

Supporting information

***In Vitro* Delivery of Calcium Ions by Nanogated  
Mesoporous Silica Nanoparticles to Induce Cancer  
Cellular Apoptosis**

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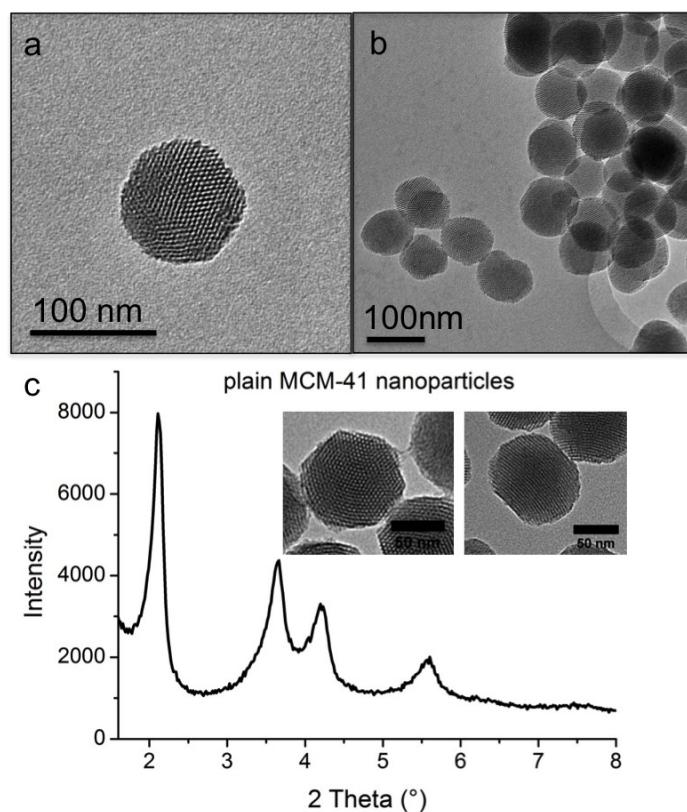
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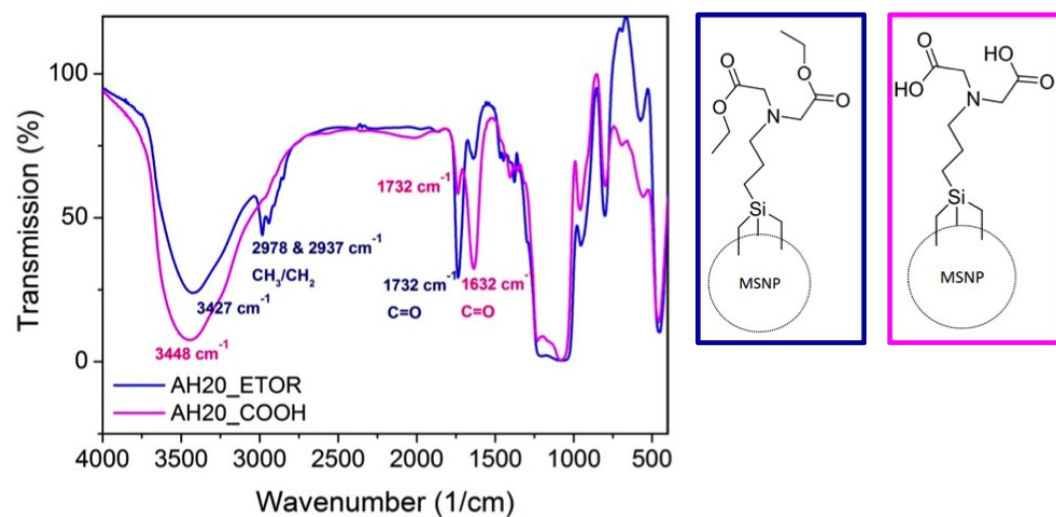
