



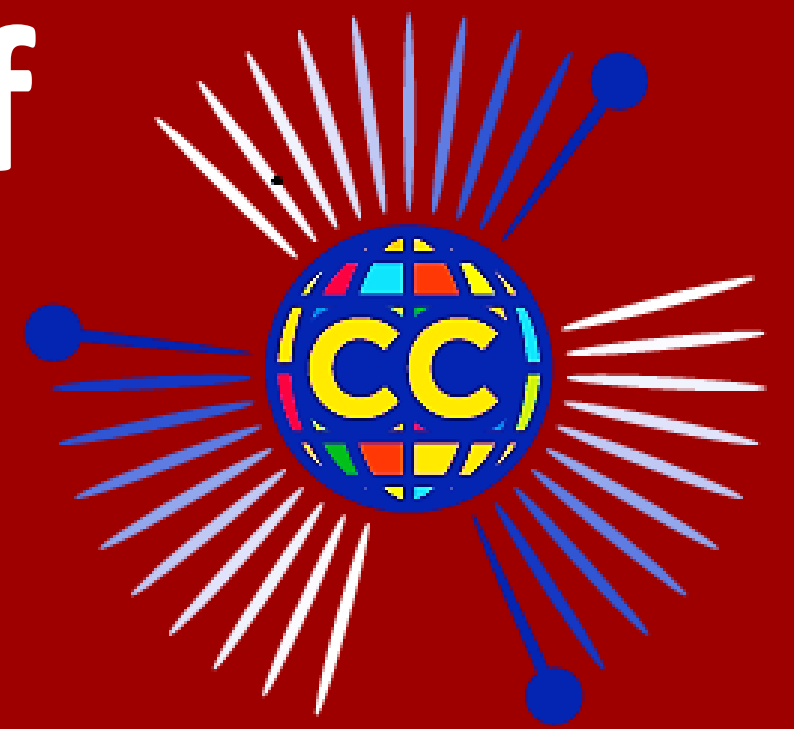
University of Colombo, Sri Lanka

Development of Dual-carrier CMC–PEG/LDH Nanocomposite Hydrogel for the Sustained Release of *Mikania cordata* Phytochemicals for Wound Healing Applications

