(MMMs)

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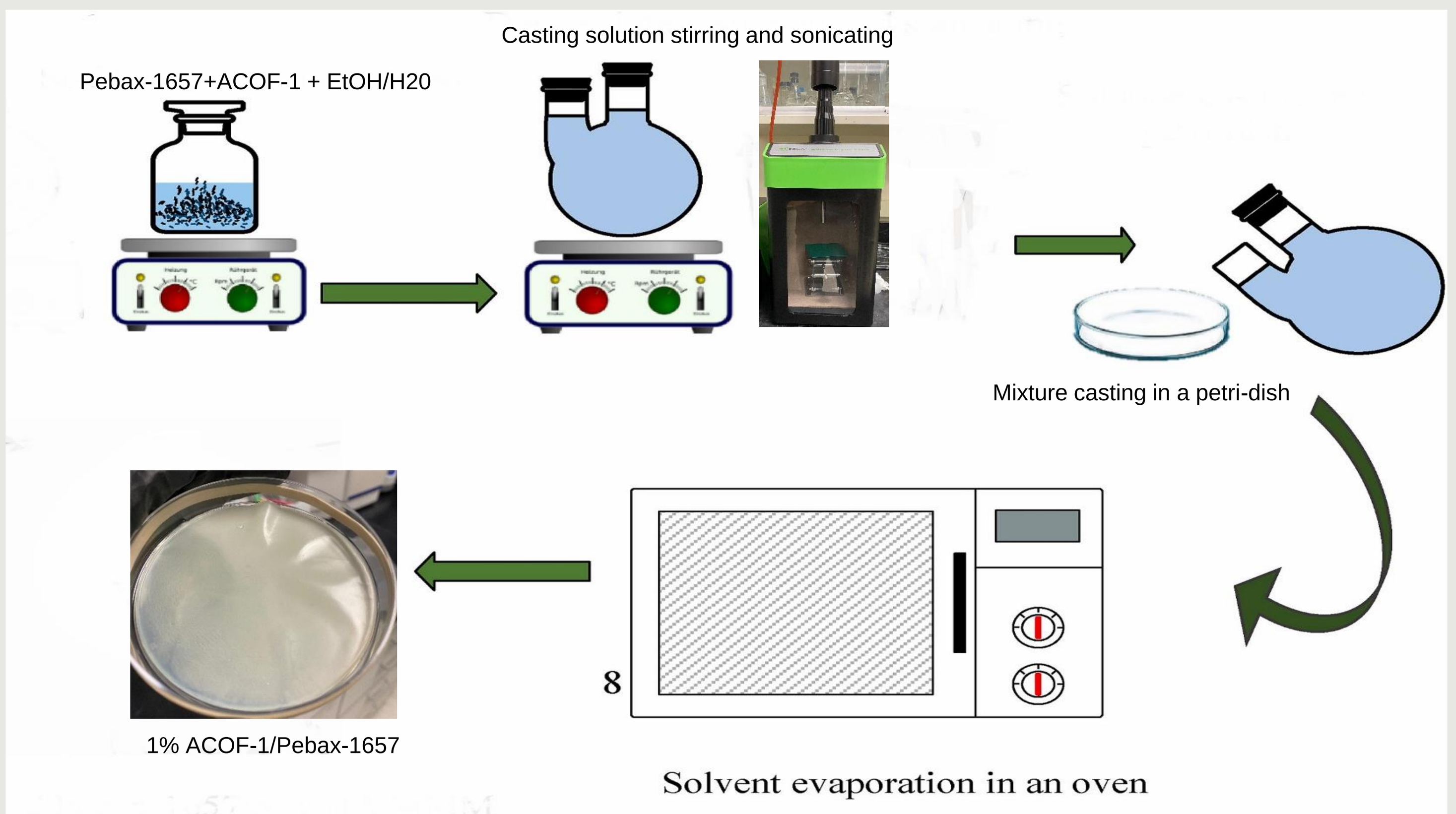
Introduction

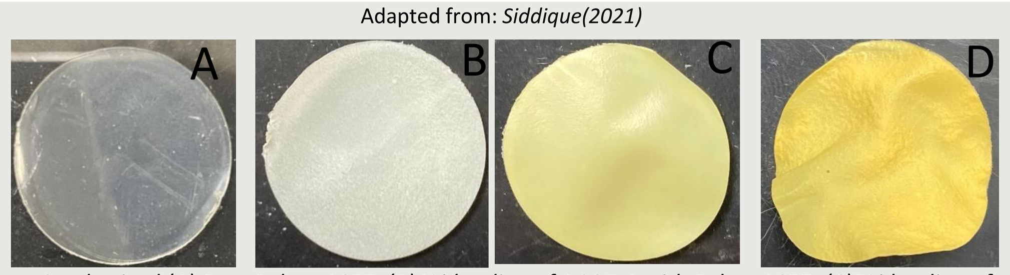
Mixed Matrix Membranes(MMMs)

