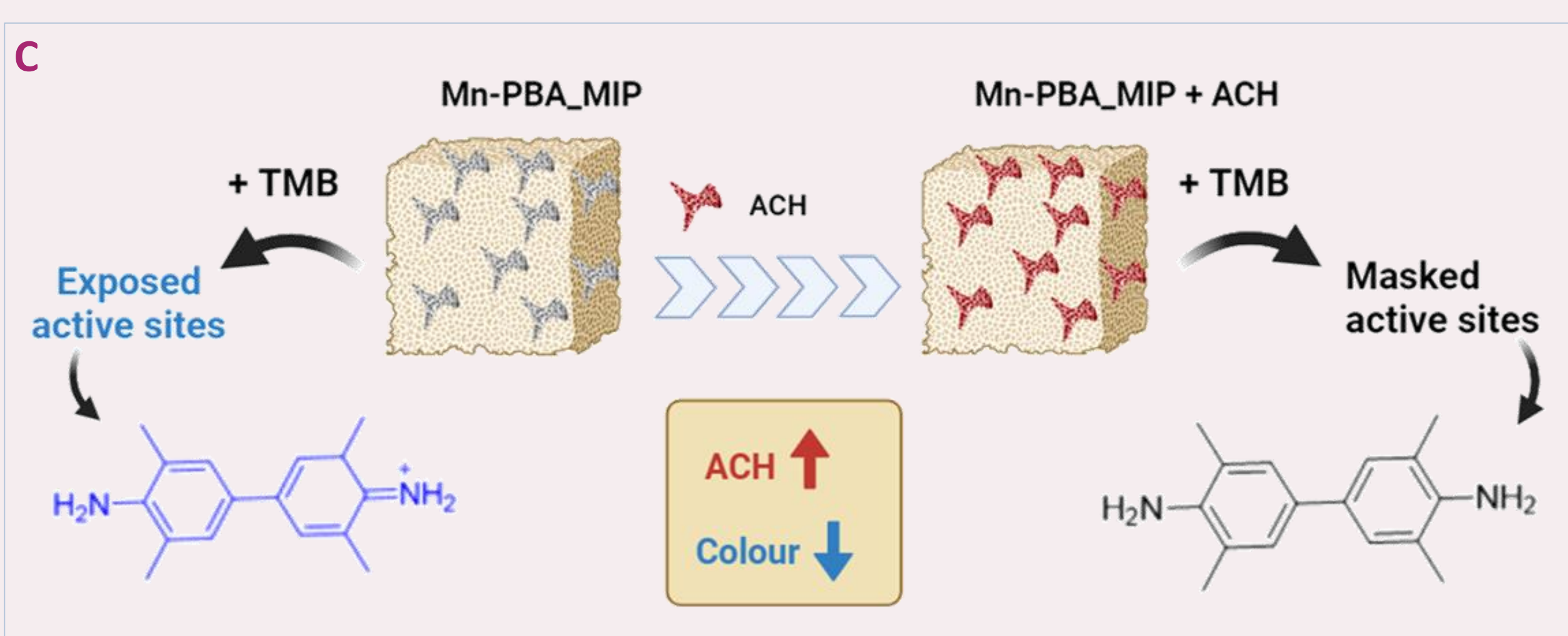
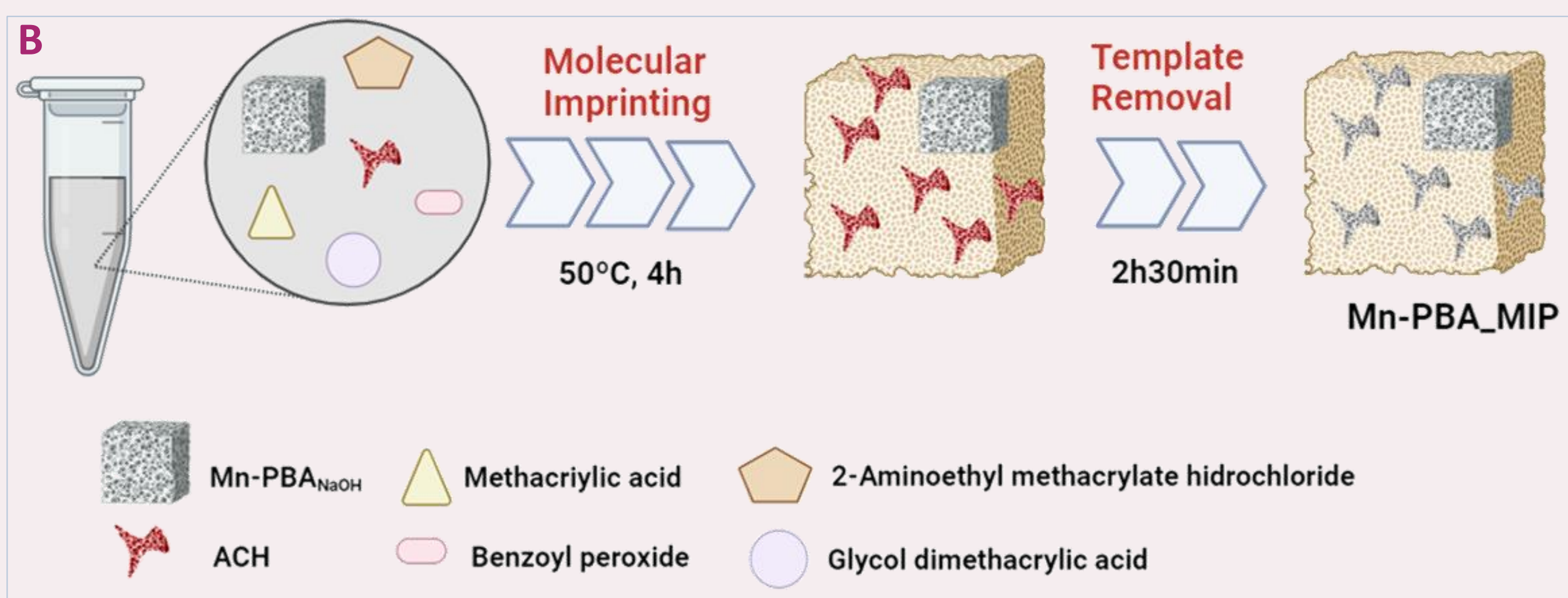