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Commonwealth Chemistry

Introduction

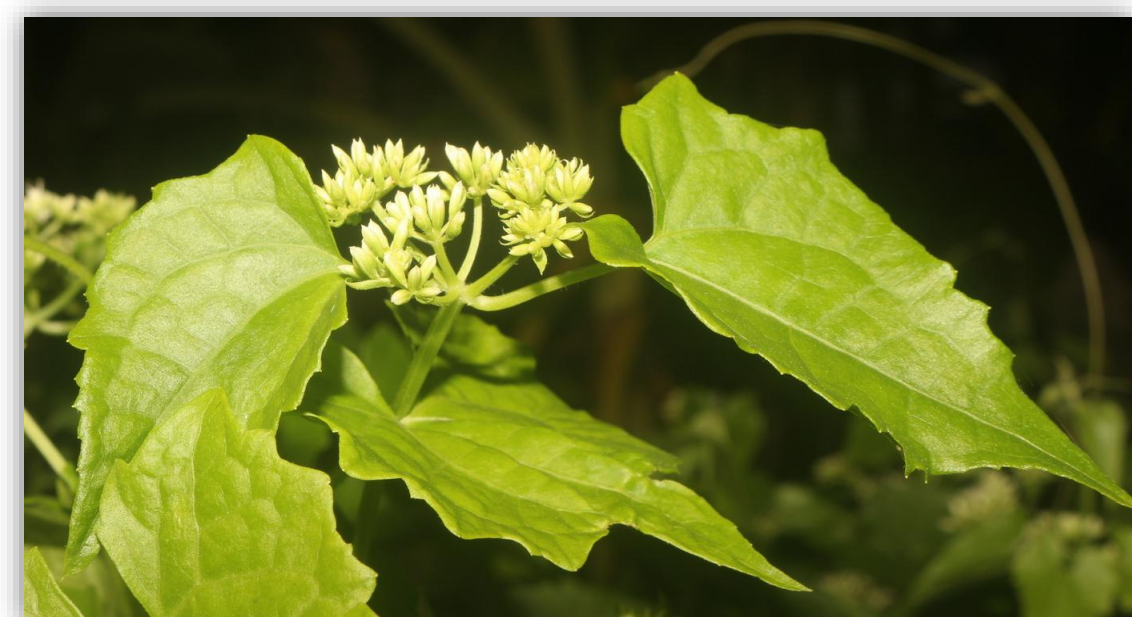
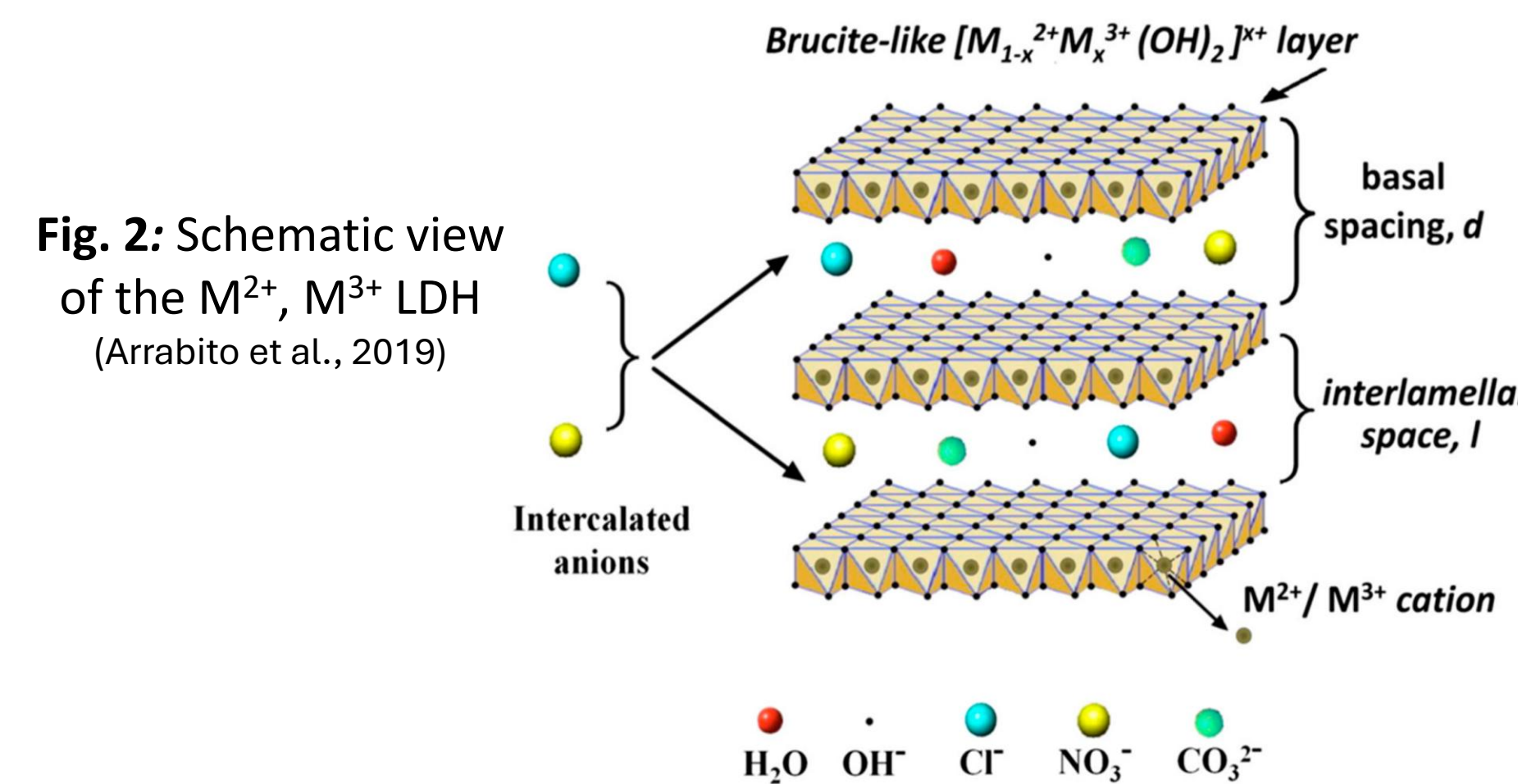


Fig. 1: *Mikania cordata* leaves

Mikania cordata

- Inexpensive | readily available
- Traditional uses in wound healing
- Rich in flavonoids and phenolic acids
- Rapid biological degradation



Layered Double Hydroxides (LDHs)

- Nanoscale reservoirs
- Protection & sustained release of phytochemicals

The Dual-carrier System

- Sustained delivery and superior wound closure.