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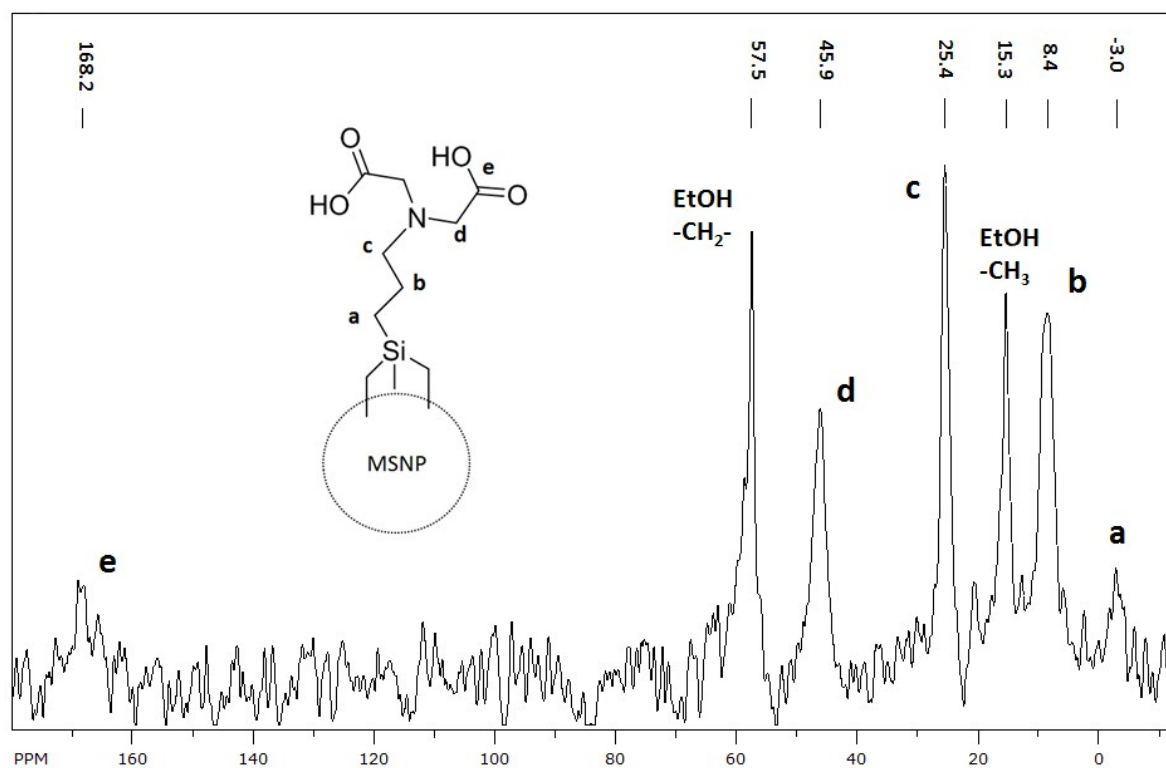
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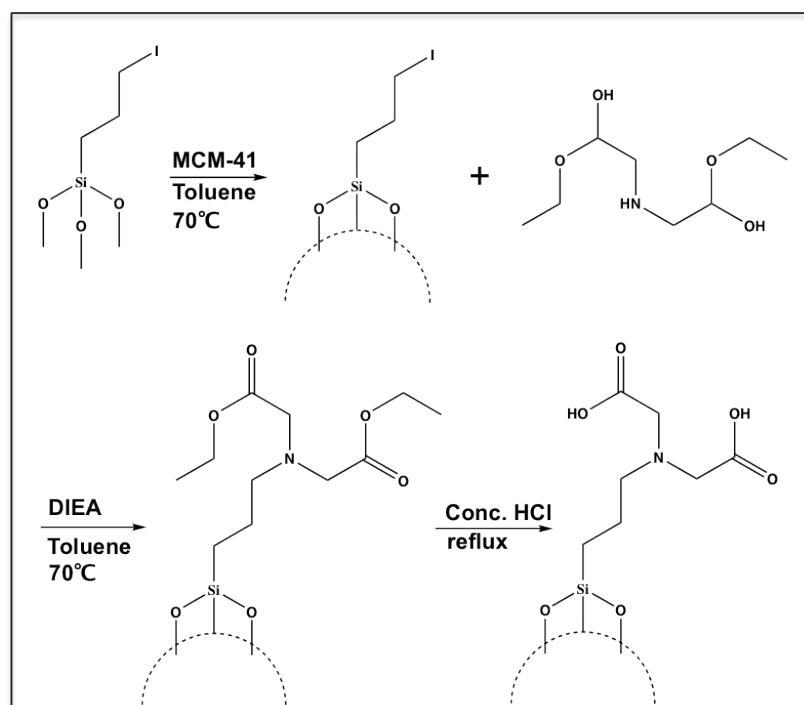
**Figure S1** a. and b. TEM images of MCM-41; c. SAXS diffractogram of plain MCM-41 showing the 2D hexagonal pattern. Inset: TEM images of plain MSNs