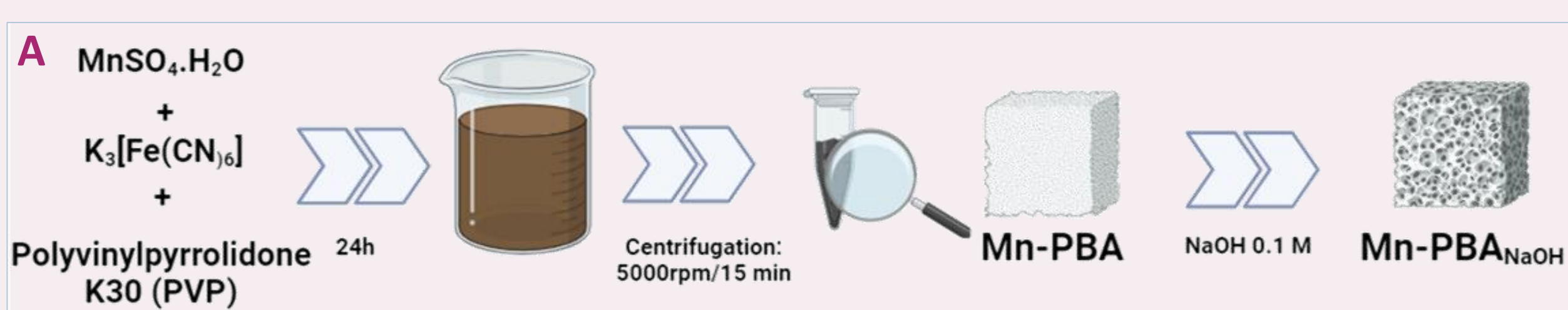


