EGFR-Targeted Mesoporous Silica Nanoparticles Enhance Docetaxel Efficacy in Prostate Cancer Cells

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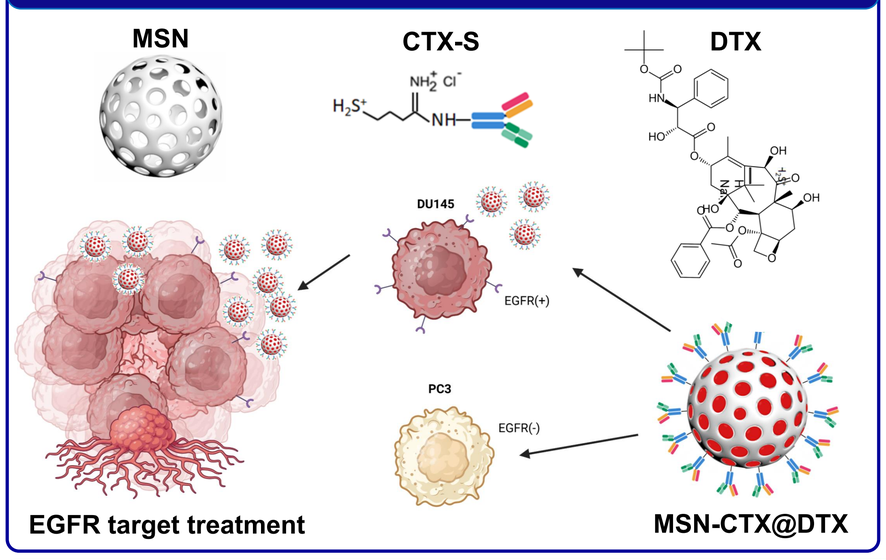
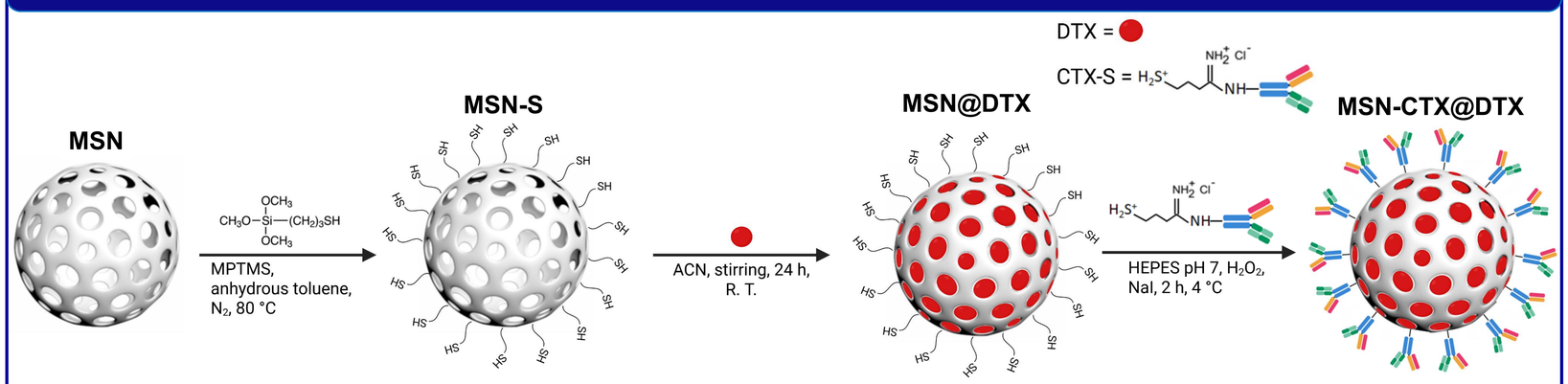
Background & Objetive