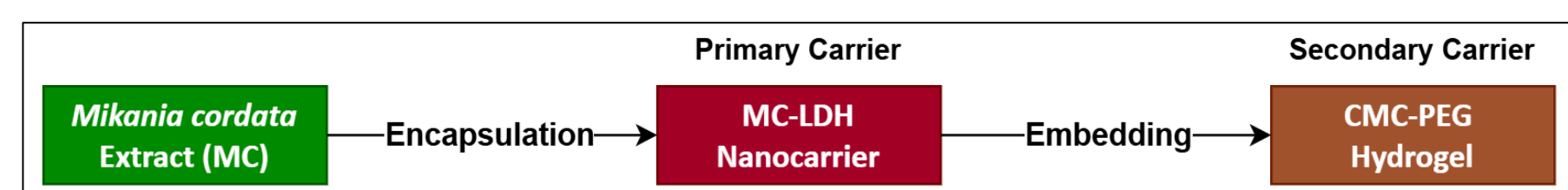


Fig. 3: Architecture of the dual-carrier delivery system

Methods and Materials

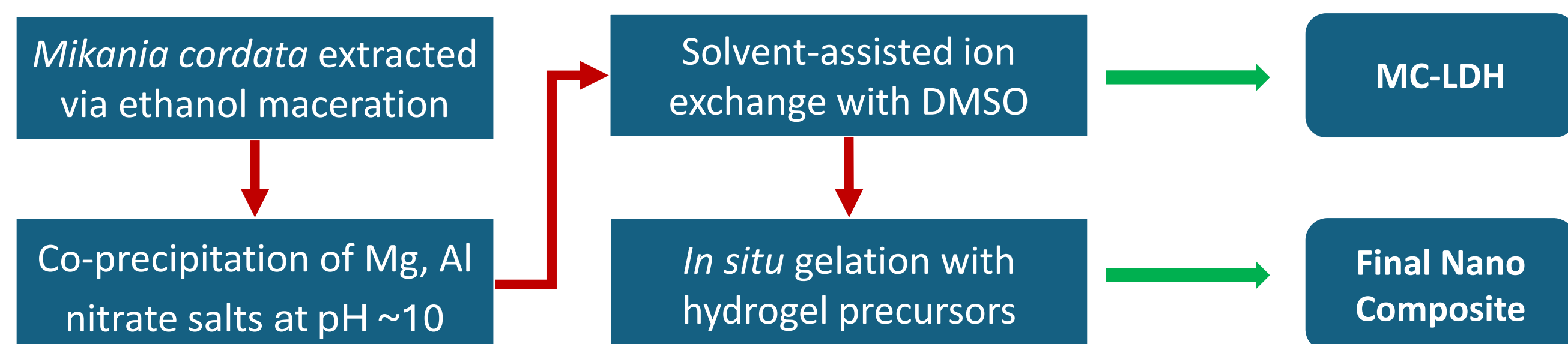


Fig. 4: Overview of the MC-LDH incorporated hydrogel nanocomposite synthesis