- Combination of Continuous Organic Polymer Phase and Porous Additive
  - Utilizes the ease of processing polymers
  - Benefits from improved gas separation performance of diverse porous filler materials
- Potential for Enhanced Separation Quality:
  - Higher gas permeance may be observed with increased loading of the porous filler. [Nuhnen,2021]
- Components:
  - Polymer Phase: Pebax 1657
  - Filler: ACOF -1; Covalent Organic Framework (COF)

MMMs Synthesis



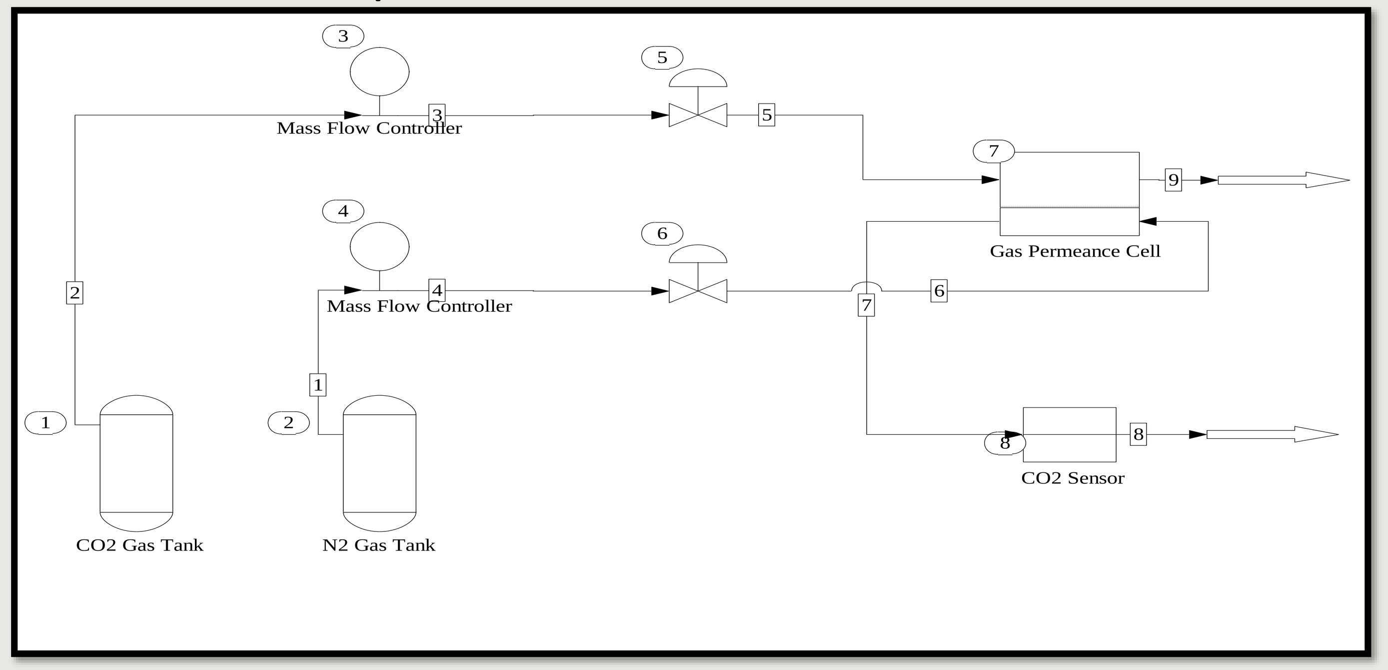
Adapted from: Siddique(2021)