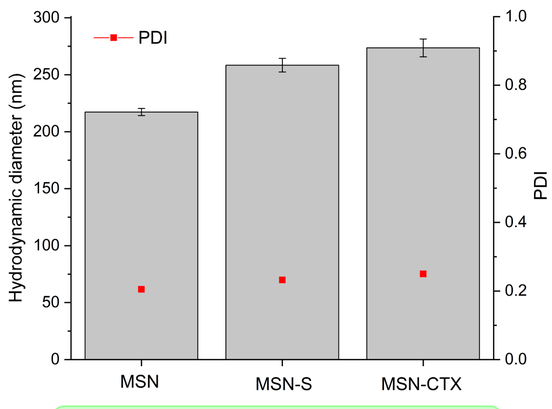


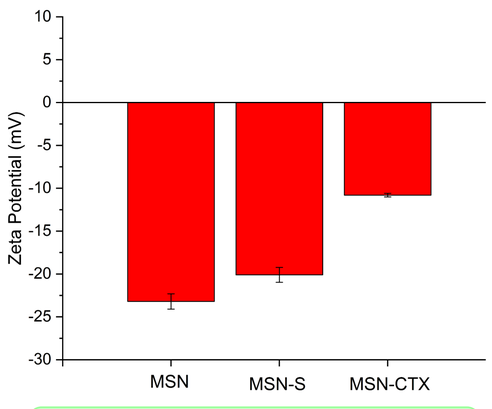
Methodology: Synthesis & Evaluation



Results & Discussion

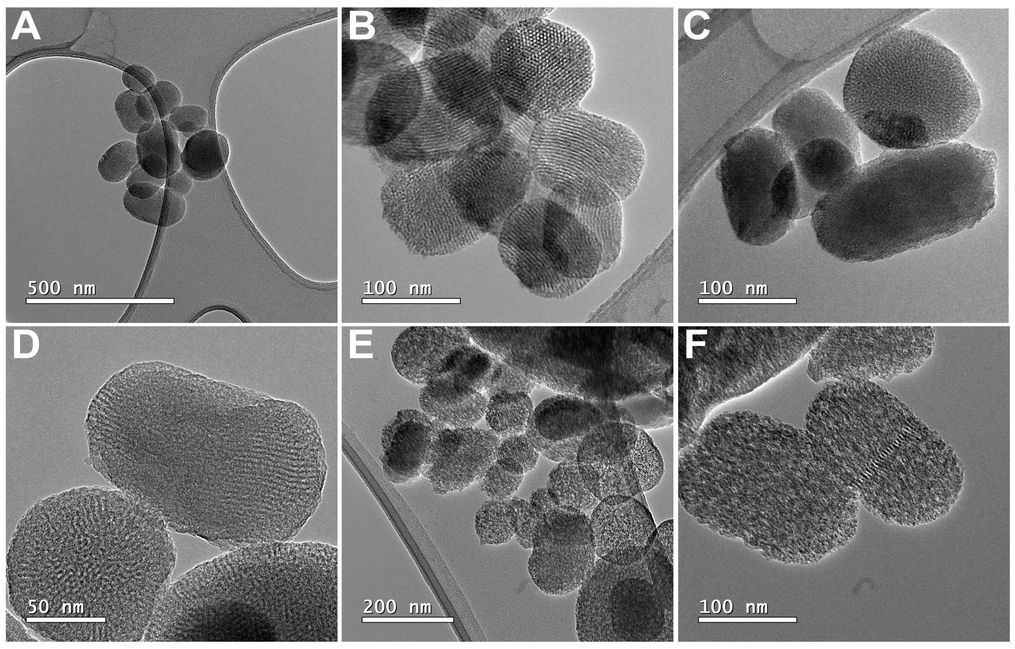
Physicochemical characterization





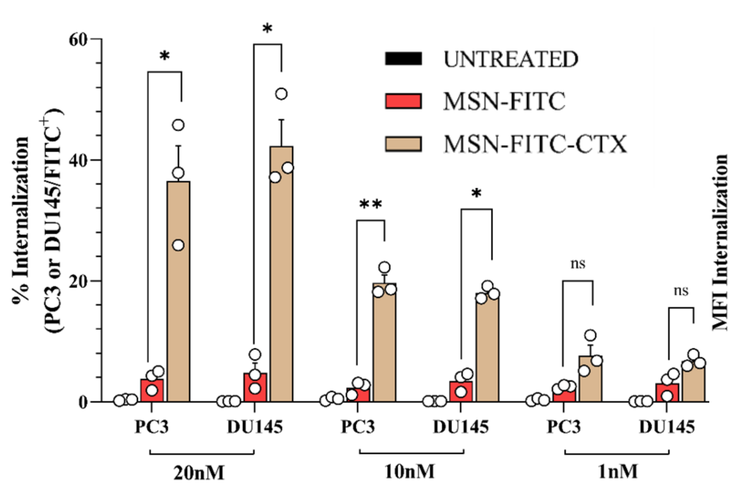
Sizes: 217-273 nm / **PDI** ≤ 0.25
Zeta potential: -23 to -11 mV

