

Fabrication of Fouling Resistant and Operationally Stable Nanocomposite Membranes for Refinery Wastewater Treatment

Introduction

Benzene (B), Toluene (T), Ethylbenzene (E), and Xylene (X) are volatile organic compounds that are among the major contaminants found in refinery wastewater. Collectively known as BTEX, these compounds are toxic and carcinogenic. Refinery wastewater containing BTEX is often discharged into the environment which can be very detrimental to both the environment and public health.

Membrane technology provides a separation technique for the removal of such contaminants, however, most membranes are hydrophobic and the hydrophobic nature of membranes adversely impacts the flux and anti-fouling capability of membranes. Hence, modification of membranes is crucial in improving their performance.

Functionalized nanoparticles are often utilized in improving the membrane's performance. In this work, the green method of functionalizing iron oxide nanoparticles was employed to improve the performance of polyvinylidene fluoride (PVDF) and polysulfone (PS) membranes. The modified membranes will be utilized in the treatment of refinery wastewater. The functionalities introduced into the membrane by the functionalized nanoparticles are expected to improve the flux and rejection capacity of the membranes.

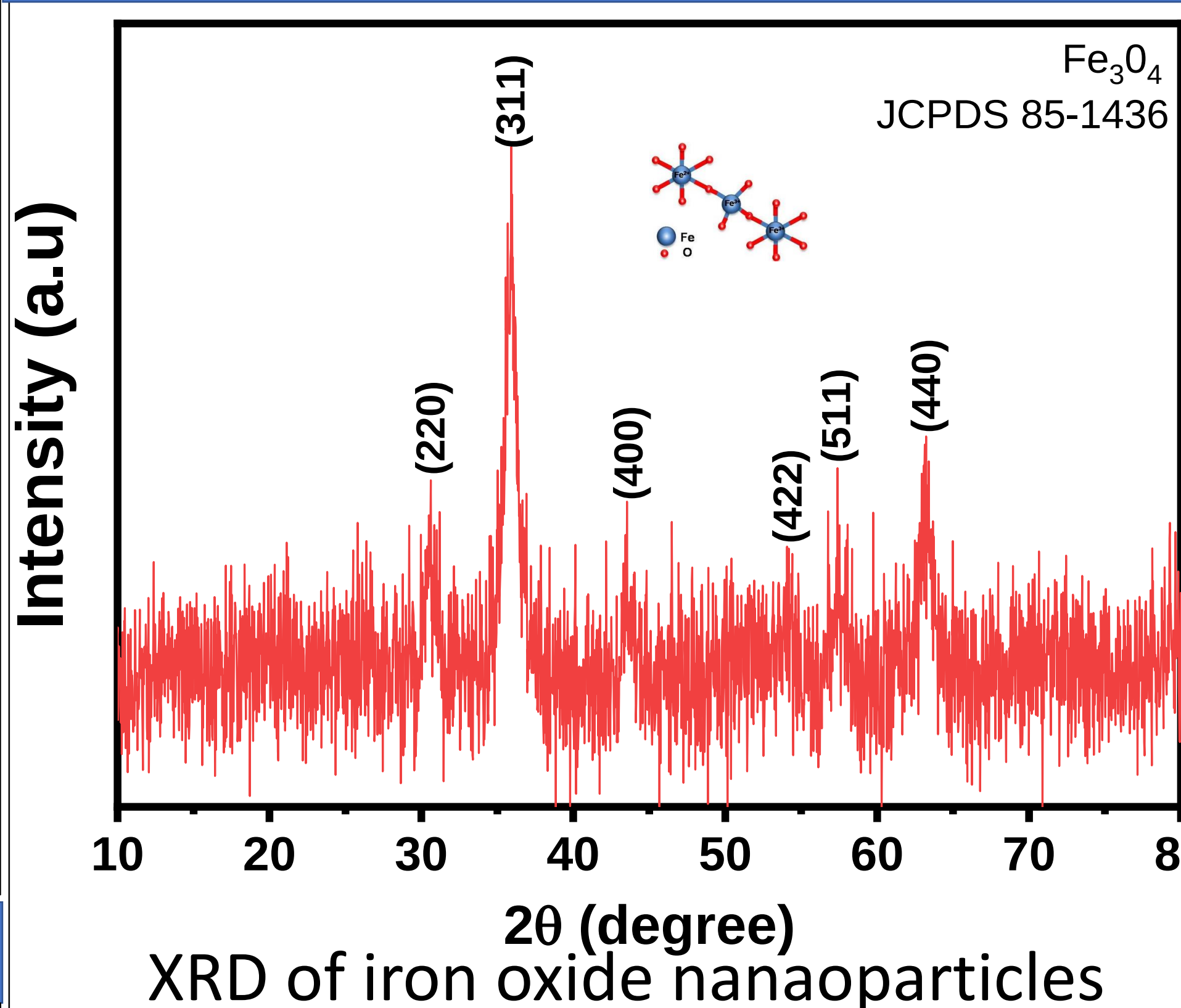
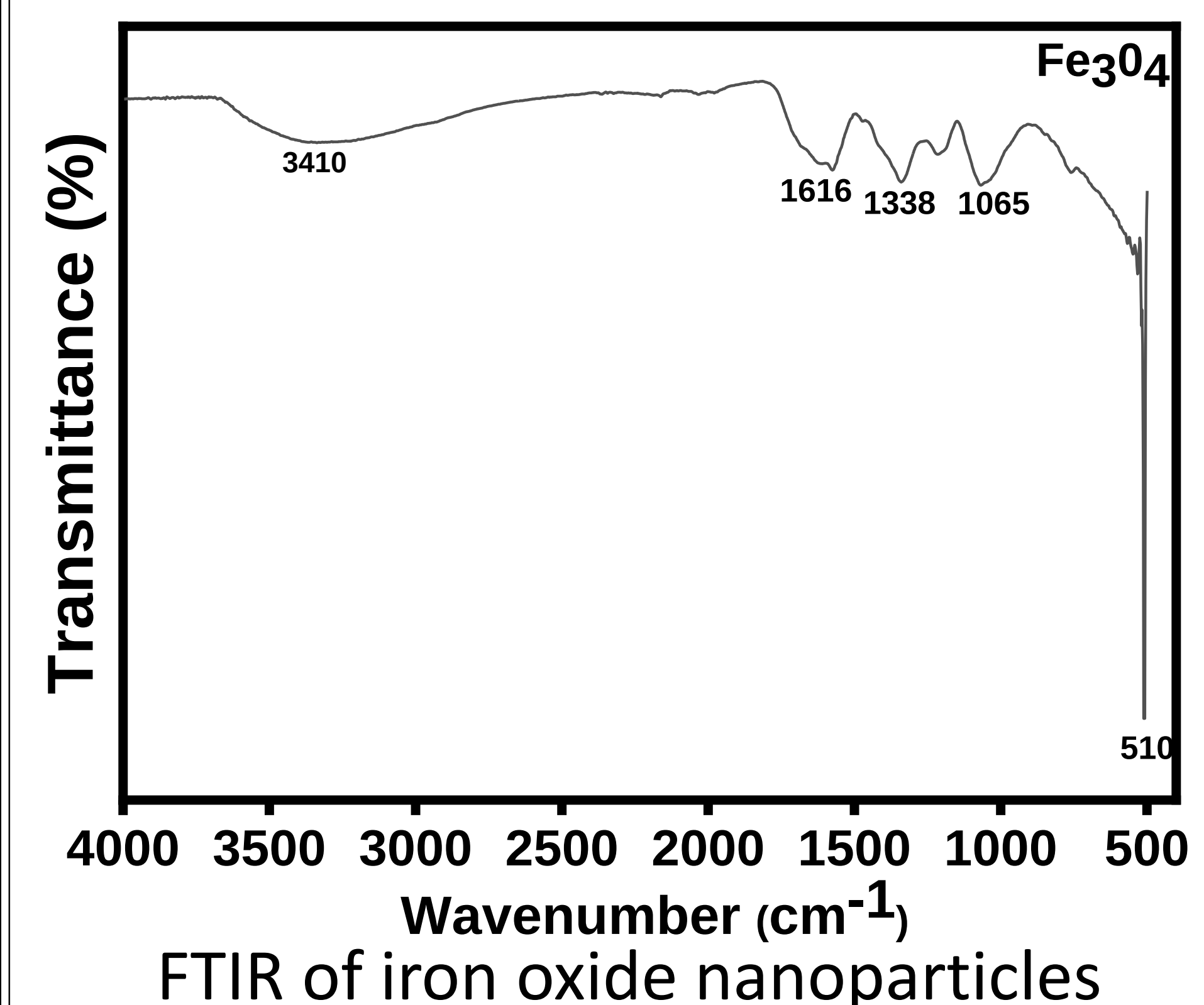
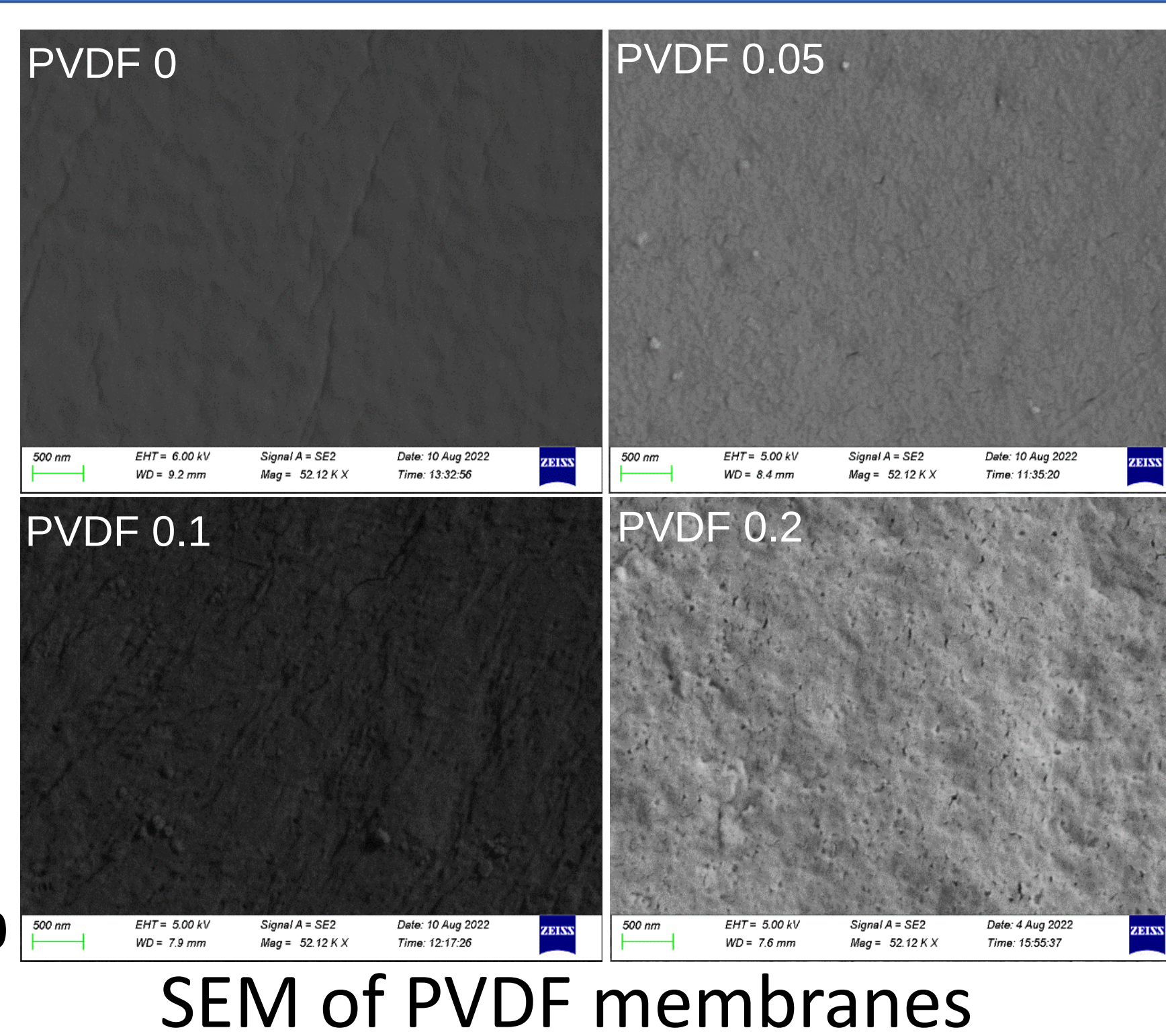
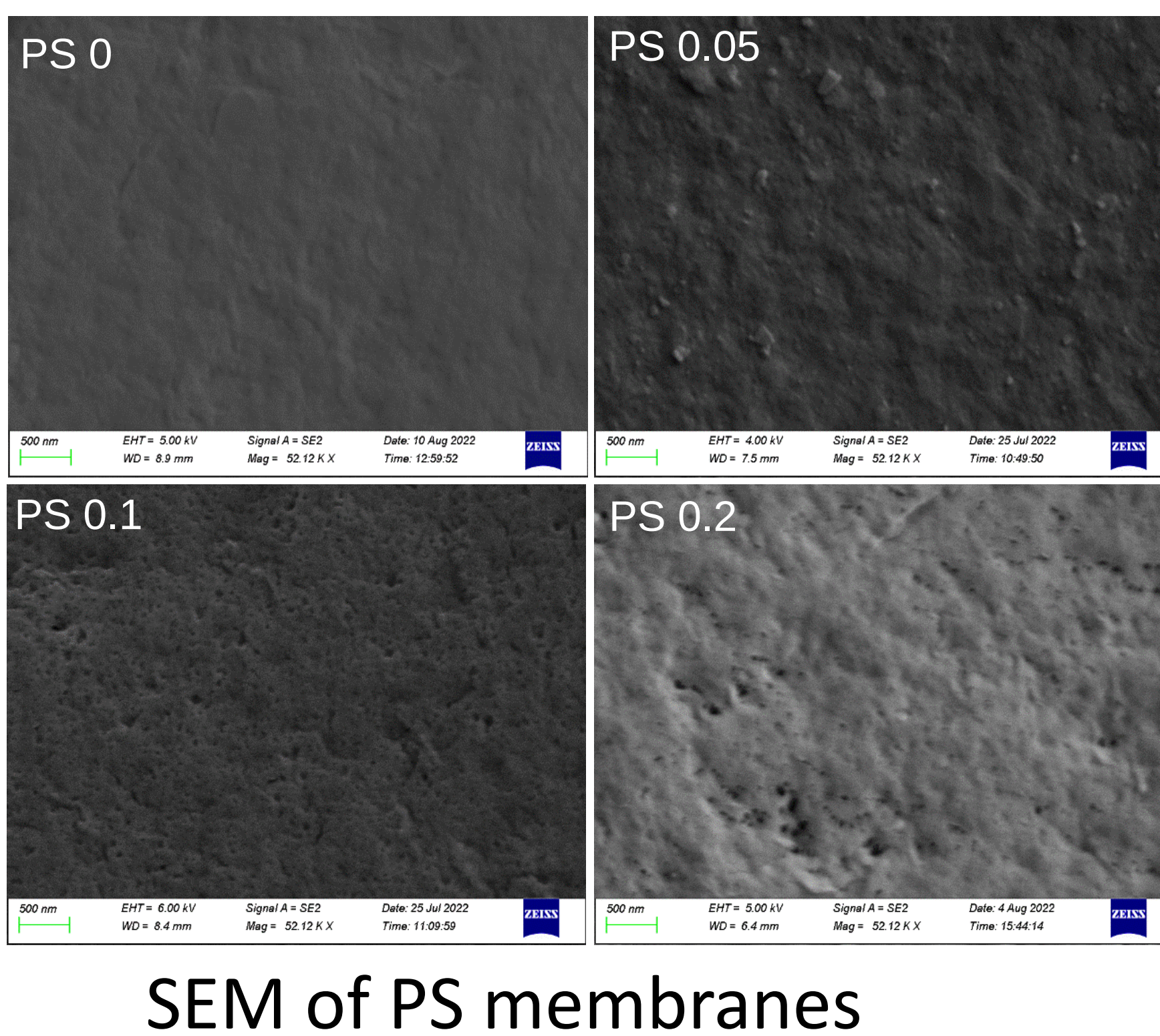
Methods