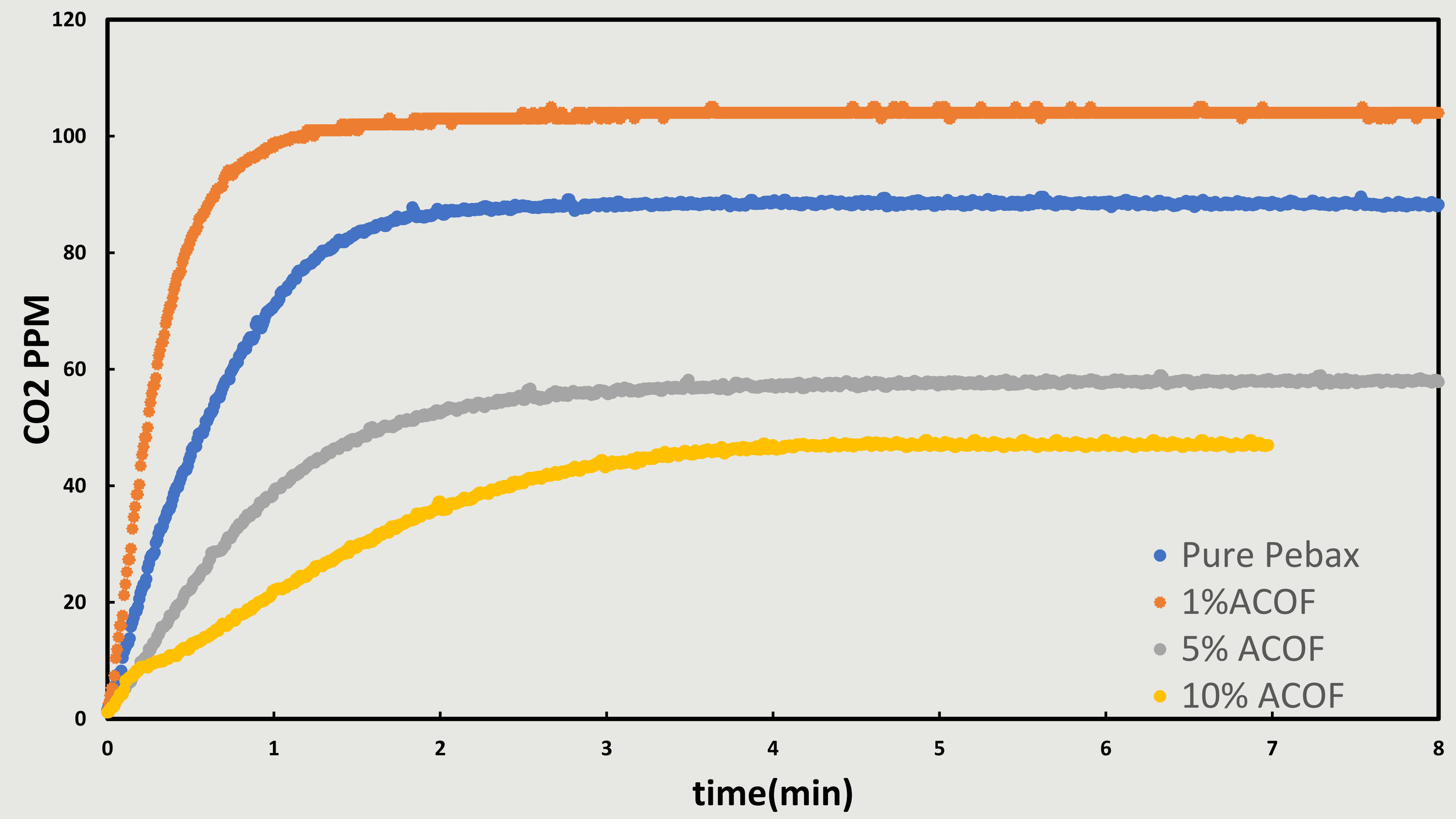


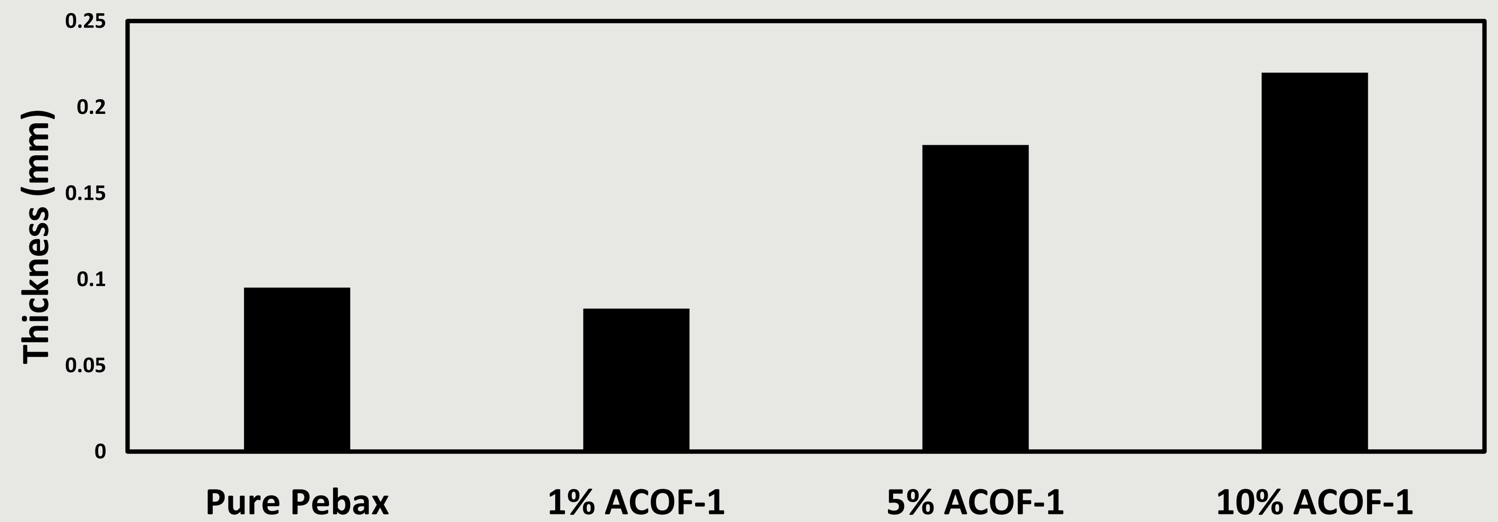
Synthesized (A) Pure Pebax-1657, (B)1% loading of ACOF-1 with Pebax 1657, (C)5% loading of ACOF-1 with Pebax 1657, (D) 10% loading of ACOF-1 with Pebax 1657

Gas Permeance Setup; CO_2 Permeation(ppm)

- In testing the permeance and performance of the synthesized MMMs, we employed an in-house-built permeation setup