INTRODUCTION

The integration of Microfluidics and Nanozyme peroxidase for the Colorimetric detection of Neurotransmitters represents a cutting-edge approach in neurochemical analysis. Microfluidics allows precise manipulation of small fluid volumes, reducing reagent consumption and accelerating reactions while integrating multiple analytical steps on a single chip. Nanozyme peroxidases, mimicking natural peroxidases, provide enhanced stability and catalytic efficiency at a lower cost. The colorimetric detection mechanism signals the presence of neurotransmitters through a visible color change, making it sensitive and easy to interpret for real-time analysis.

Detecting neurotransmitters like acetylcholine (ACH) is crucial for understanding and diagnosing various neurological conditions. Acetylcholine plays a key role in physiological processes such as muscle activation, memory function, and synaptic transmission. Abnormal levels are linked to disorders like Alzheimer's disease, myasthenia gravis, and Parkinson's disease. Accurate measurement aids in early diagnosis, monitoring disease progression, and evaluating treatment efficacy. A reliable detection method can advance our understanding of brain function and neurotransmitter dynamics. Real-time monitoring provides insights into how neurotransmitter fluctuations correlate with cognitive functions, behaviors, and responses to stimuli, essential for developing new therapeutic strategies and discovering novel drugs targeting neurotransmitter systems.[1]

