A Light-Responsive Release Platform by Controlling the Wetting Behavior of Hydrophobic Surface

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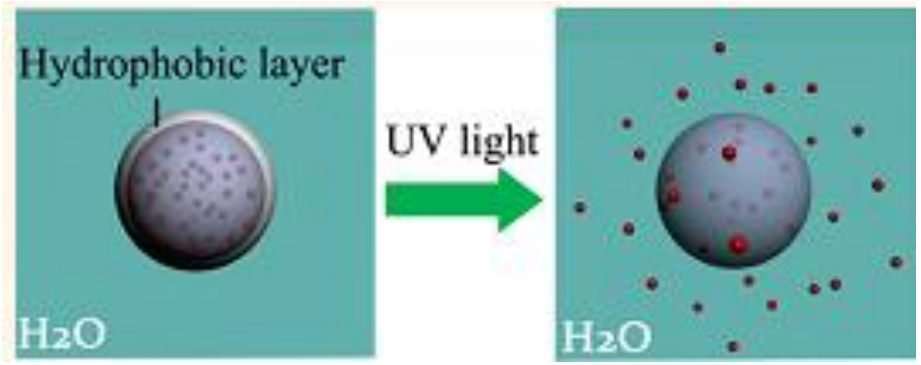
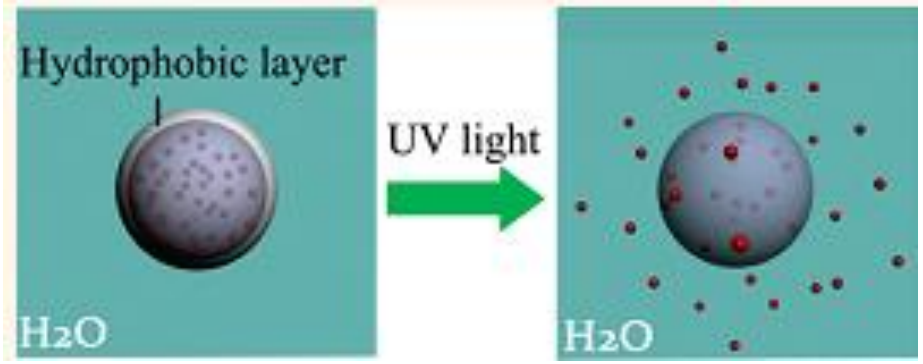
Outline

- Big Picture
- Applications
- Detailed Overview
- Experimental Results
- Conclusions

Big Picture

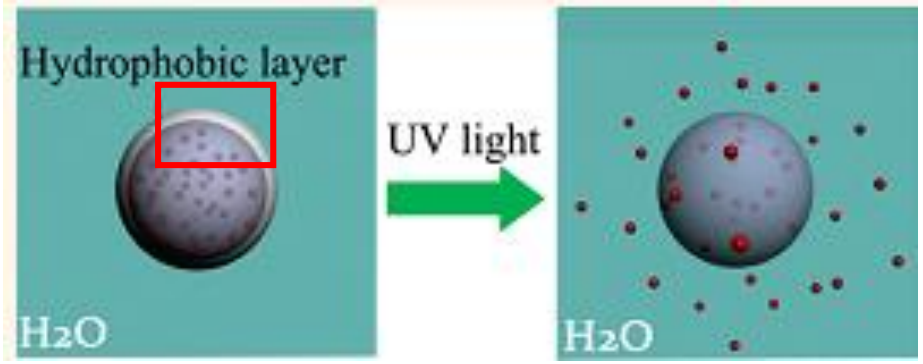


Applications



- Biomedical Applications
  - Therapeutics
  - Imaging
  - Diagnosis
- Previous Platform Designs:
  - Nanopistons
  - Polymers
  - Tunable hydrophobic polymers

Applications



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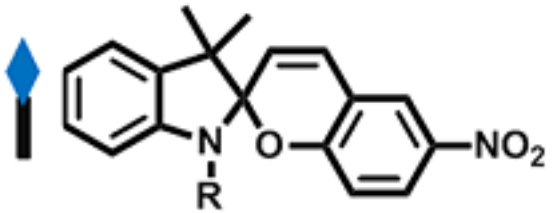
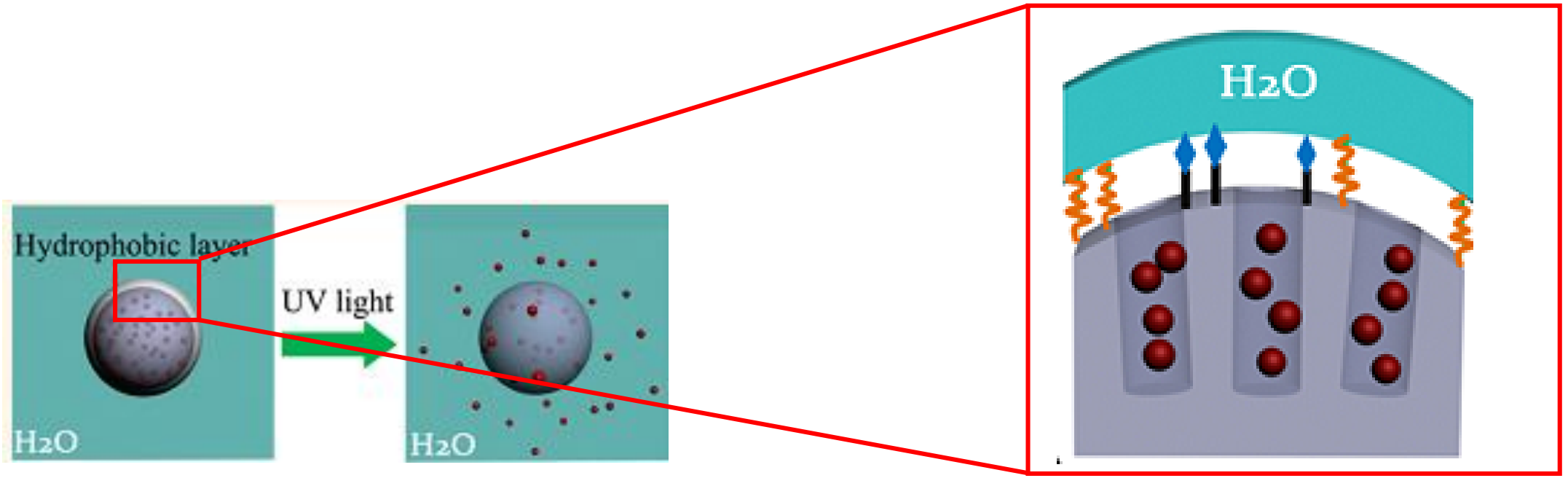
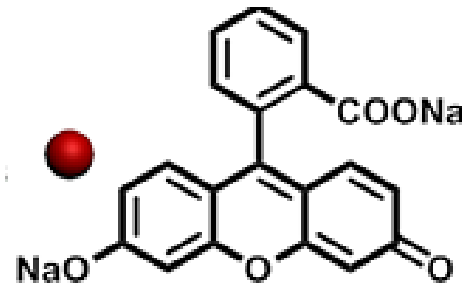
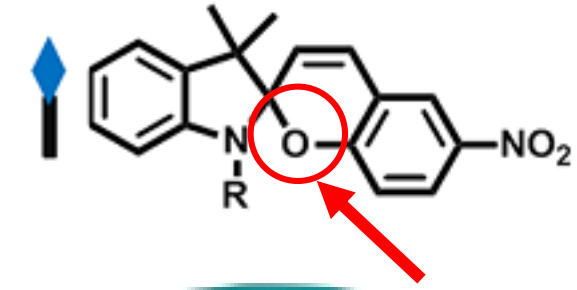
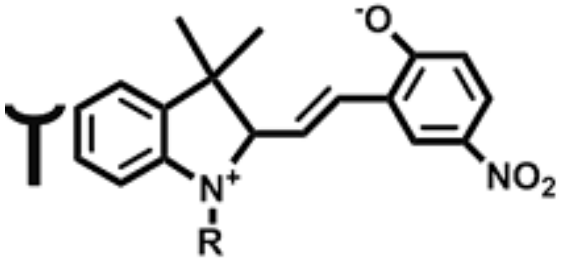