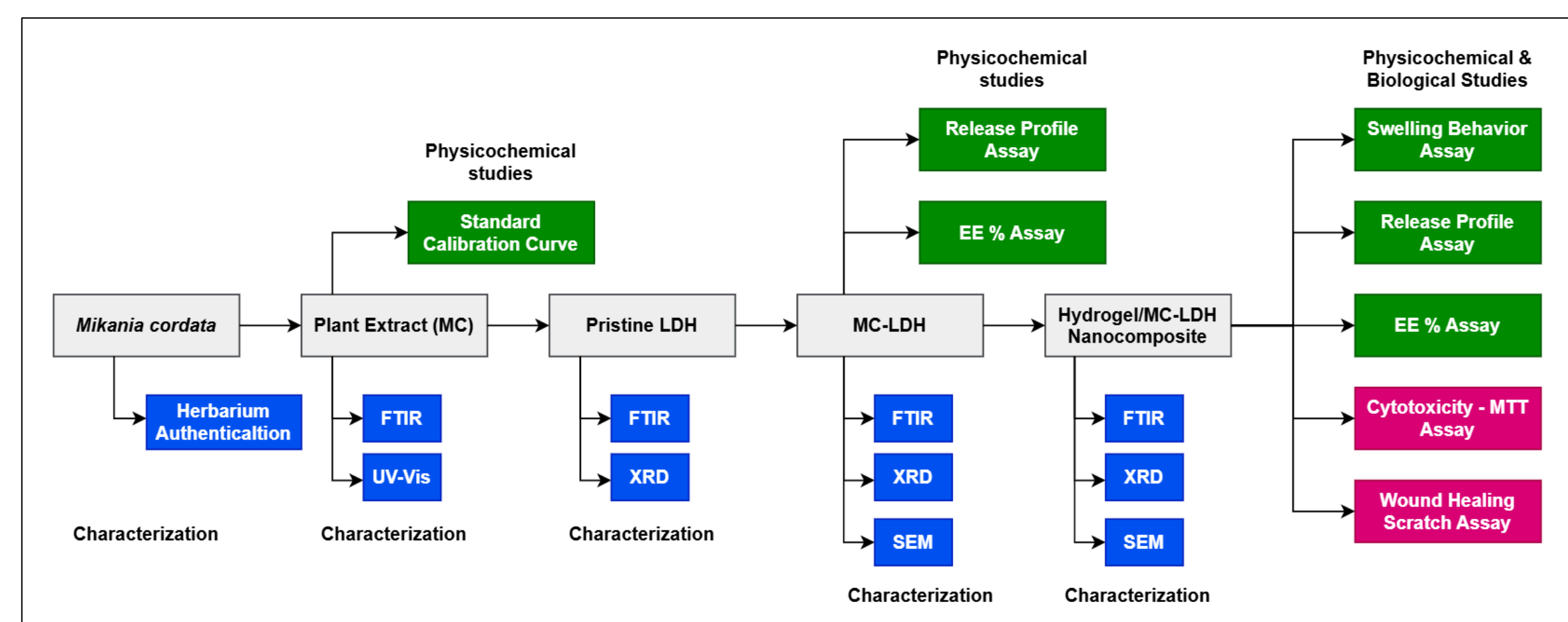


Fig. 5: Overview of the synthesis, characterization, and application studies

Results and Discussion

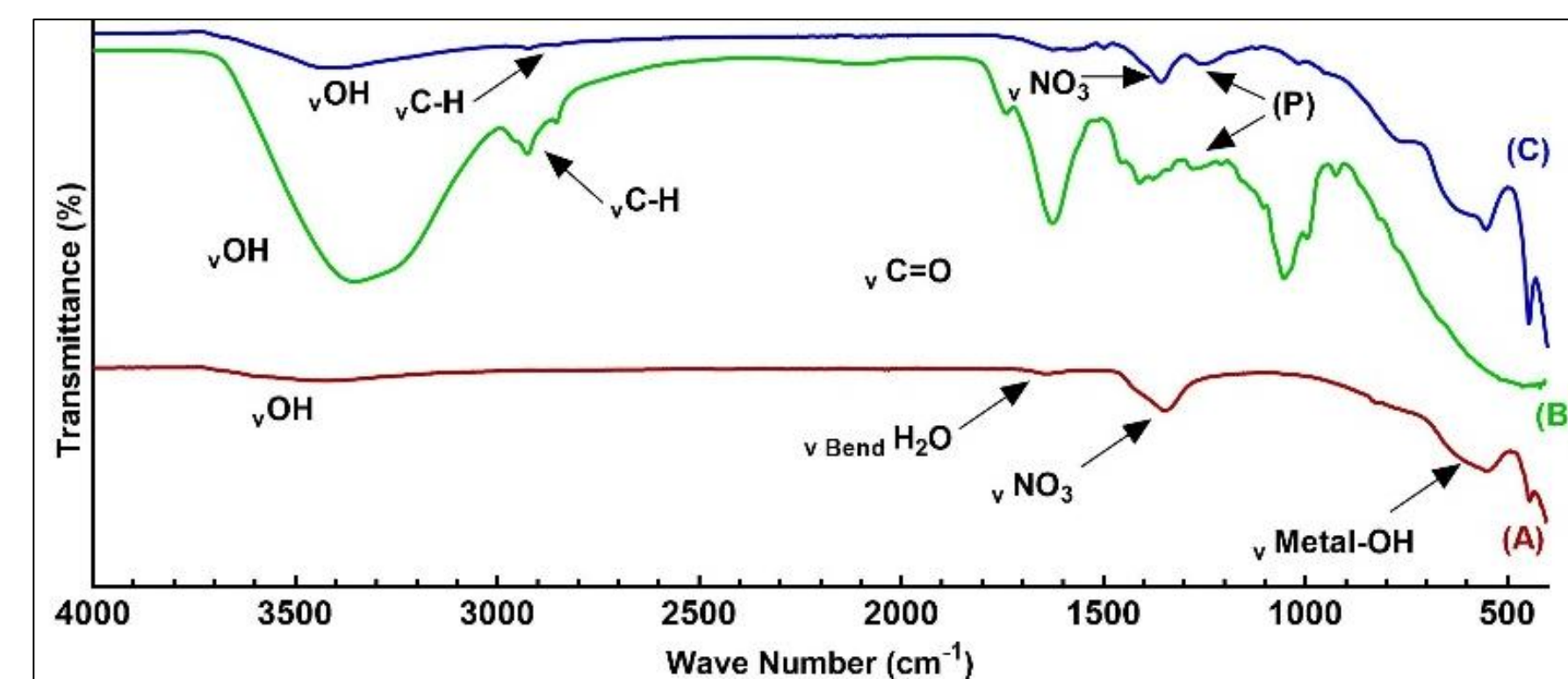


Fig. 6: FTIR spectra of pristine LDH (A), plant extract (B), and MC-LDH (C)