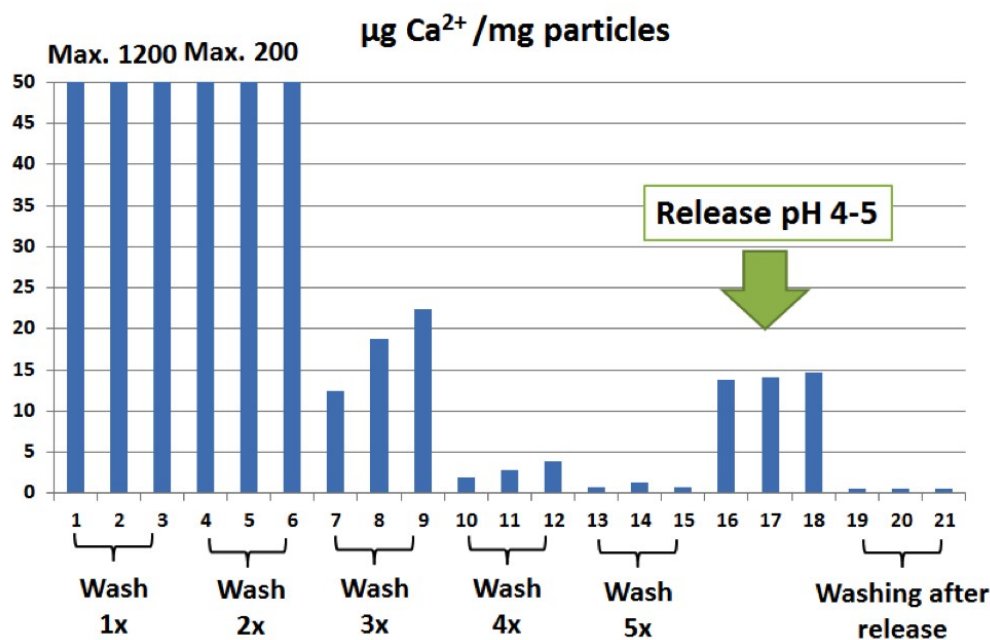
**Figure S2** FT-IR spectroscopy of functionalization process. MSNPs with diethyl iminodiacetate)-propyl moiety (Blue line) and IDA-MSNPs (pink line).



**Figure S3** Solid state  $^{13}\text{C}\{-\text{H}\}$ -CP-MAS-NMR spectrum of IDA-MSNPs



**Figure S4.** Chemical reaction of method 2. The linker molecule was first attached on the MSNs followed by the IDA precursor.



**Figure S5.** ICP-OES data of Calcium amount in the washed supernatants and release supernatants. All three trials show that the calcium was washed away completely after five times wash. After lowering the pH, the calcium release was triggered.

Ca release data from IDA-MSN	µmol Ca <sup>2+</sup> /mg particle %	Wt% (mg Ca/mg particles)
Batch 1	0.35	1.4
Batch 2	0.46	1.9
Batch 3	0.54	2.2
Batch 4	0.33	1.3
Batch 5	0.12	0.5
Batch 6	0.22	0.9

**Table S1.** Batch 1-4, the functionalization was conducted with the nucleophilic substitution first and then grafted the as-synthesized silane onto MSNs. Batch 5-6, the functionalization was to graft 3-Iodopropyltrimethoxysilane onto the MSNs at first, and then the nucleophilic substitution was conducted.