N
O
R
NO2

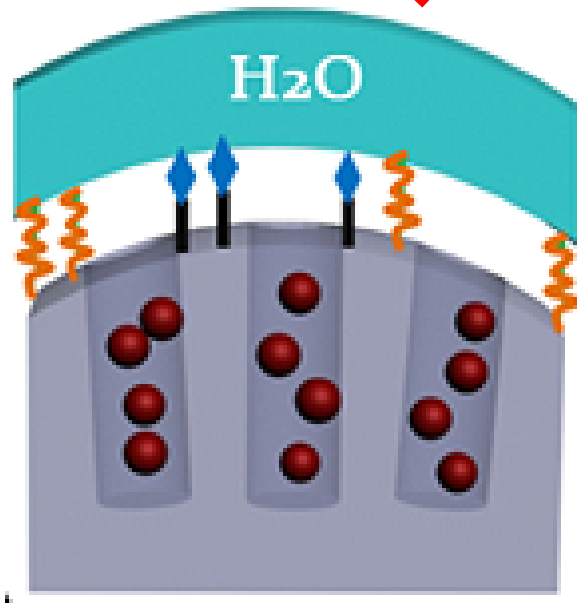

Hydrophobic layer
H2O
UV light
H2O
H2O


-Si(CH2)2(CF2)7CF3

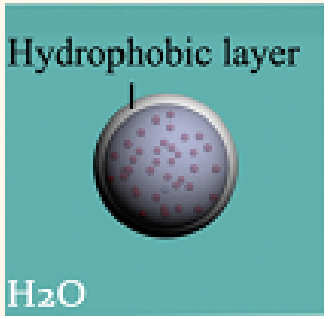

COONa
NaO
O
O

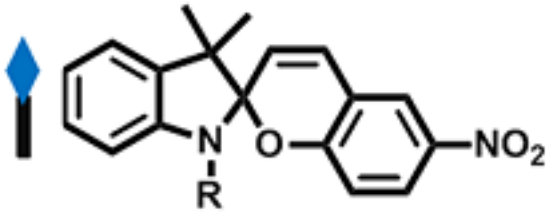


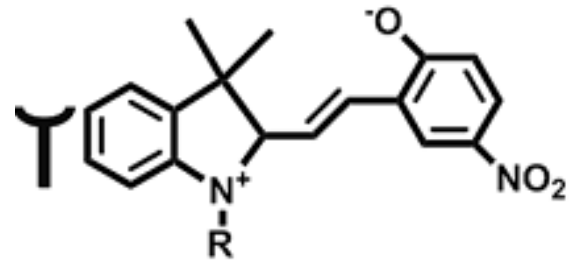


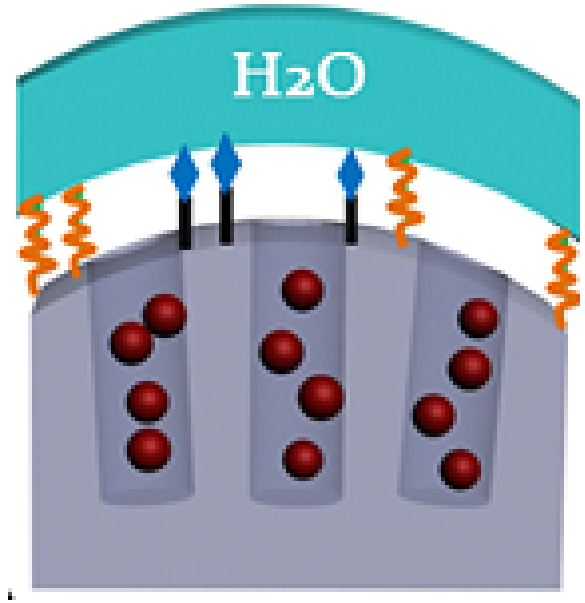


UV light

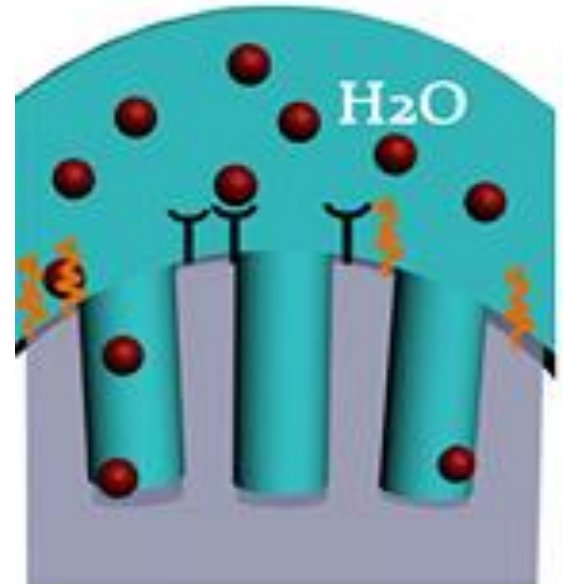