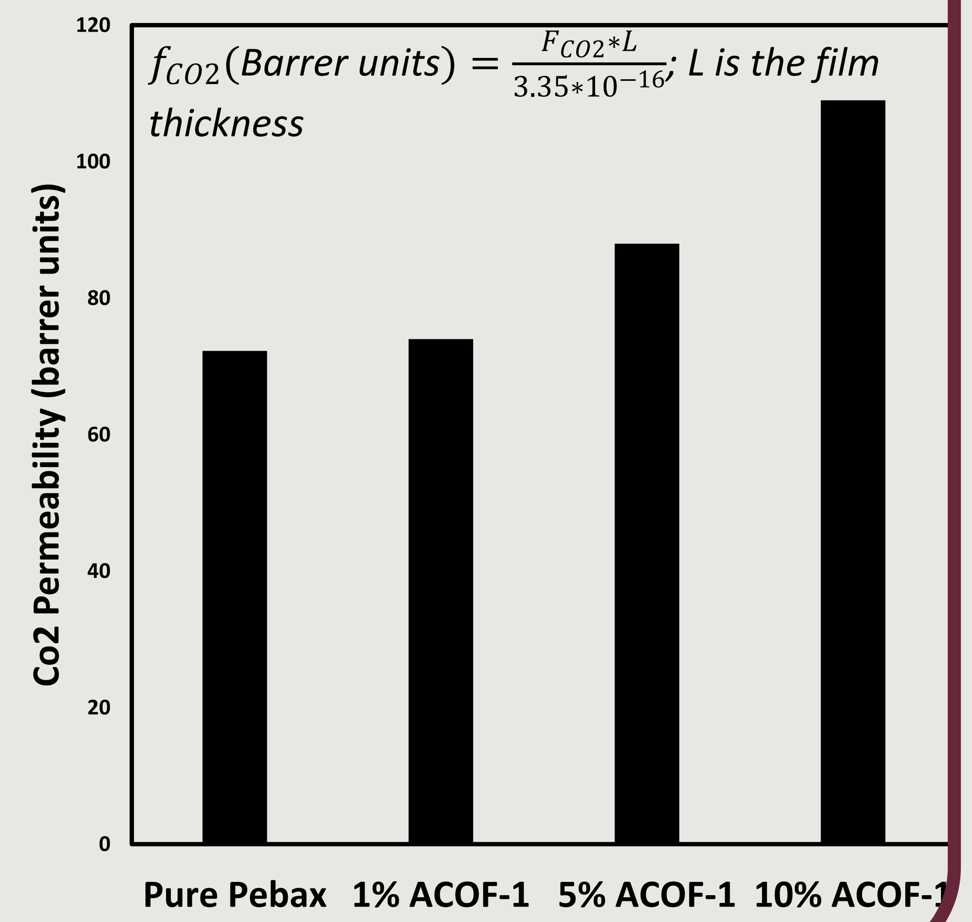






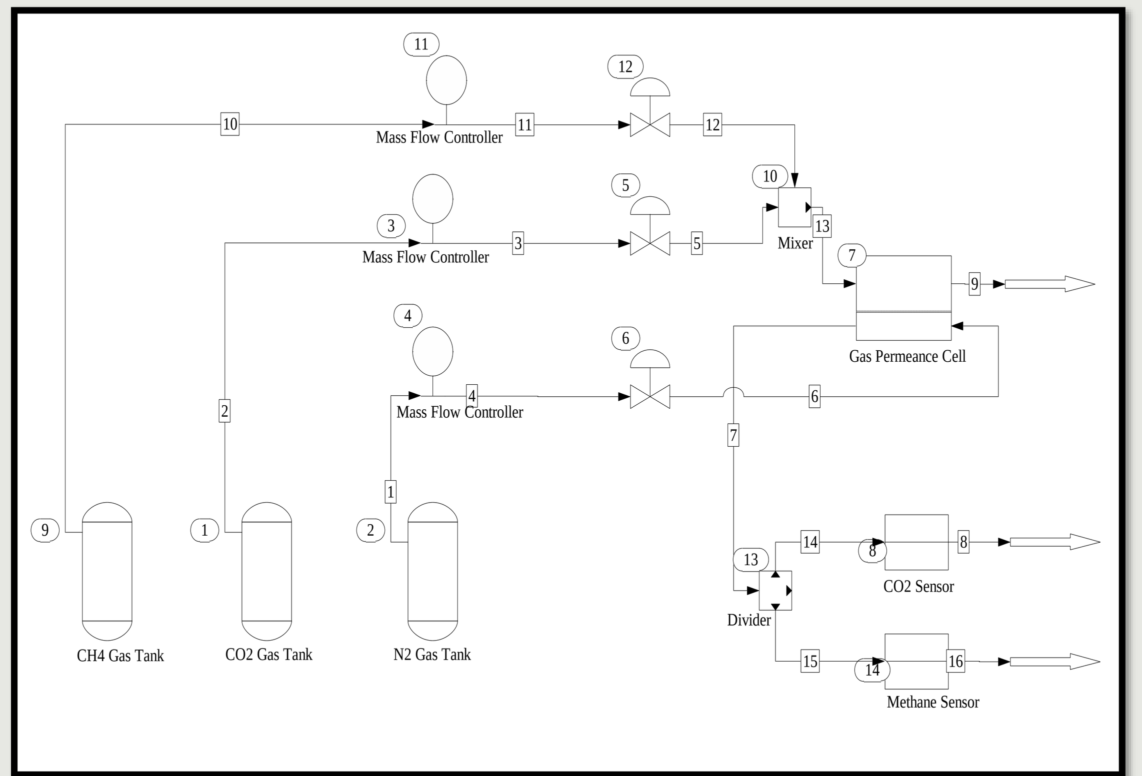
Conclusion; CO_2 Permeation(Barrer Units)

- MMMs have the potential for increasing the CO2 permeance as compared to typical polymers:
  - Significant increase with higher ACOF-1 loading
- The in-house built gas permeance cell and the MMMs show reliable data.
  - Sensible CO2 parts per million (PPM) data
  - Absence of erratic peaks



Future Work

- Test for Selectivity:
  - Experiment with gas mixtures such as CO2/CH4 to assess the selectivity of the material towards specific gases
- Increase ACOF-1 Loading to assess the impact on permeance and selectivity.
- Experiments to test if the sonication impacted the chemical composition of the casting solution.



Proposed Gas Permeance Setup For Testing Selectivity

Nuhnen, A., & Janiak, C. (2021). Mixed-matrix membranes. New Trends in Macromolecular and Supramolecular Chemistry for Biological Applications, 87–113. https://doi.org/10.1007/978-3-030-57456-7_5

Siddique, T., Dutta, N. K., & Choudhury, N. R. (2021). Mixed-matrix membrane fabrication for water treatment. Membranes, 11(8), 557. https://doi.org/10.3390/membranes11080557