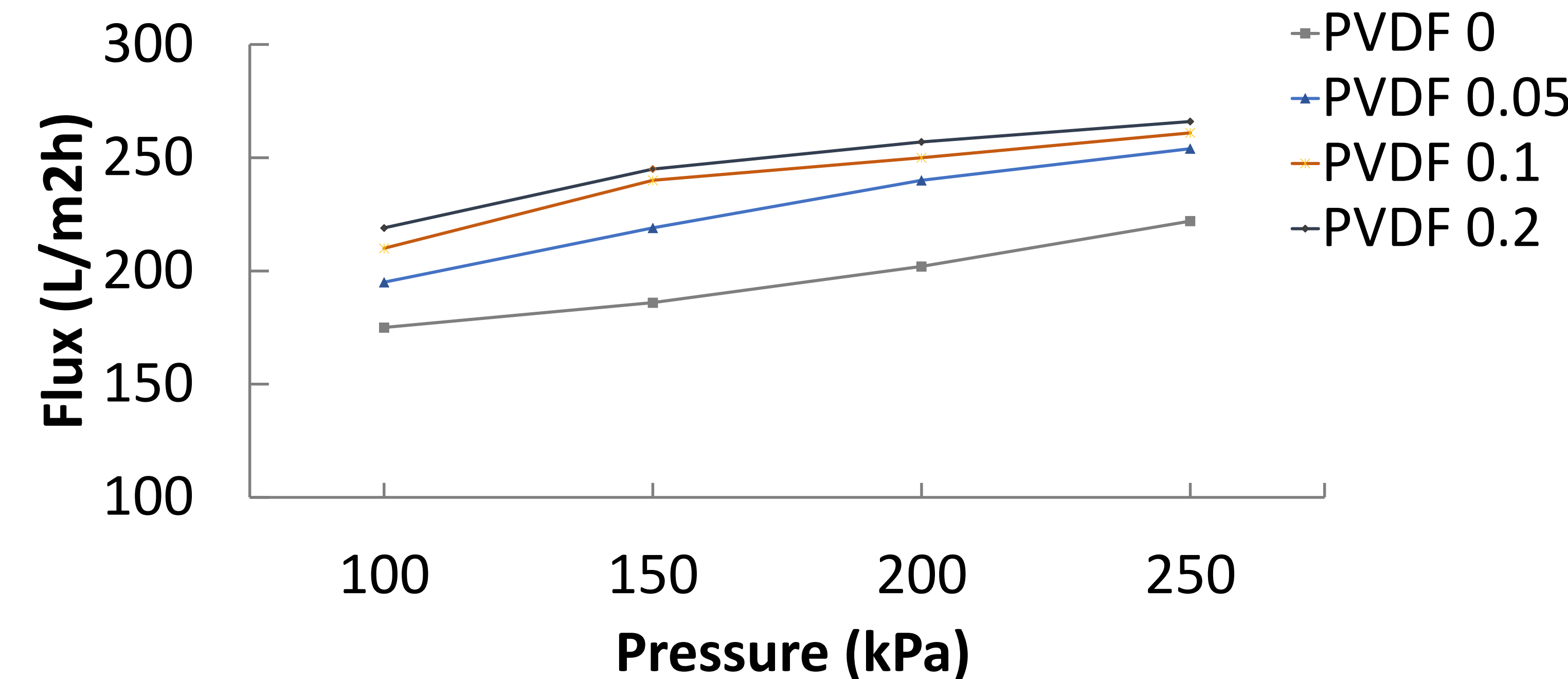
Hypothesis

- Green functionalization of nanoparticles integrates adsorptive sites on the nanoparticles
- Membranes modified with the functionalized nanoparticles improves in performance
- Stability of the functionalized nanoparticles in the membrane matrix is high
- Leaching of incorporated nanoparticle from the membranes is minimal due to the functionality in the nanoparticles that ensures strong bonding between the nanoparticles and the membrane.

Results



Result continues



Work in progress

- Analysis of other physical properties of the functionalized membranes.
- Application of the functionalized membranes in the treatment of lab-produced BTEX.
- Analysis of the membrane's performance in treating real refinery wastewater targeting BTEX removal.

Conclusion

The pomegranate extract-functionalized nanoparticles provides a greener way of improving the performance of polymeric membranes in wastewater treatment. Successful application of the membranes in the removal of BTEX from refinery wastewater ensures that viable and greener alternative is available to curtail the negative impact of BTEX to the environment and public health.

References

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- Jhaveri, J.H., Murthy, Z.V.P., 2016. A comprehensive review on anti-fouling nanocomposite membranes for pressure driven membrane separation processes. Desalination 379, 137–154.