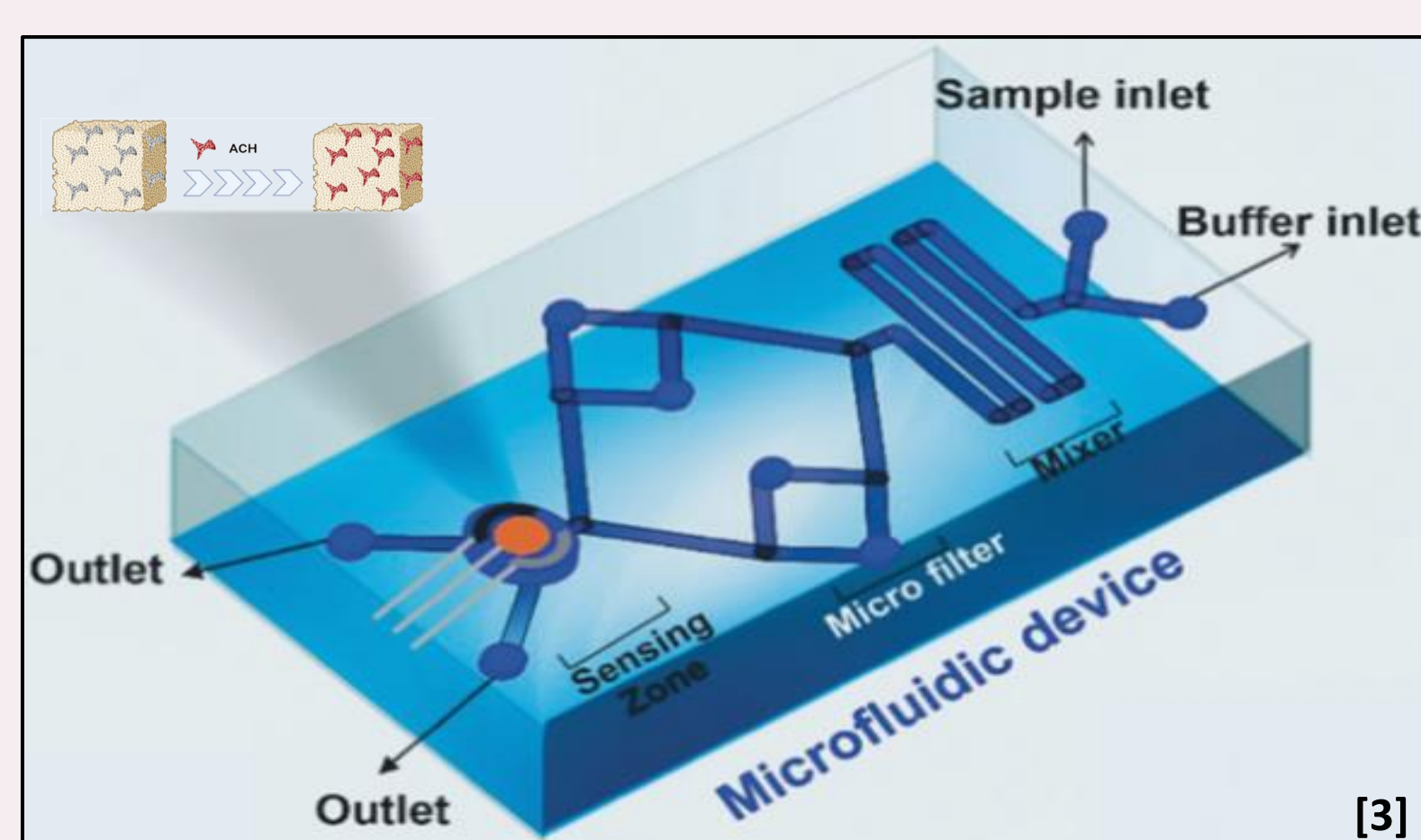
METHODOLOGY



Schematic representation of: (A) Synthetic process of Mn-Based Prussian Blue Analogues leading to Mn-PBA_{NaOH} [2]; (B) Synthetic process of Mn-PBA_MIP; (C) Principle for the ACH induced inhibition of oxidase-like activity.

Microfluidic Design of the Biosensor

Future Perspective



ACKNOWLEDGMENTS

This study was financed by project IBEROS+ (0072_IBEROS_MAIS_1_E, Interreg-POCTEP 2021-2027).

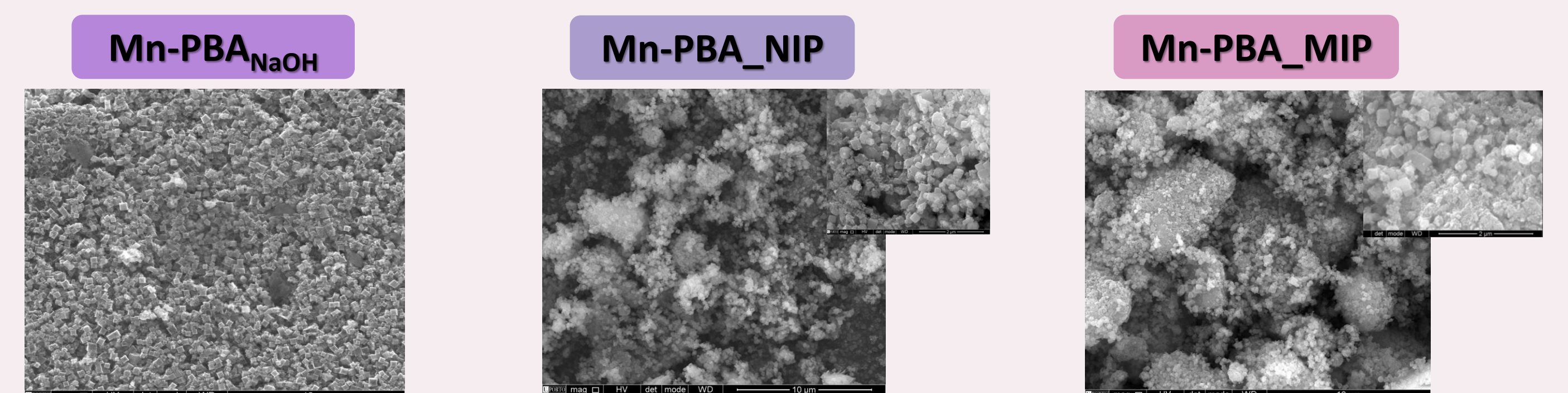
REFERENCES

- [1]. Sacramento *et al.* (2017) *Materials Science and Engineering: C*, 79, 541-549.
- [2]. Liu *et al.* (2023) *ACS Appl. Mater. Interfaces*: 15, 20, 24736–24746.
- [3]. Ebrahimi *et al.* (2022) *Microchim Acta* 189, 252.

