Mesoporous Silica Nanostars for Rifampicin Delivery: Toward Damage-State-Selective Activation

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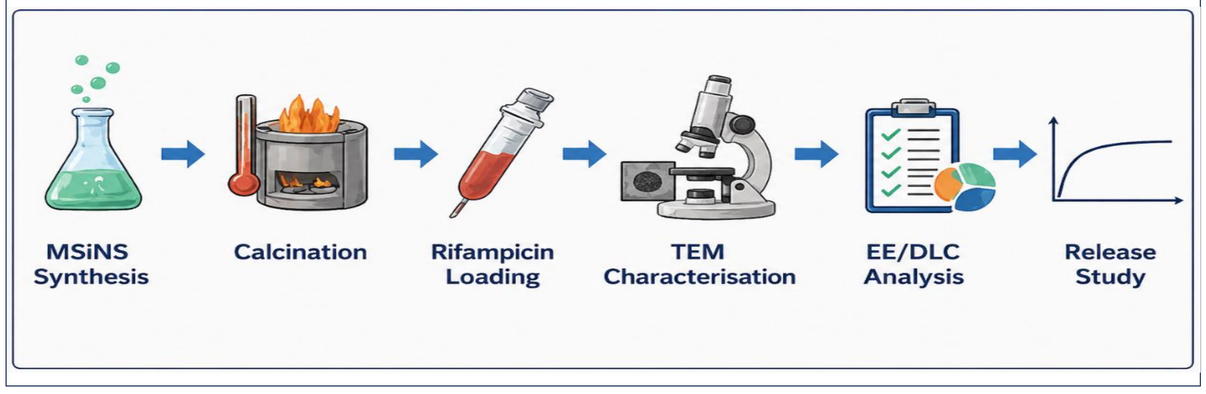
91% Encapsulation Efficiency Achieved

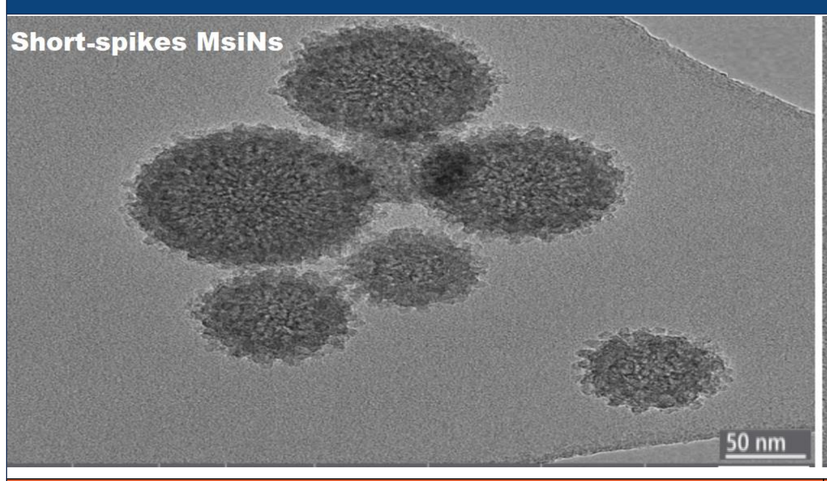
Background & Objective

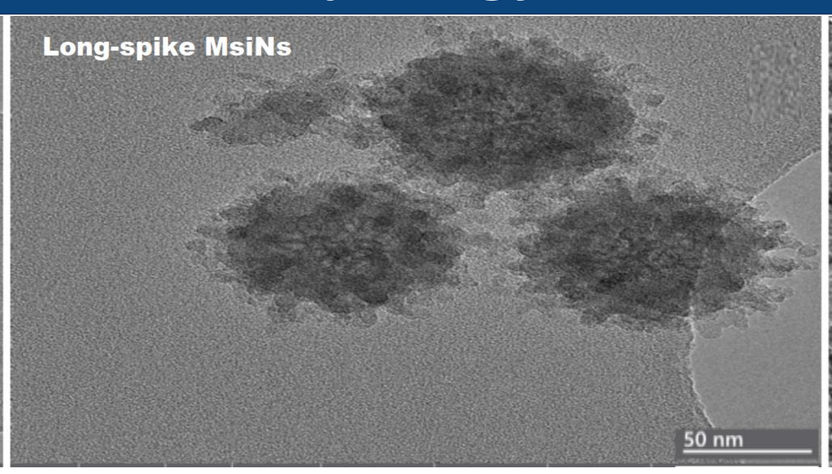
- Rifampicin efficacy is limited by poor tissue penetration and systemic toxicity.
- Conventional nanocarriers improve localisation but lack selective activation.
- **MSiNS** may provide a platform for future damage-responsive drug delivery.