Encapsulation efficiency: 96%
Drug loading: up to 2.1% (w/w)

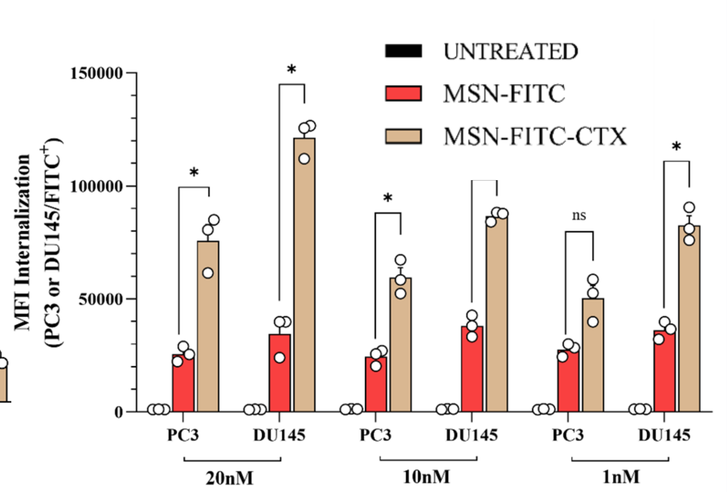


MSN (**A, B**), MSN@DTX (**C, D**), MSN-CTX@DTX (**E, F**)

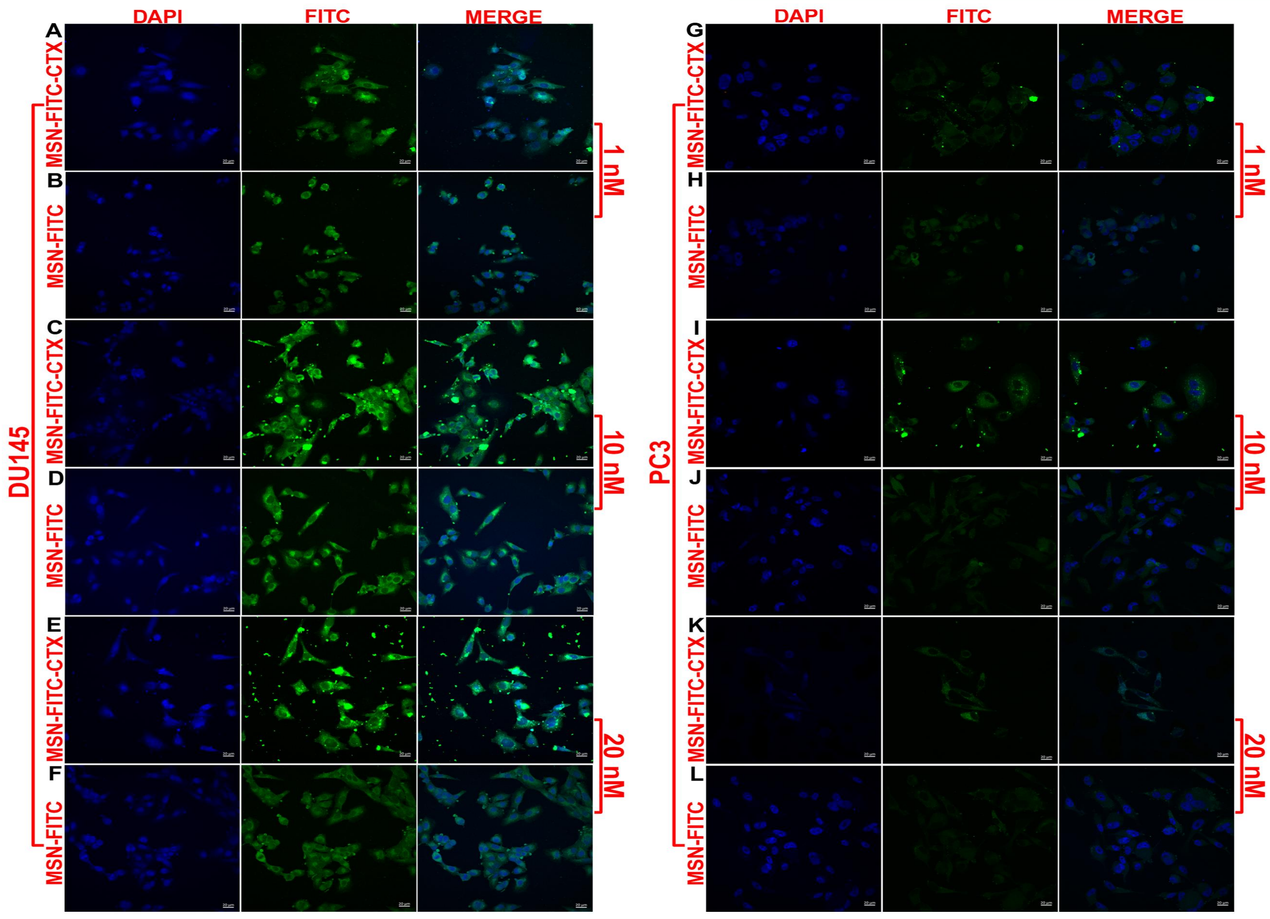
Celular internalization & Confocal microscopy