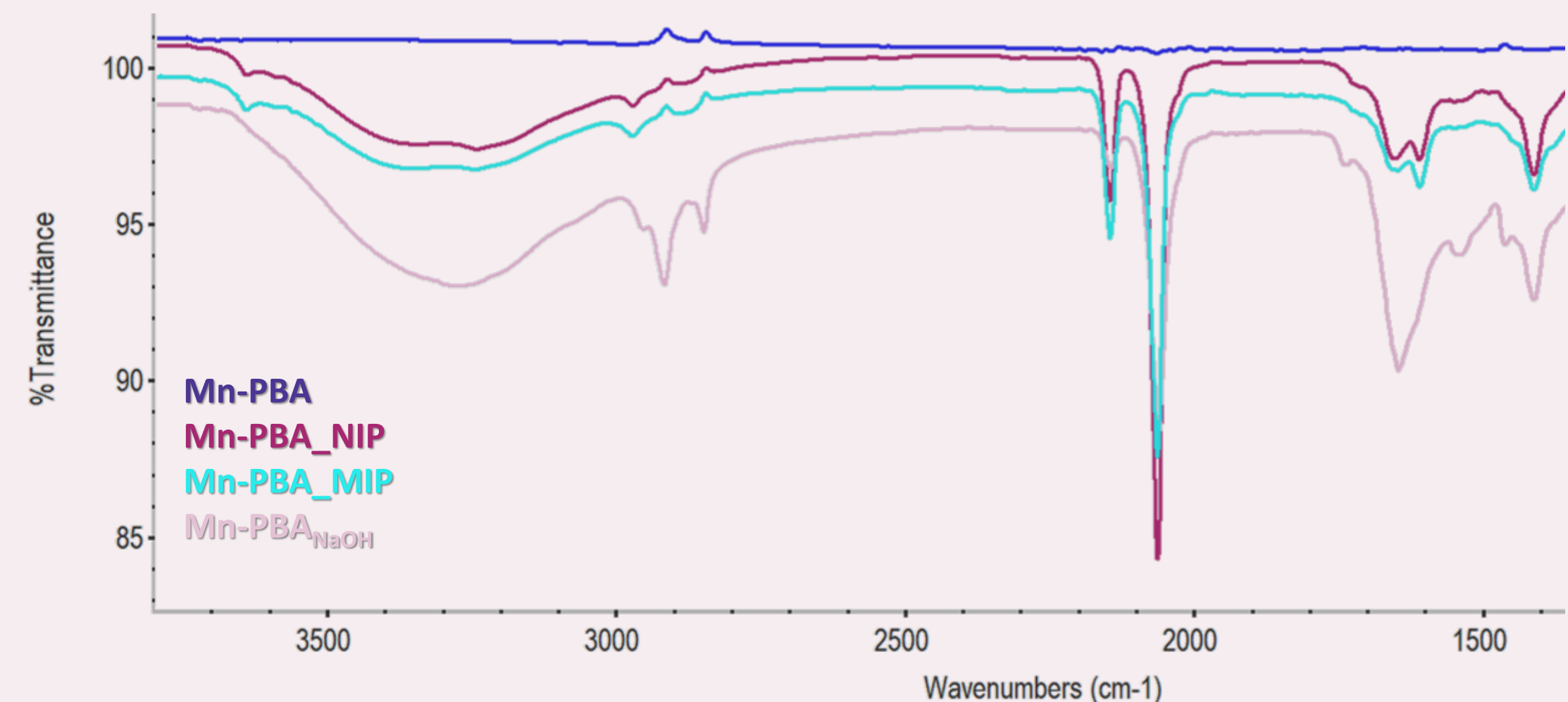
RESULTS

Surface modification characterization

SEM images

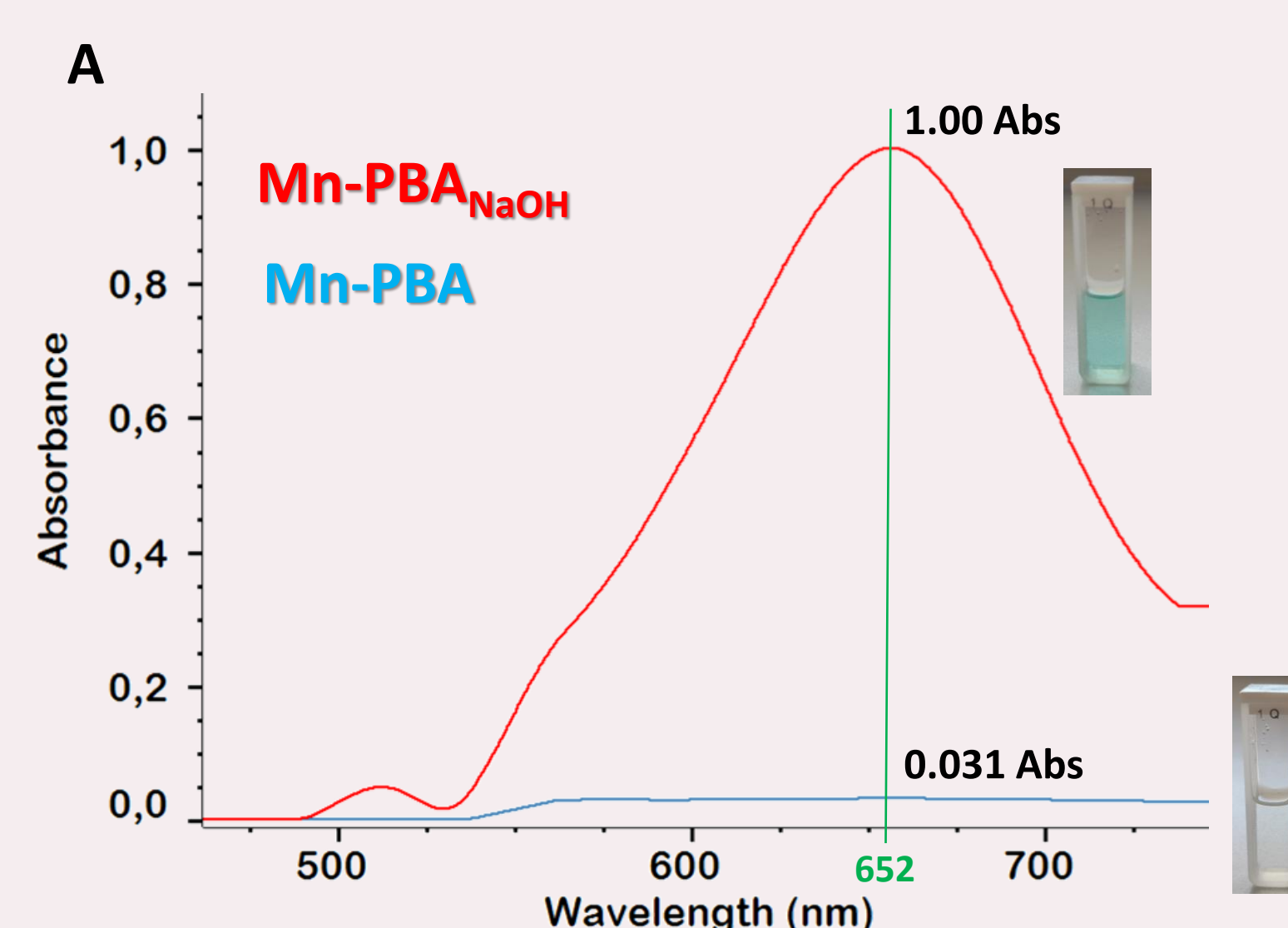


FTIR analysis

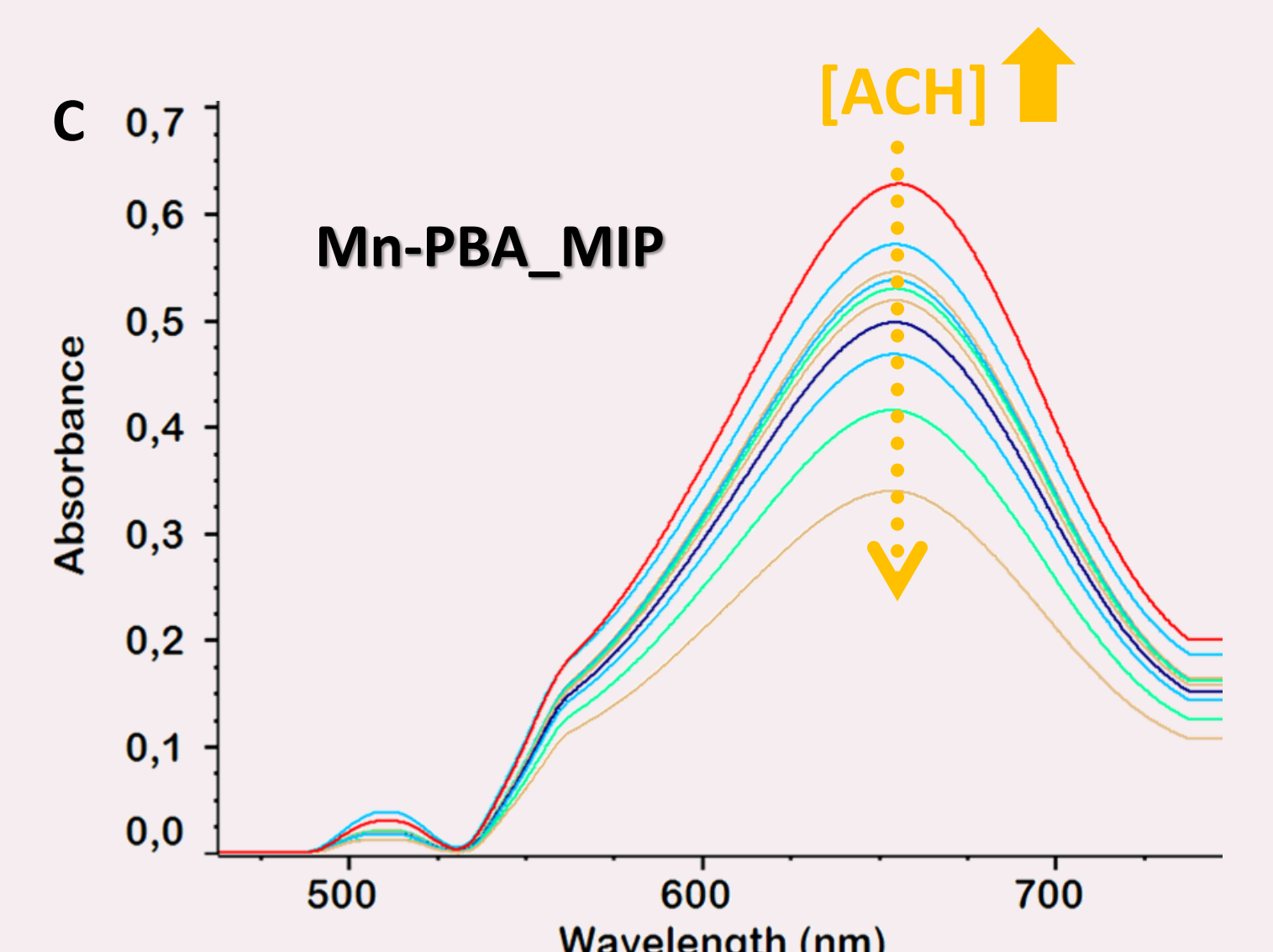