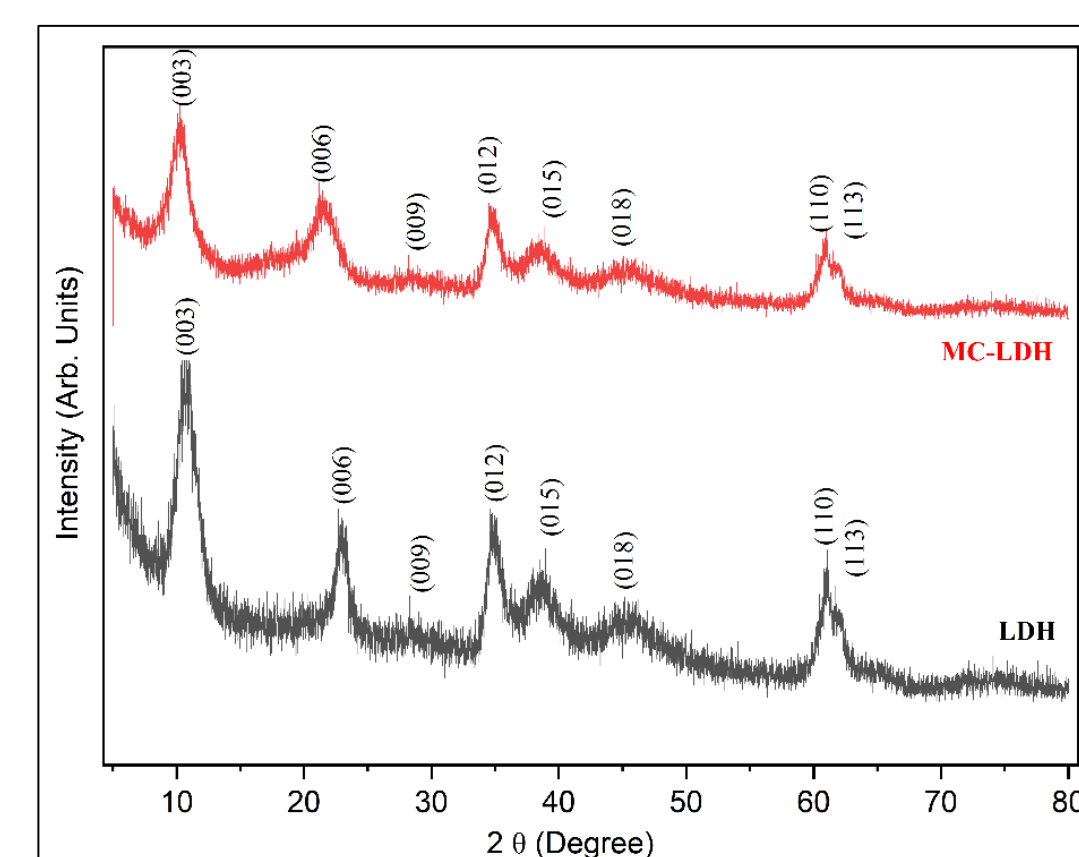


Fig. 7: PXRD spectra of pristine LDH and MC-LDH

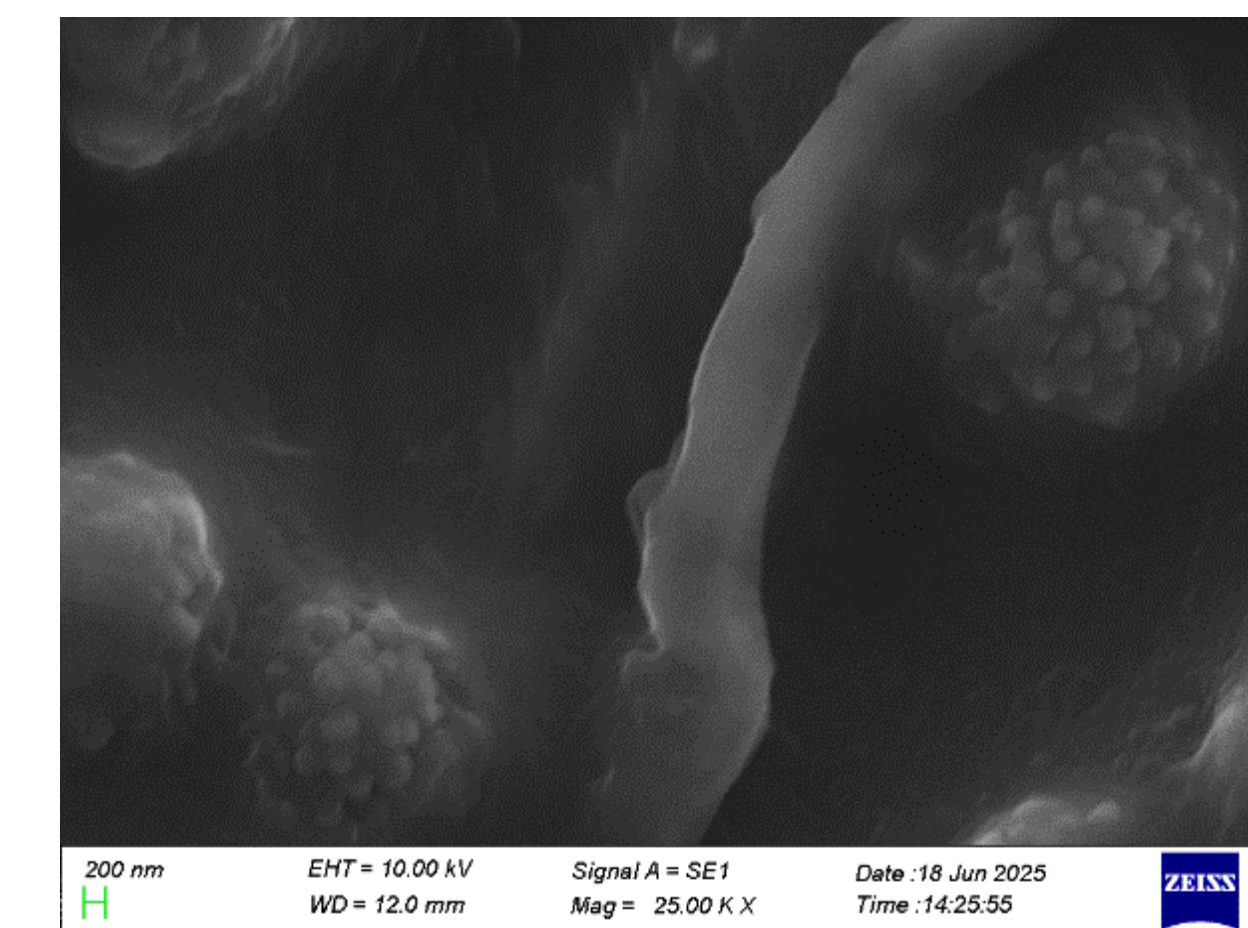


Fig. 8: SEM images of the hydrogel (200 nm Scale)

FTIR, PXRD, SEM, EDX Confirm:

- Phytoconstituent retention
- Intact LDH framework
- Nano range morphology
- Hydrogel porosity
- LDH purity

Encapsulation efficiencies:

- LDH - 81.36% | HG - 72.58%

Swelling capacity – 162%

Release profile:

- In 3 hours, hydrogel – 70% & MC-LDH – 95%

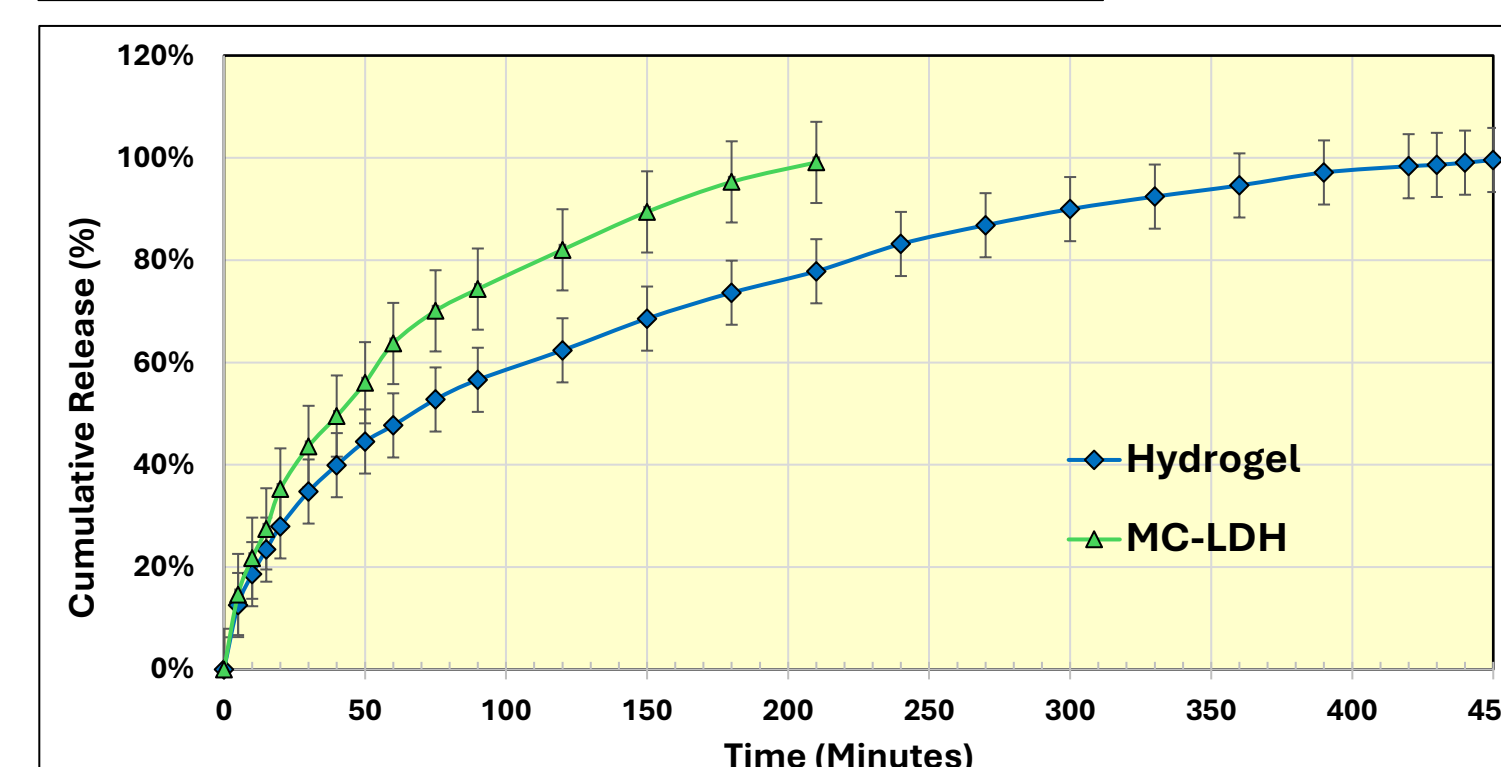


Fig. 9: Release profile of MC-LDH and hydrogel

