Mucoadhesive polymer coated MXene as a carrier for the delivery of antimicrobial drugs

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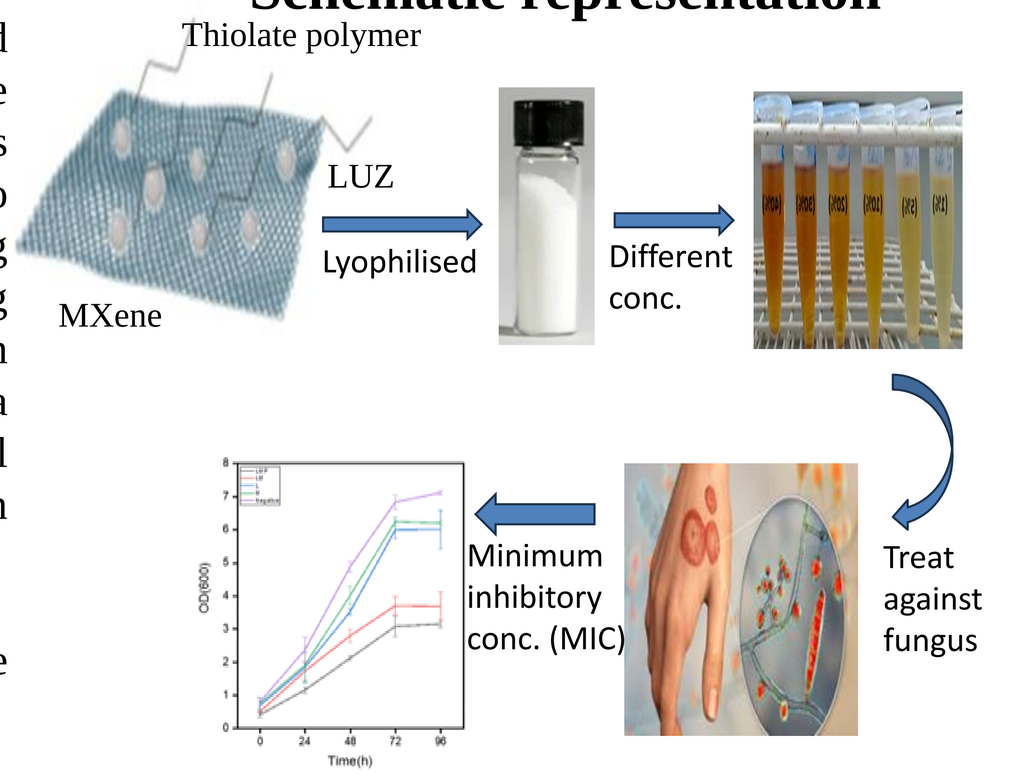
Introduction

MXene are a group of two-dimensional (2D) transition metal carbides and carbonitriles. Inherently hydrophilic mainly due to the presence of surface terminating groups. Widely used in drug delivery, and bioimaging due to its remarkable biocompatibility and outstanding antimicrobial properties. To enhance drug stability, skin permeation, and effectiveness, antifungal drug were encapsulated within MXene nanocarriers. Due to its drug loading capacity MXene carry high amount of drug at target site. To facilitate skin adhesion, these drug-loaded MXene nanocarriers were further coated with a mucoadhesive polymer. Sulphur-containing amino acids within epithelial cells formed robust di-sulphide bonds with mucoadhesive pullulan polymers, resulting in strong adhesion.

Objectives

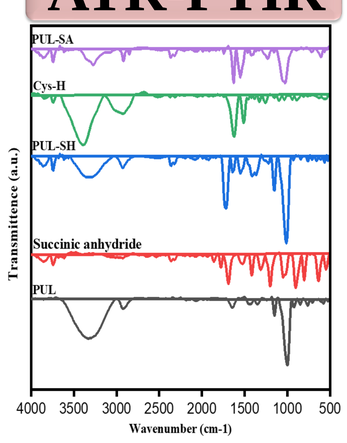
- ❑ Preparation of LUZ loaded MXene formulation for enhancing the antimicrobial activity.
- ❑ Characterization of P-LUZ@MXene formulation.
- ❑ Preparation of thiolate polymer for enhancing the adhesive properties of LUZ@MXene formulation.