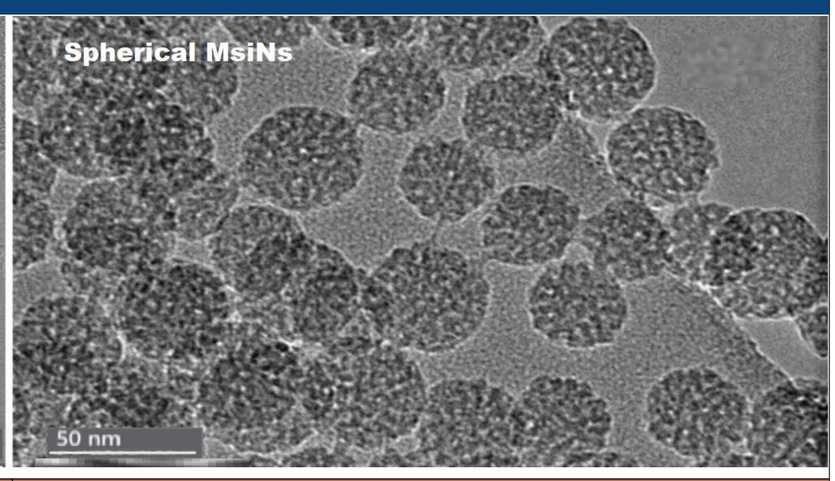
Methods



Result 1 — Morphology & Particle Size



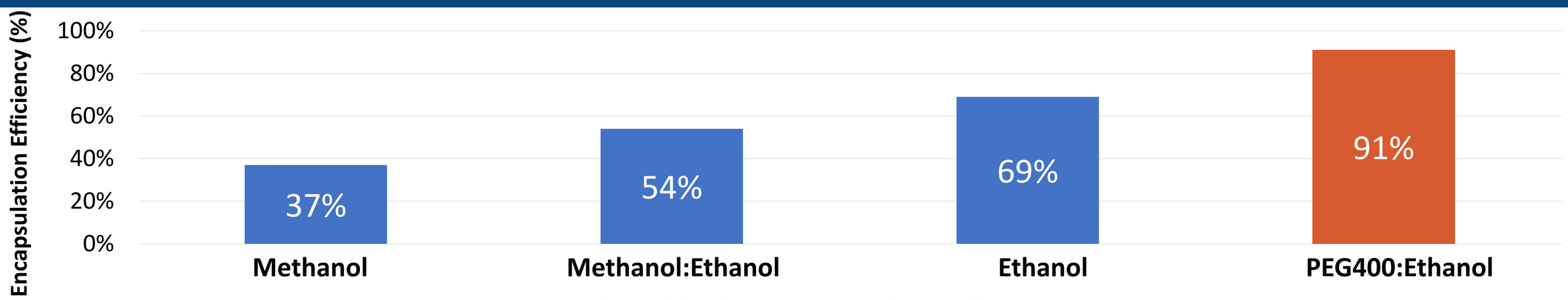




Particle Type	Core Diameter (nm)	Spike Length (nm)
Spherical MSNs	36.1 ± 3.2	N/A
Long-spike MSiNS	96.4 ± 7.5	19.8 ± 4.1
Short-spike MSiNS	83.2 ± 6.8	9.5 ± 2.3

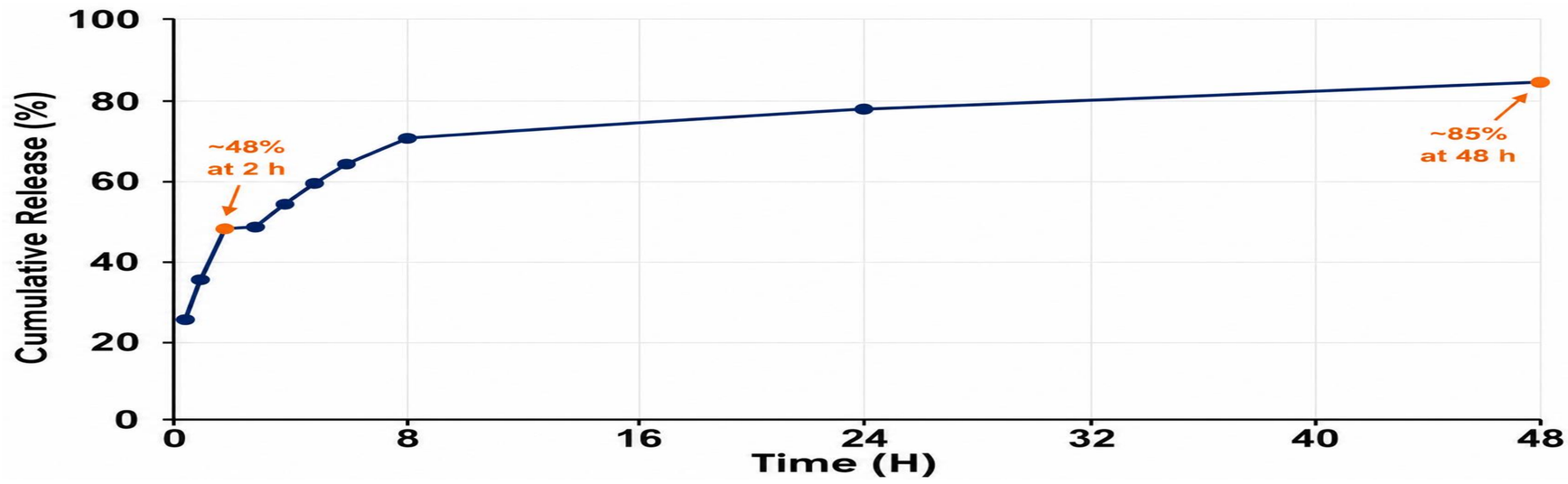
TEM analysis confirmed successful formation of short-spike, long-spike and spherical MSiNS morphologies.

Results 2 — Loading Efficiency



PEG400:EtOH achieved the highest encapsulation efficiency (91.1%).

Results 3 — In Vitro Release



Conclusion & Future Work

- **Long-spike MSiNS achieved up to 91.1% EE.**
- **Sustained rifampicin release reached ~85% after 48 h.**
- **MSiNS provide a promising platform for future damage-responsive drug delivery.**

CRS Controlled Release Society

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