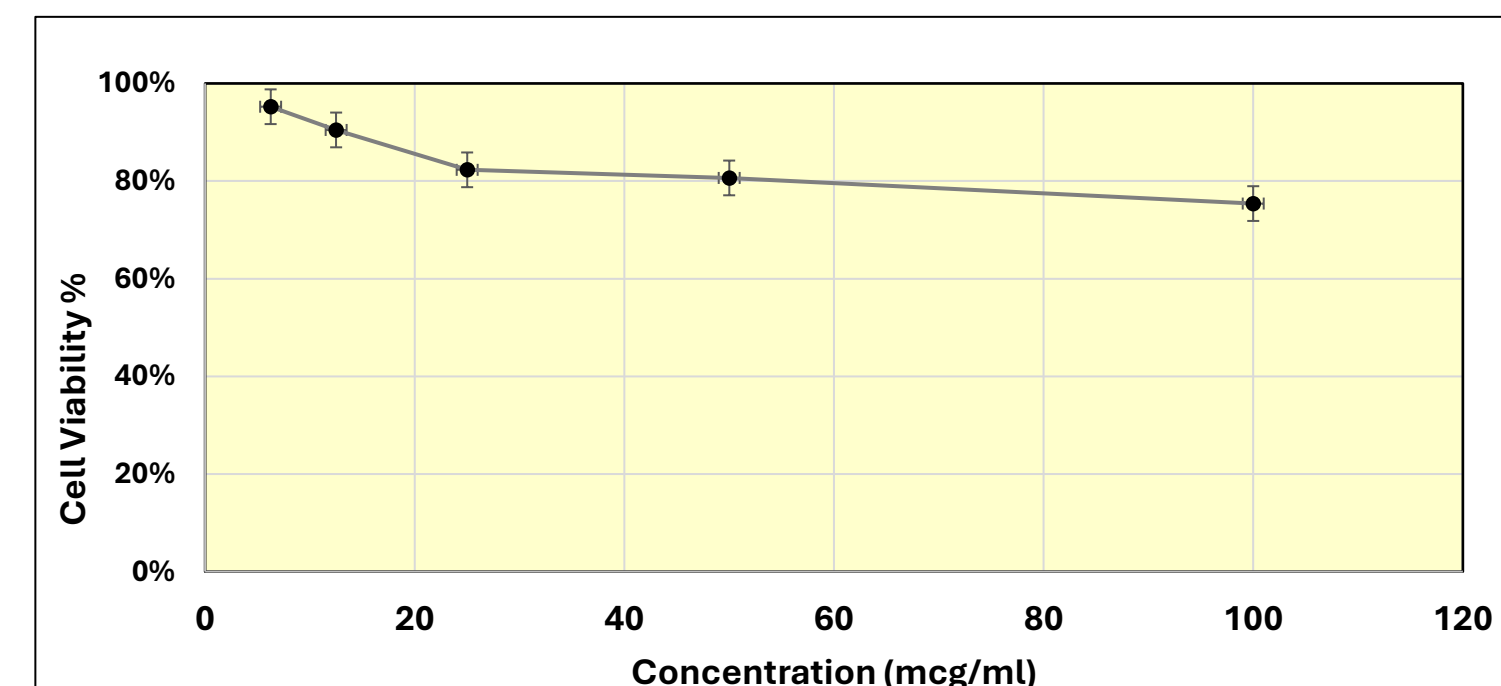


Fig. 10: Cell viability (Hydrogel NC)

MTT assays – Over 90% cell viability in Vero cells at lower hydrogel concentrations.