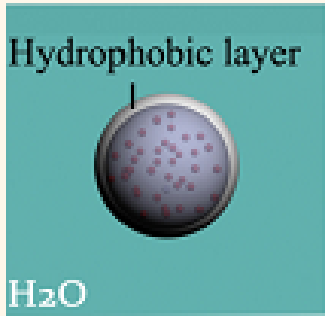


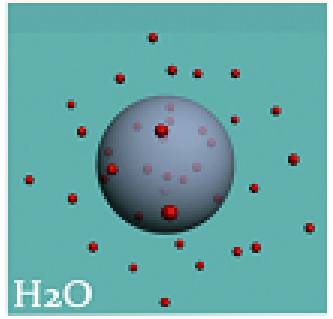




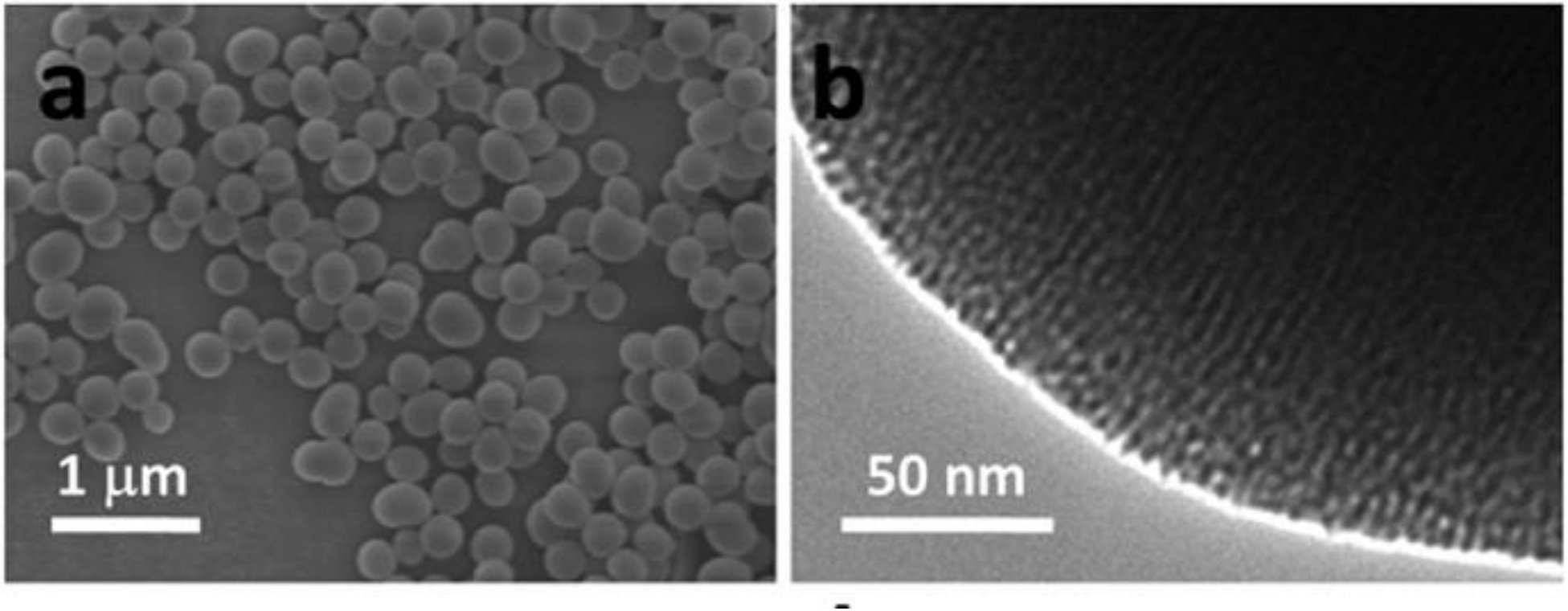
UV light



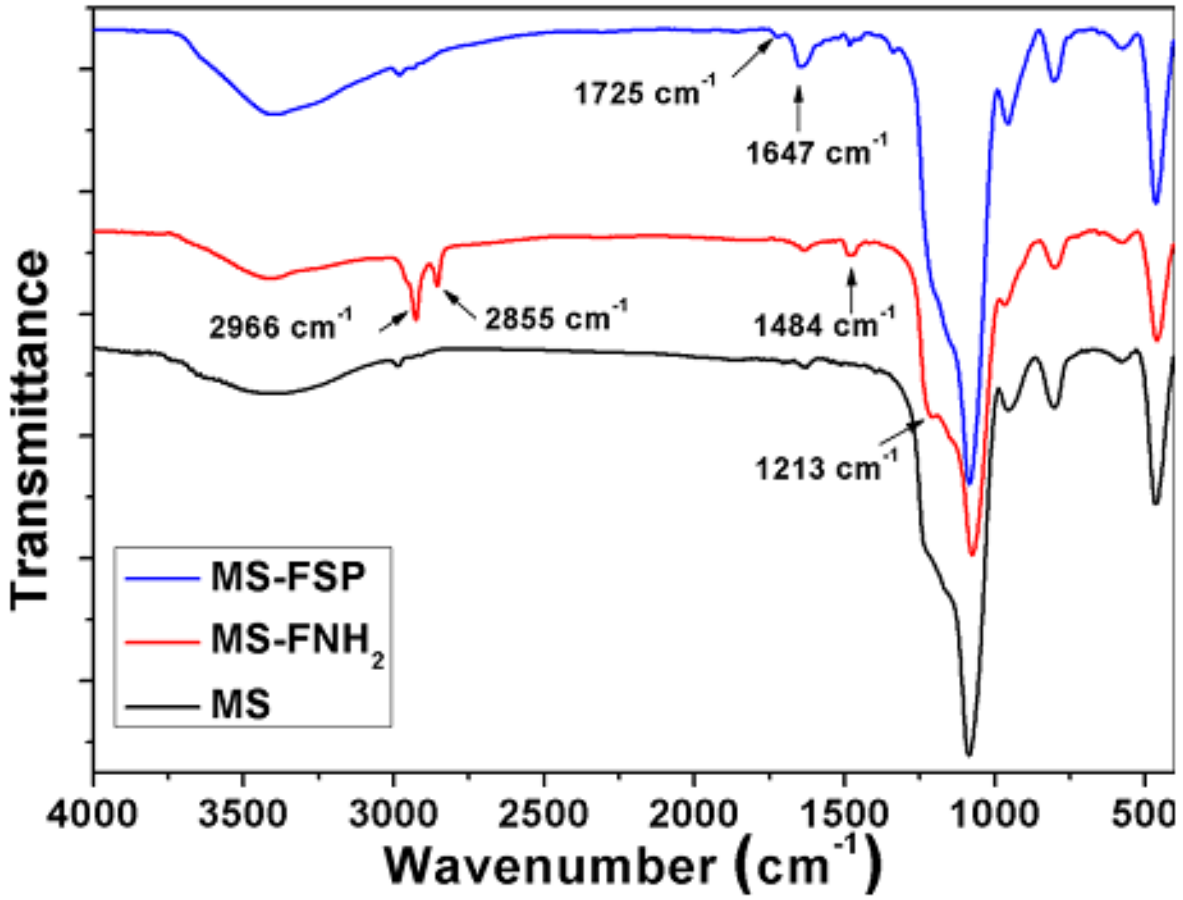




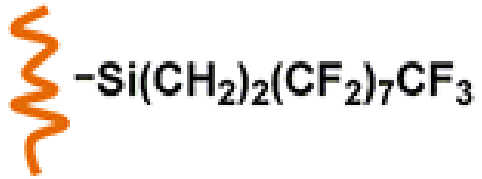
Characterization of MS



FTIR Characterization of Functionalized MS



- MS-FNH_2 (amine- and fluorinated silane-modified MS)
  - MS was treated with APTES PFTDES