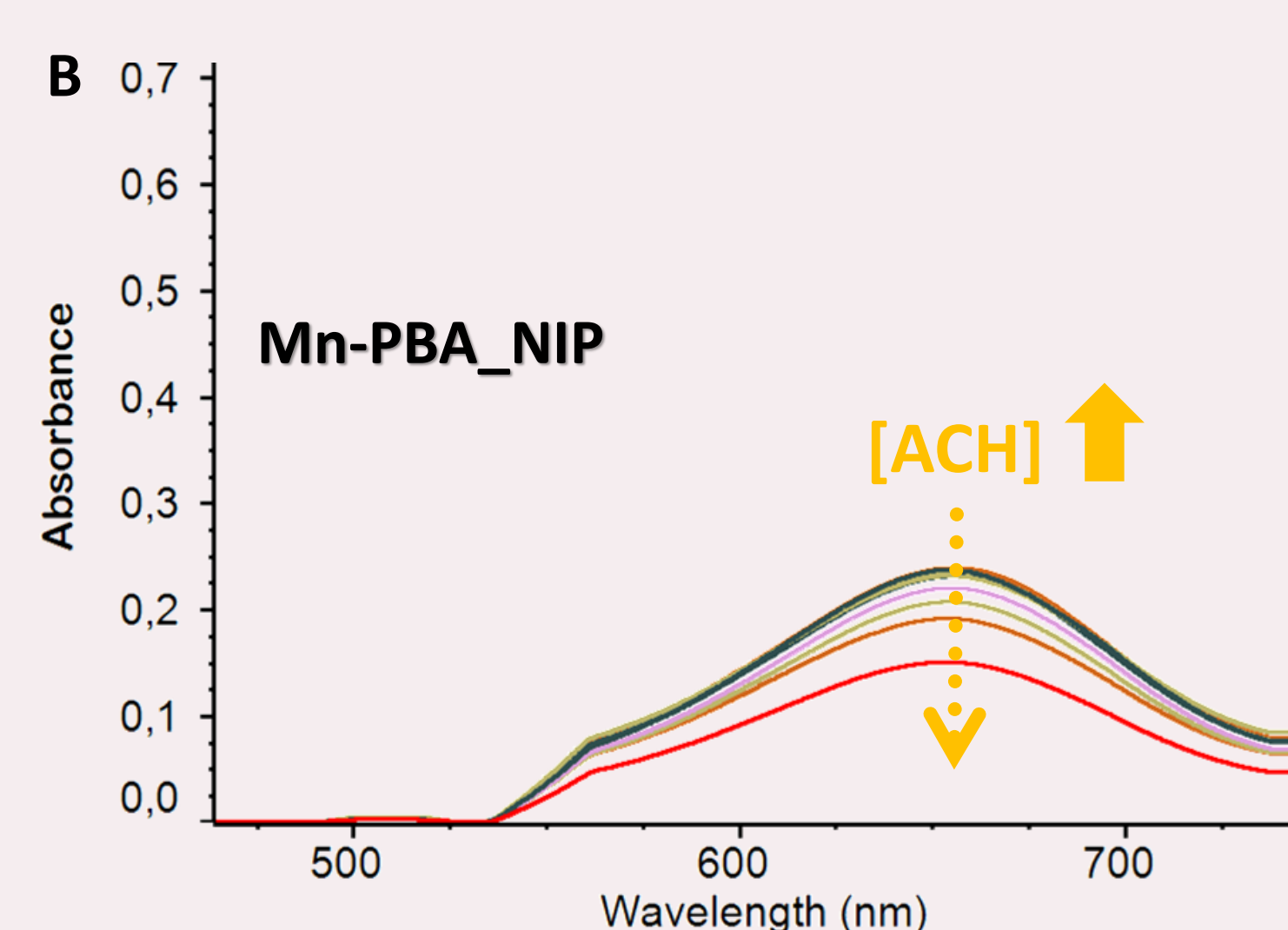


✓ The structural and chemical alterations are confirmed by both SEM and FTIR analyses.

UV analysis



- The absorbance difference confirms the formation of Mn-PBA_{NaOH}
- The difference in absorbance between the Mn-PBA_MIP and Mn-PBA_NIP across various concentrations of ACH indicates that this method can effectively determine ACH concentration



(A) UV-vis spectra of Mn-PBA vs Mn-PBA_{NaOH}; (B) UV-vis activity of Mn-PBA_NIP with ACH at different levels; (C) UV-vis activity of Mn-PBA_MIP with ACH at different levels; [ACH]=0.0022 - 0.242 μM.