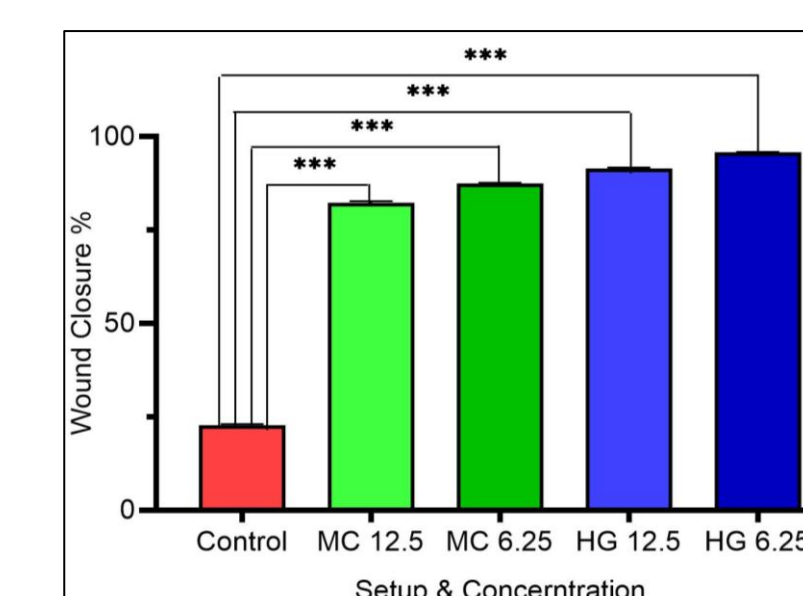


Fig. 11: Wound closure % at 24h

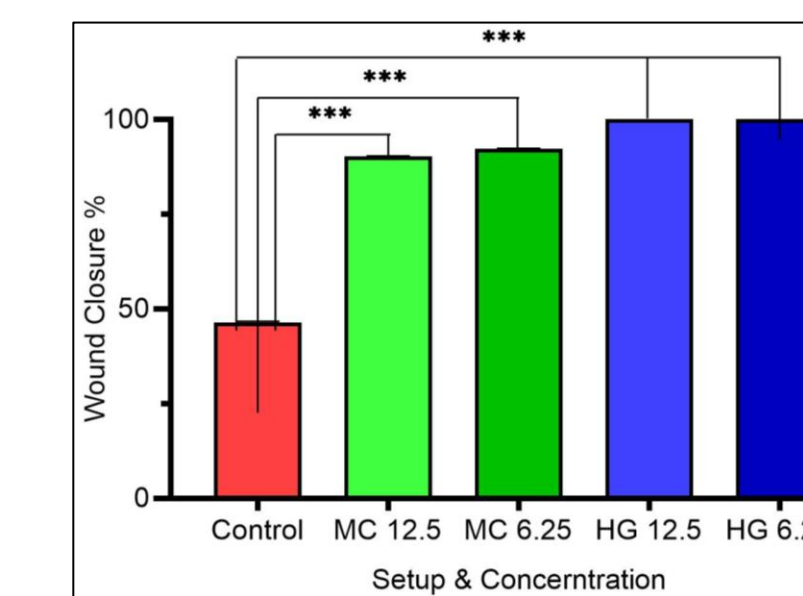


Fig. 12: Wound closure % at 48h

Hydrogel: 24 h – 95.75% | 48h – 100%

Control: 24 h – 22.78% | 48h – 46.42% (1% serum media)

Conclusions

Dual-carrier system:

- LDH – Controlled release
- CMC–PEG hydrogel – Biocompatible secondary reservoir.

Successful encapsulation & retention

Favorable performance:

- High water uptake | Prolonged release | Safety in MTT assays

Superior wound healing

Future Work

Translational research – Animal models

- Immune response | Wound-site retention | Real-tissue performance

Complementary extracts – For multifaceted activities.

Varied crosslinkers – Hydrogel strength/flexibility

Develop stimuli-responsive systems:

- Wound pH | Temperature | Specific enzymes

Acknowledgement

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References

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