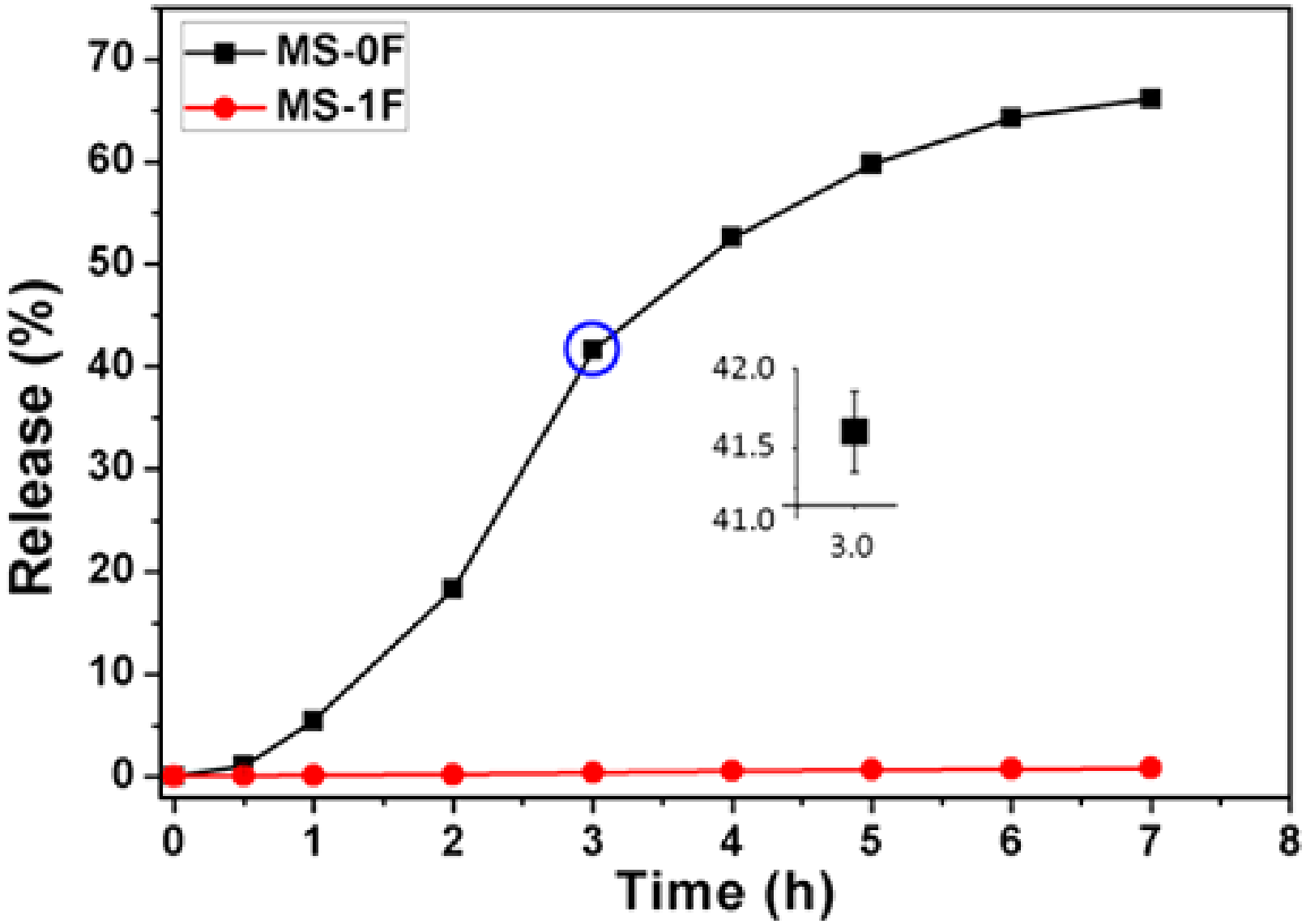


- MS-FSP = SP-COOH + MS-FNH_2

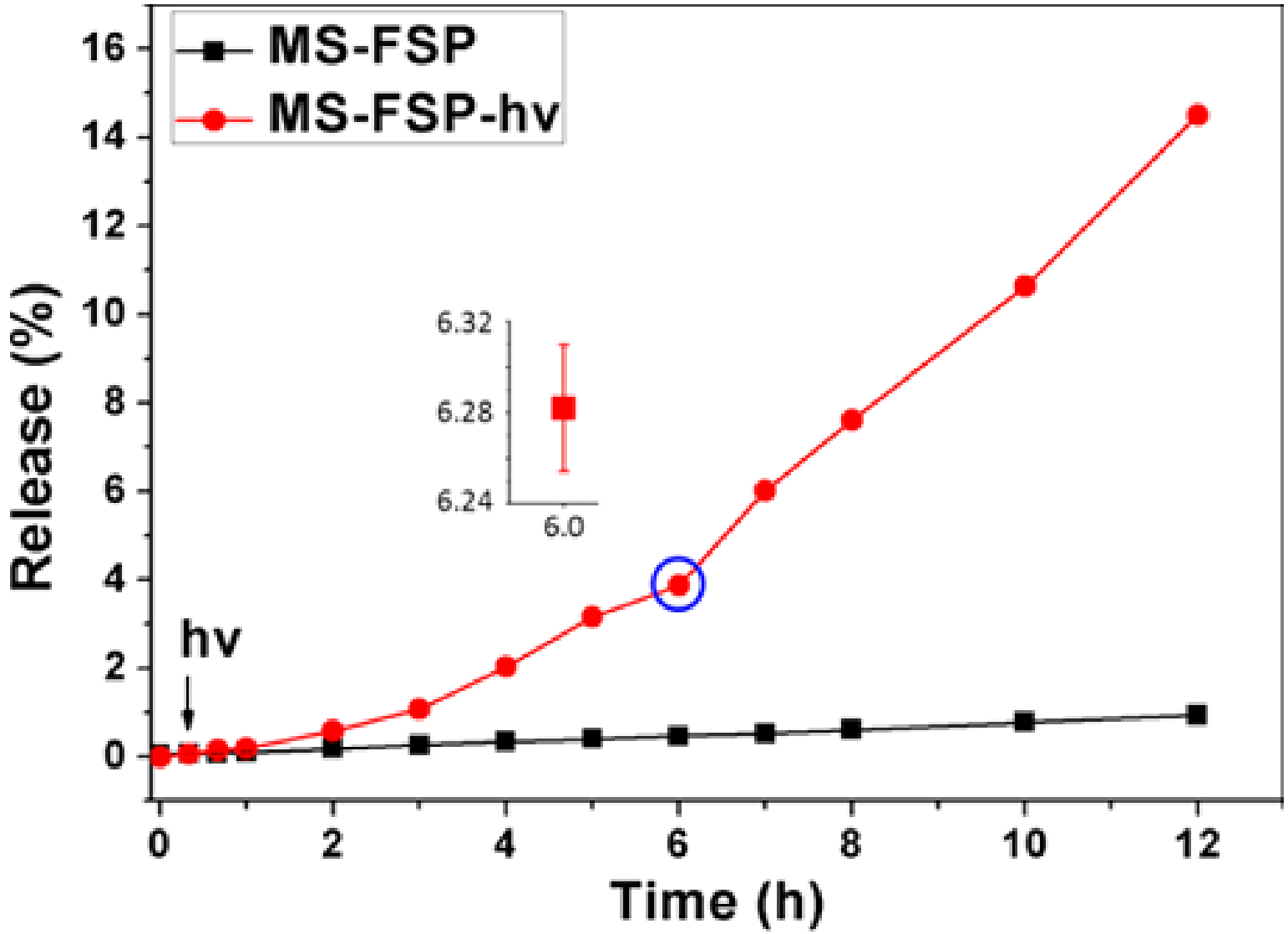
Loading the Cargo Molecule

- Fluorescein disodium (FD)
- Sonicate MS-FSP with FD in ethanol/water (8 hours)
- Centrifuge and wash with water
- Dry at 50°C under vacuum (24 hours)