Schematic representation

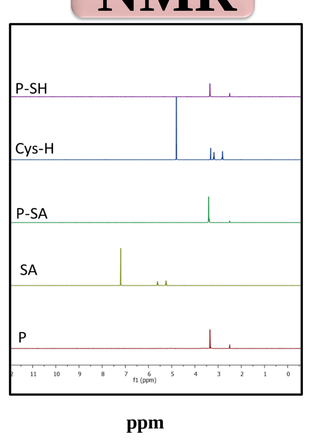


Results

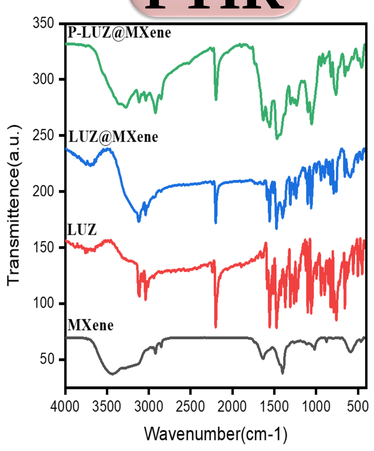
ATR-FTIR



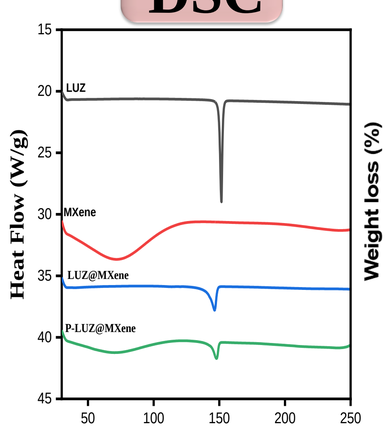
NMR



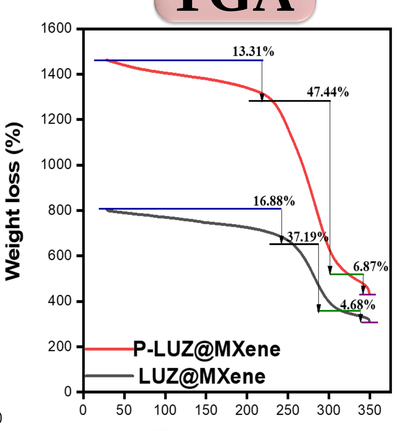
FTIR



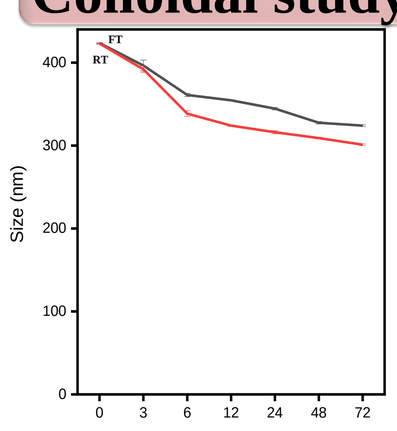
DSC



TGA



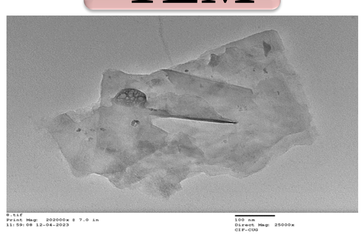
Colloidal study



PSA

Formulation	Particle size(nm)	PDI
MXene	253± 9.8	0.669±0.166
LUZ@MXene	389 ±11.8	0.718±0.087
P-LUZ@MXene	412.6± 25.4	0.831±0.152

TEM



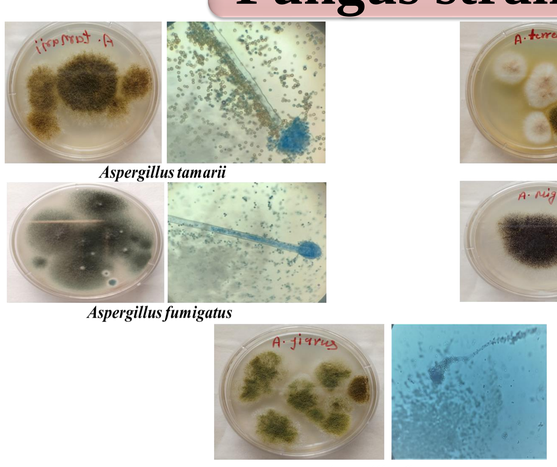
Thiol content

Sample Name	Thiol content (µM)
P-SH	26.61

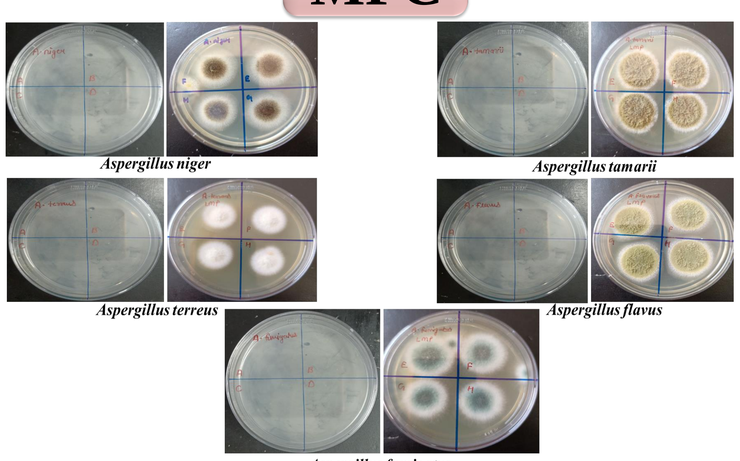
Elemental analysis

Sample Name	C%	H%	N%	S%
P	38.75	6.69	-	-
P-SH	43.85	5.53	6.50	4.60

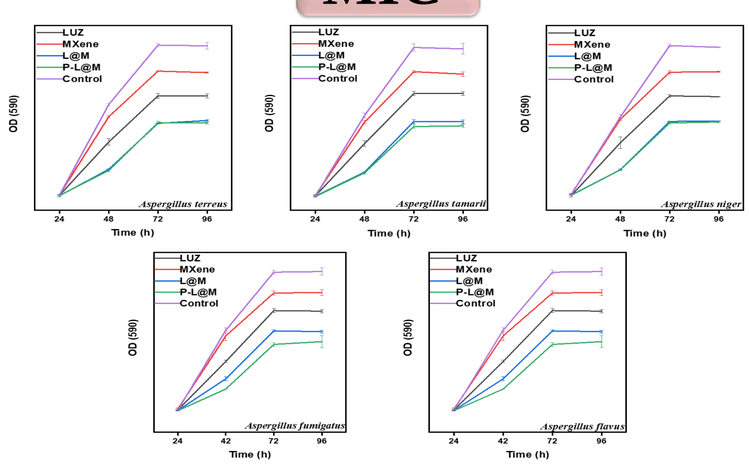
Fungus strains



MFC



MIC



Conclusions

- ❑ Successfully synthesised P-LUZ@MXene formulation.
- ❑ Enhanced adhesive properties of P-LUZ@MXene formulation.
- ❑ Enhanced antimicrobial activity of final formulation compared to bare drug.

References

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