At 20 nm: FITC+ cells increased from 4.8% to 42.2% in DU145 and from 3.75% to36.5% in PC3, after CTX conjugation

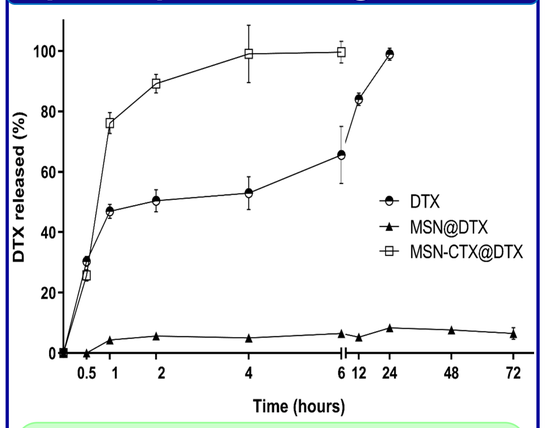


At 20 nm: MFI increased from 34,591 to 121,405 in DU145 and from 25,551 to75,683 in PC3



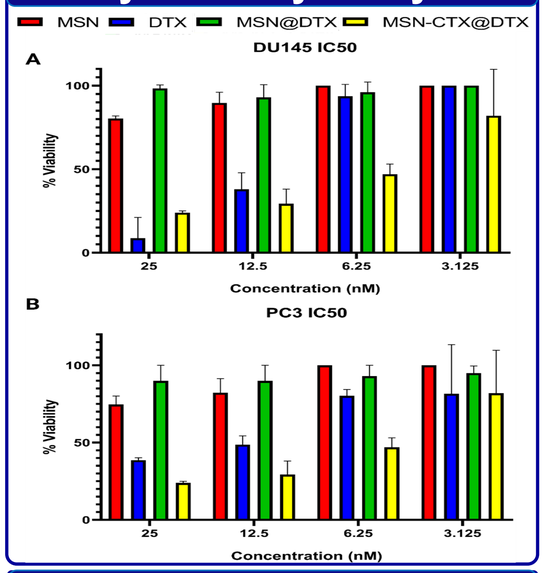
Dose-dependent, EGFR-mediated uptake with strong intracellular colocalization

pH-responsive drug release



~ 89% DTX release (**MSN-CTX@DTX**) in 2h at pH 5.4 vs. only **~7%** (**MSN@DTX**) after 72h

Cytotoxicity assays



DU145 (EGFR+)

MSN-CTX@DTX = 5.38 ± 1.54 nM
DTX = 11.33 ± 0.73 nM
MSN@DTX = 37.28 ± 0.33 nM

PC3 (EGFR-)

MSN-CTX@DTX = 15.64 ± 66.39 nM
DTX = 35.88 ± 1.55 nM
MSN@DTX = > 50 nM

EGFR expression drives higher cytotoxicity of MSN-CTX@DTX in DU145 cells

Conclusions

- ✓ CTX conjugation significantly enhanced cell internalization and cytotoxic efficacy of Docetaxel.
- ✓ Active EGFR targeting provied superior performance in EGFR-overexpressing DU145 cells.
- ✓ pH-responsive release ensured efficient drug delivery under tumor-mimicking conditions.
- ✓ This strategy overcomes Key limitations fo conventional DTX therapy and reinforces antibody-guided nanomedicine.
- ✓ Future studies will address in vivo validation, safety, immugenicity and combination therapies.

Acknowledgements

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