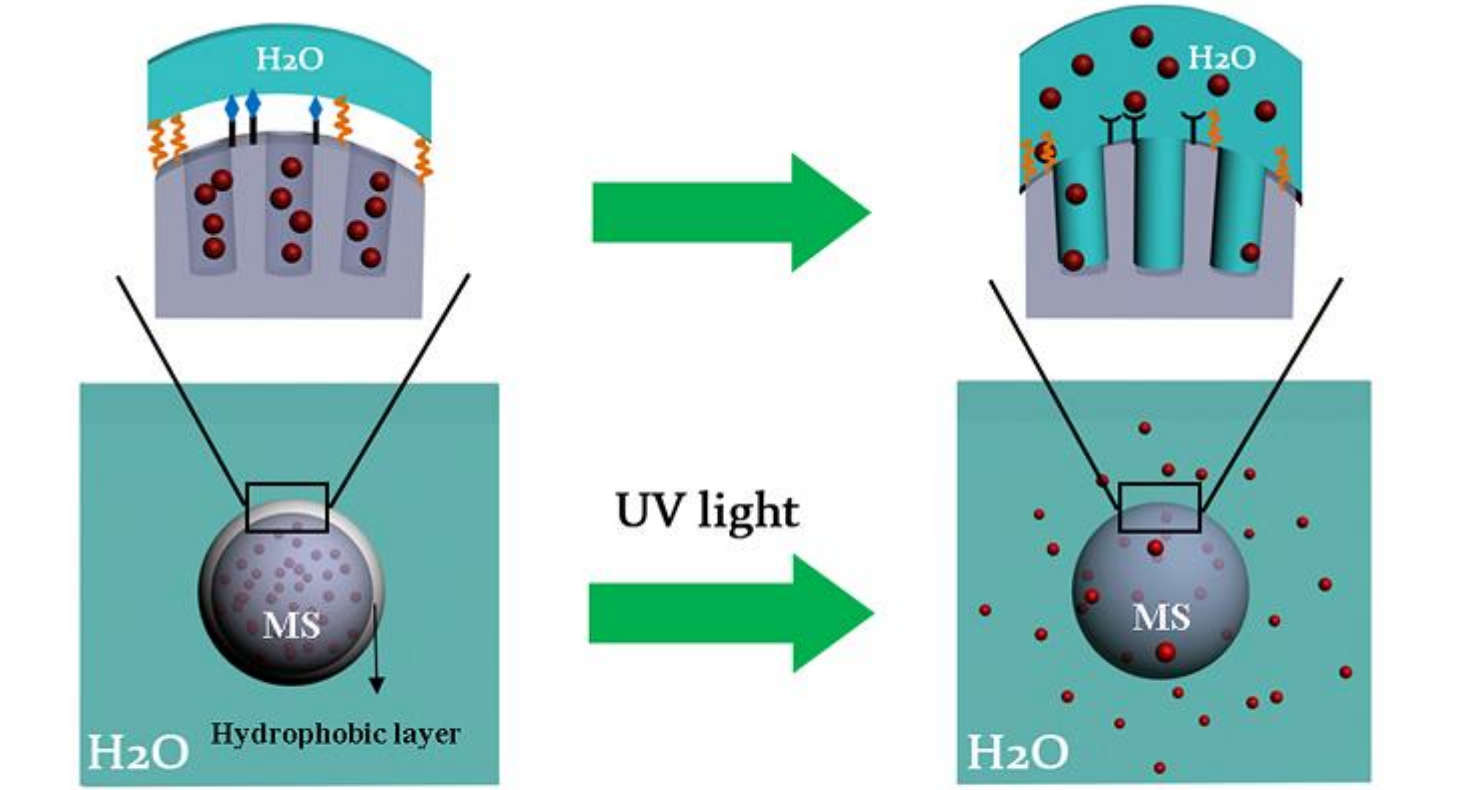
Hydrophobic/Hydrophilic Release Process



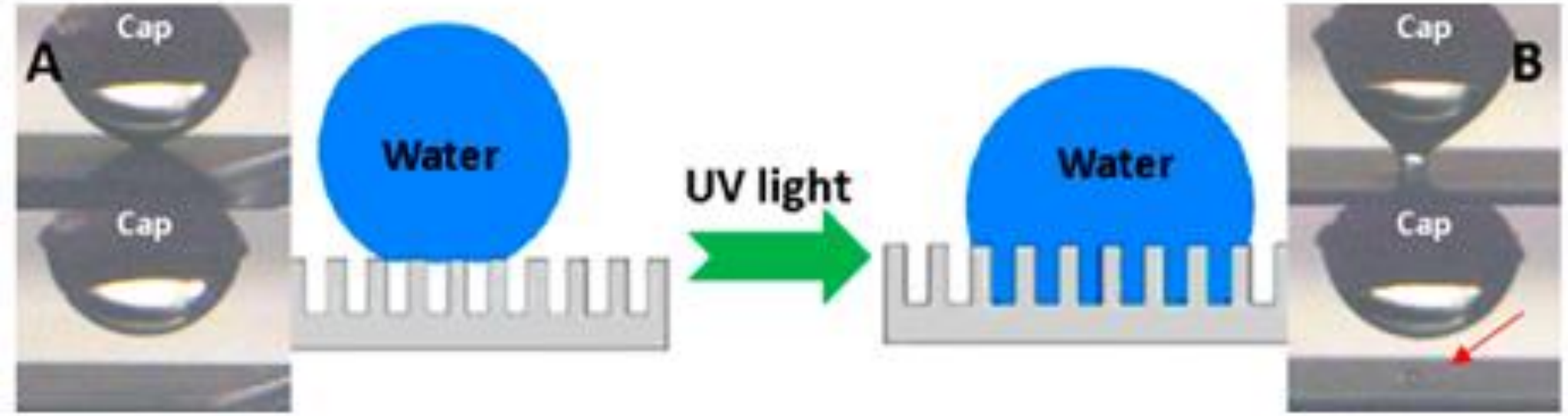
Fully Functionalized MS Under UV Irradiation



Proposed Model



Assessing the Surface Wettability



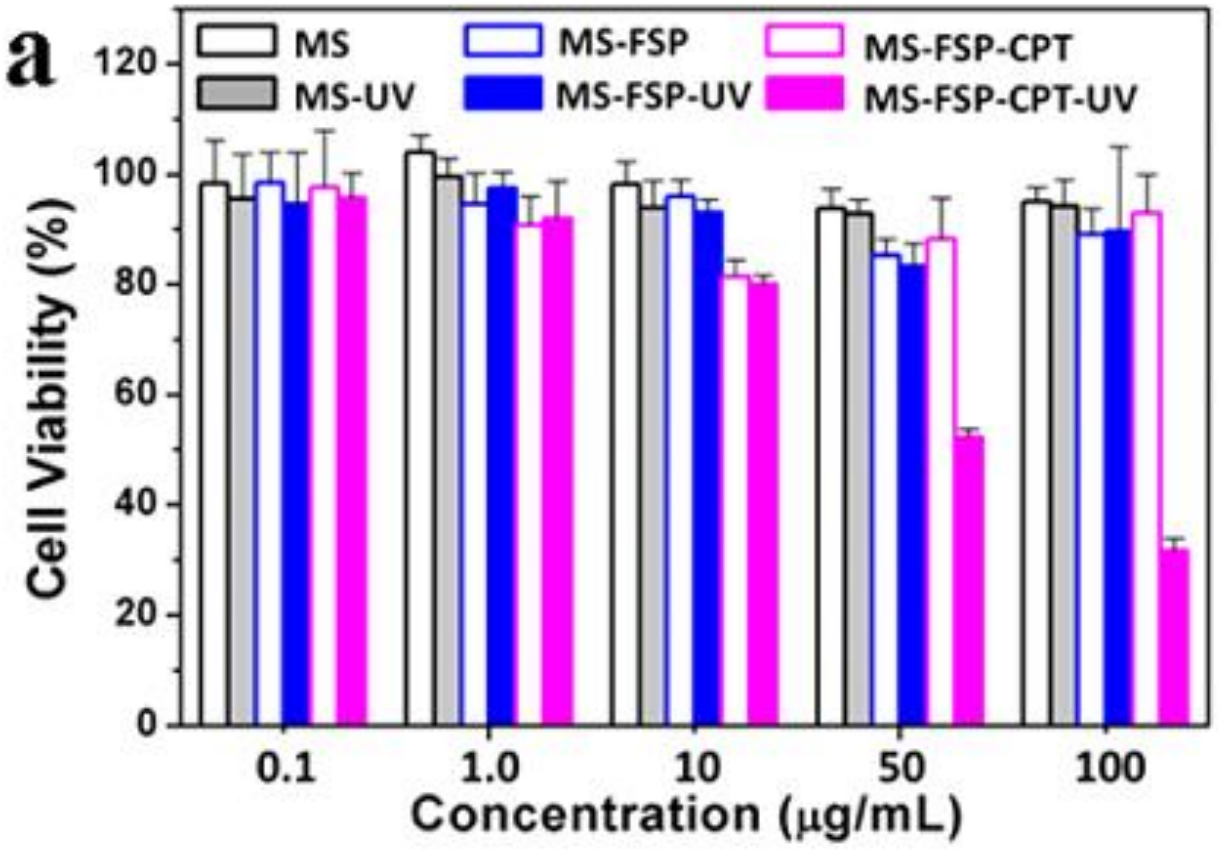
Low Water Adhesion: 39.0 ± 2.7µN

High Water Adhesion: 88.7 ± 13.1µN

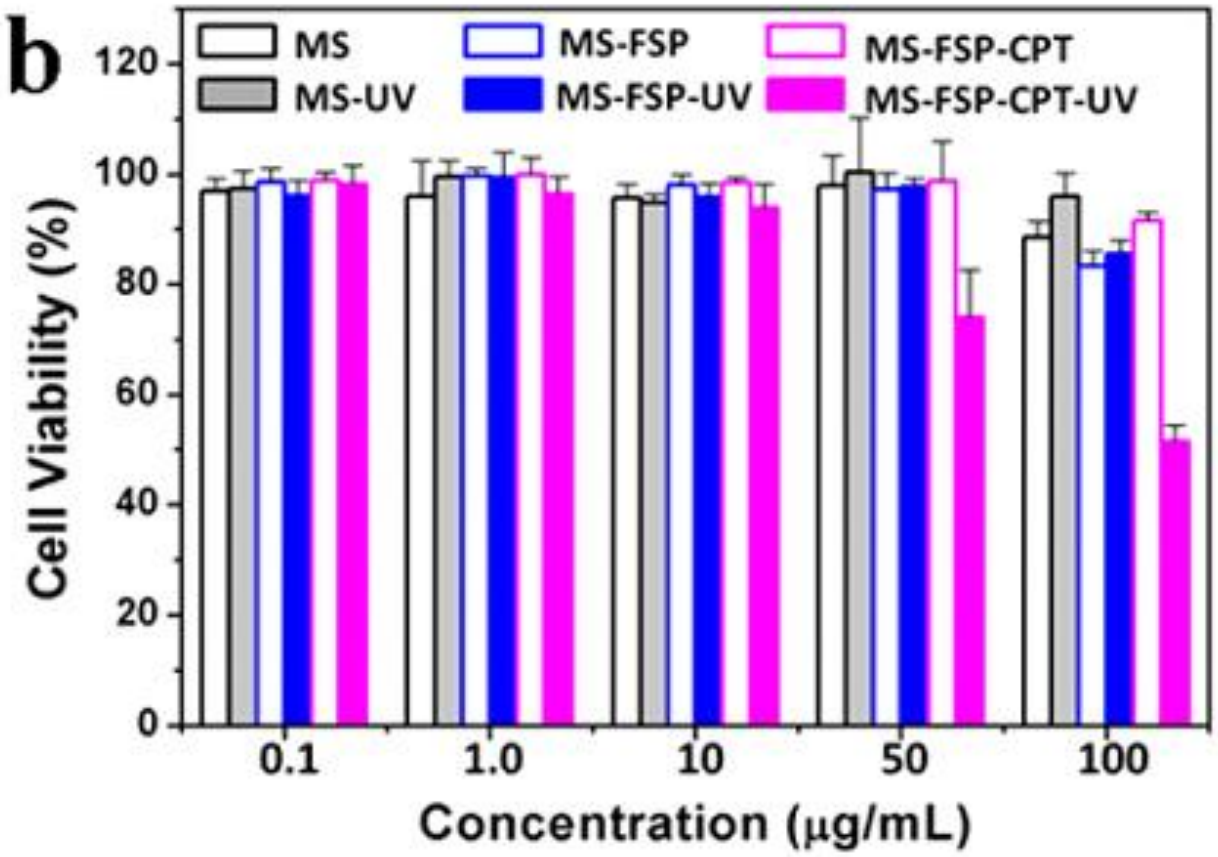
In vitro Light-Controlled Release

- Two cell lines
  - EA.hy926 (human umbilical vein endothelial cells)
  - HeLa cells (a cell line from human cervical cancer cells)
- Cargo Molecule: camptothecin (CPT)
- Cells incubated with MS-FSP-CPT for 24 hours

Cell Viability

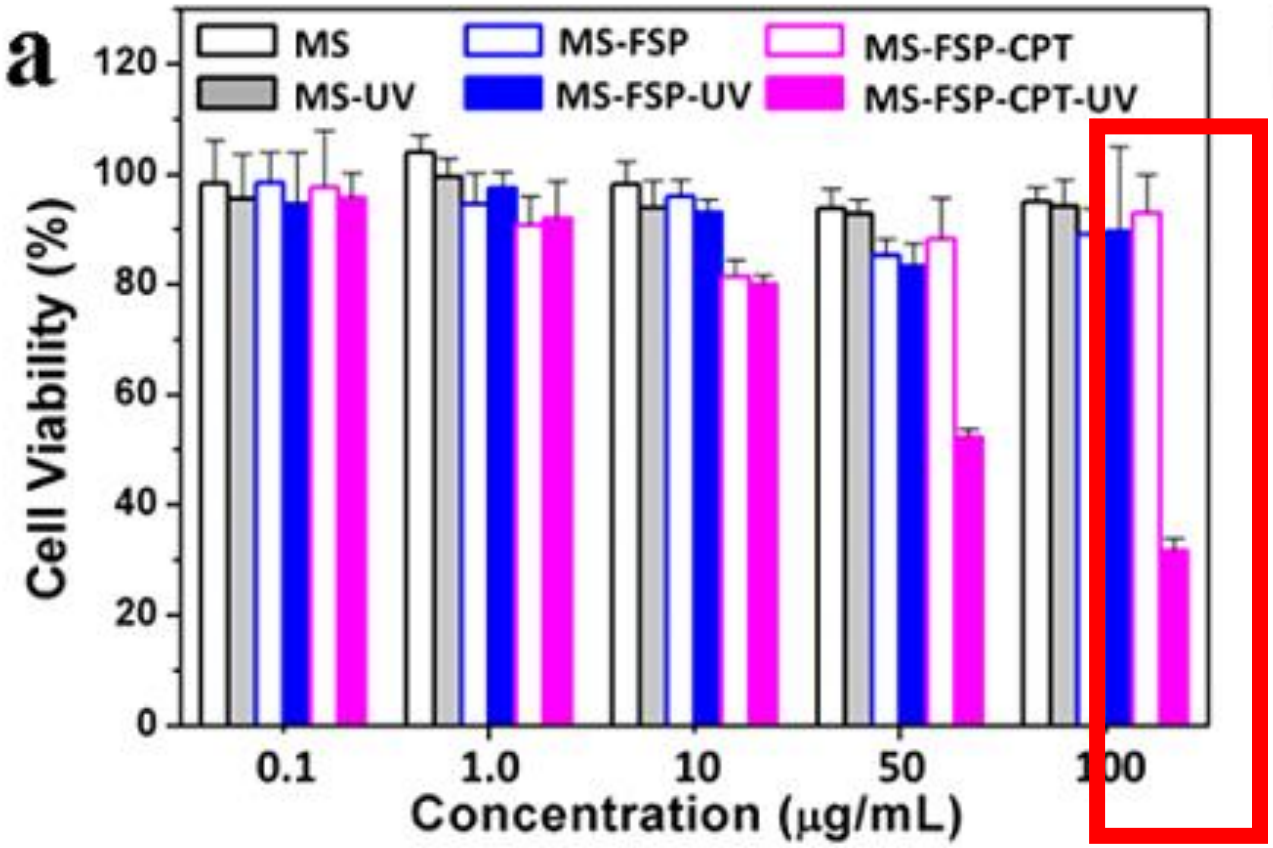


EA.hy926 Cells

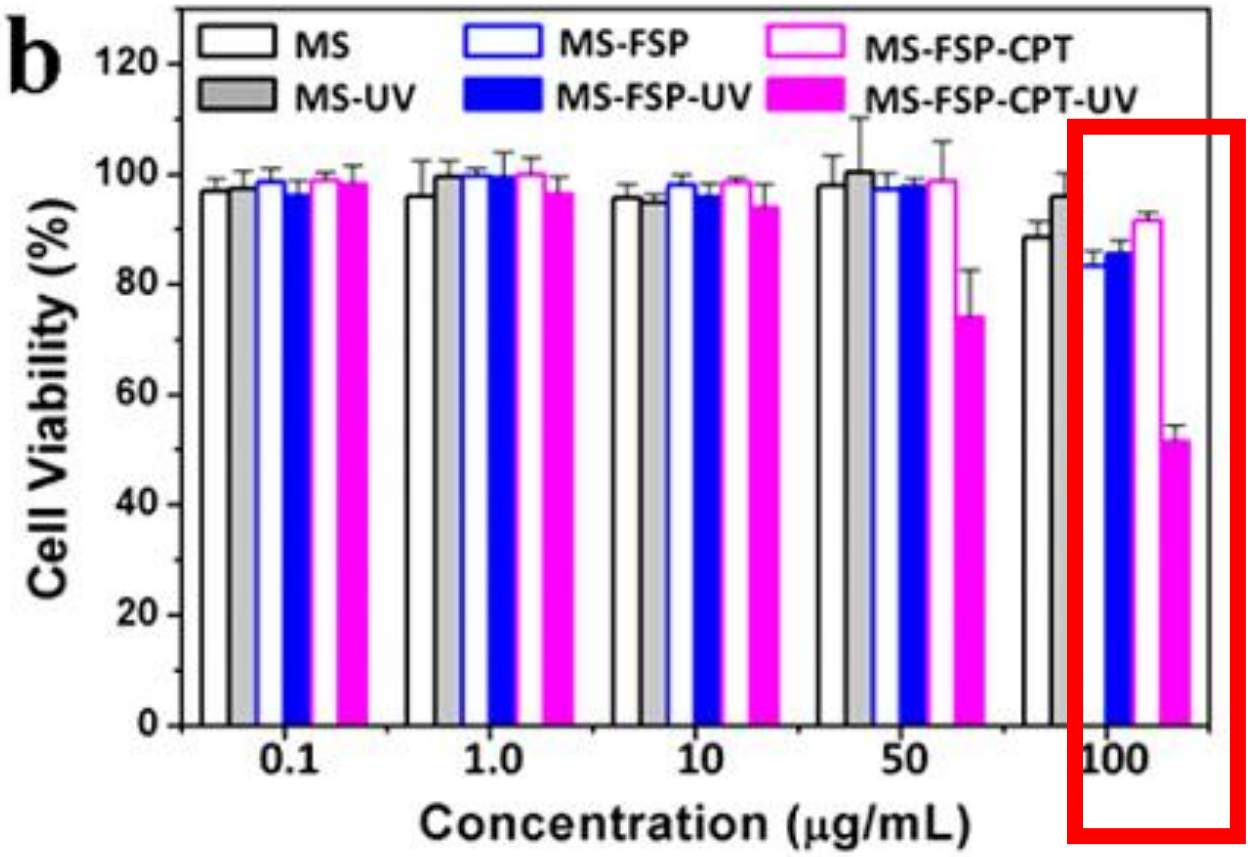


HeLa Cells

Cell Viability

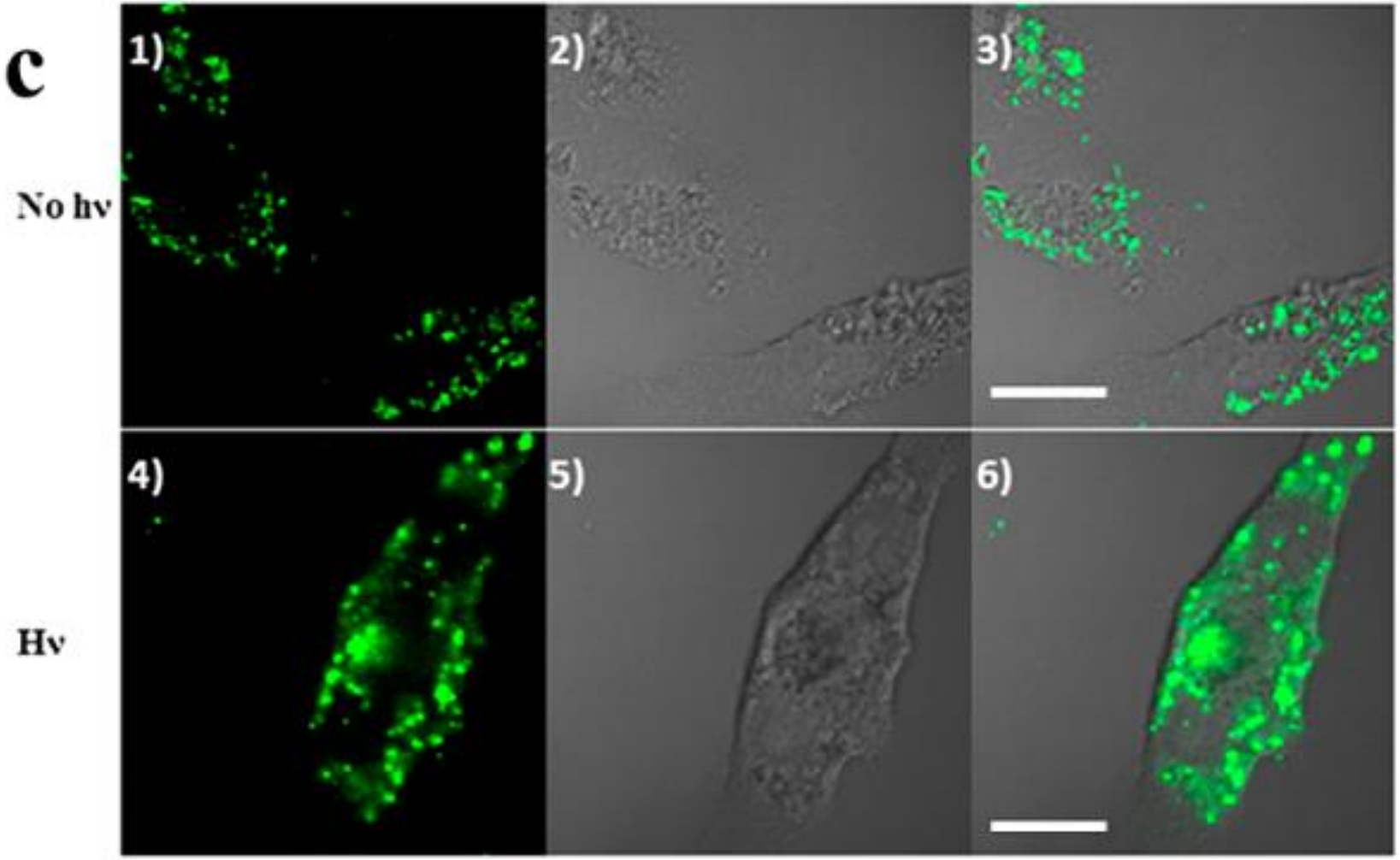


EA.hy926 Cells



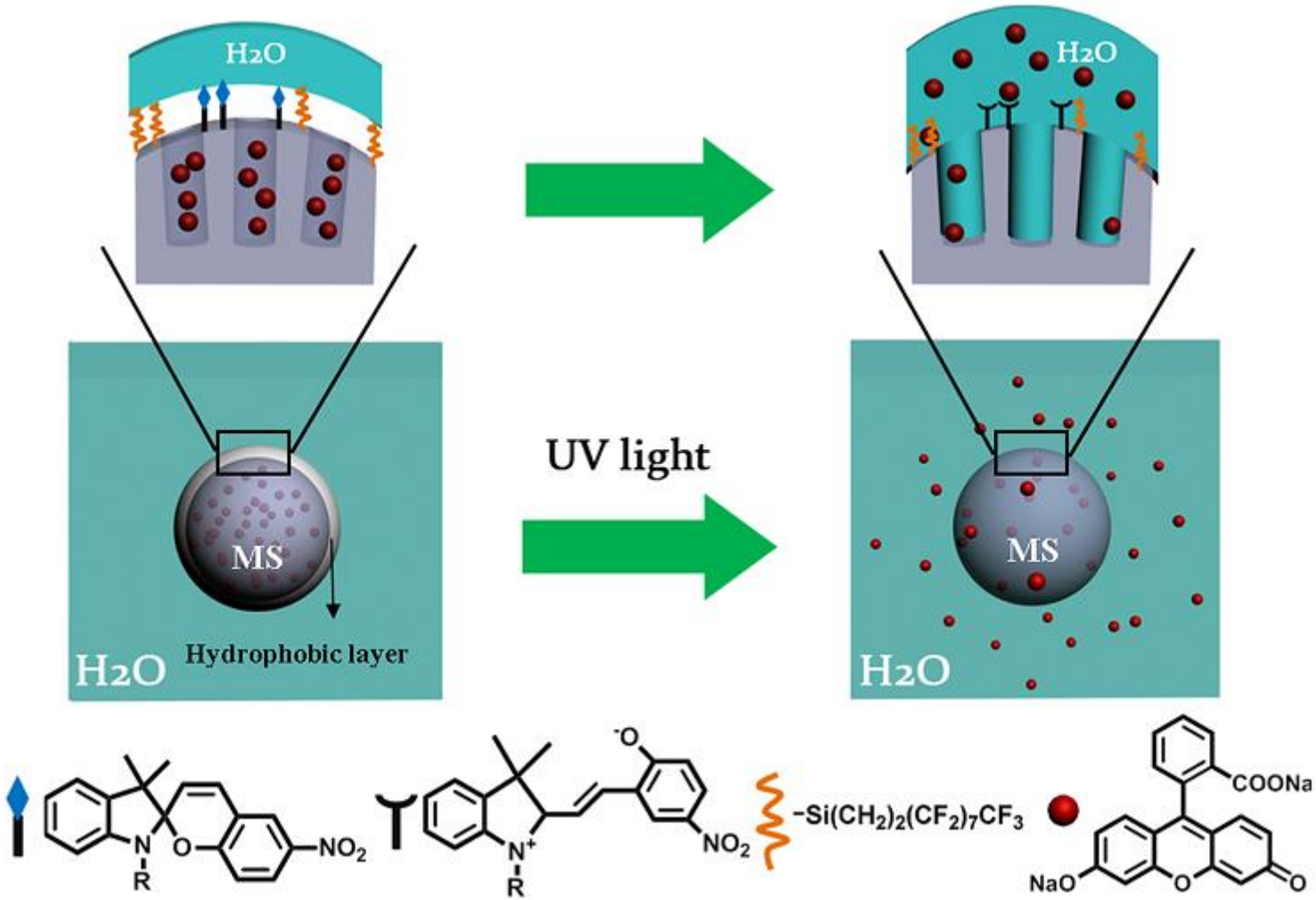
HeLa Cells

Endocytosis



Endothelial cells incubated with modified MS loaded with FD

Conclusion


H2O
MS
Hydrophobic layer
H2O
UV light
H2O
MS
H2O
NO2
N
O
R
O
NO2
N+
R
-Si(CH2)2(CF2)7CF3
COONa
NaO
O
O

Acknowledgements and Questions

Thanks for listening!

L. Chen, W. Wang, B. Su, Y. Wen, C. Li, Y. Zhou, M. Li, X. Shi, H. Du, Y. Song and L. Jiang, A Light-Responsive Release Platform by Controlling the Wetting Behavior of Hydrophobic Surface. *ACS Nano*. **2014**, 8 (1), pp 744–751.