Supporting information

**pH-responsive nanocontainer based on hydrazone-bearing hollow silica nanoparticles for targeting tumor therapy**

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Figure S1. The FTIR spectra of HMSNs (a), HMSNs-NH$_2$ (b), HMSNs-PA (c), HMSNs-PA-HA (d), and HA-NHNH$_2$ (e), respectively.
As shown in Figure S1 a, the native HMSNs shows the intrinsic characteristic peaks, in which 471 cm\(^{-1}\) (Si-O bending), 800 cm\(^{-1}\) (Si-O-Si bending), 962 cm\(^{-1}\) (Si-OH bending) and 1090 cm\(^{-1}\) (Si-O stretching), respectively.\(^{51, 52}\) After modification with APTS, distinctive absorption peaks of -NH\(_2\) (1642 cm\(^{-1}\) and 1556 cm\(^{-1}\) ) were observed in the spectrum of HMSNs-NH\(_2\) (Figure S1, b),\(^{52}\) suggesting the successful grafting of APTS to HMSNs. Following conjugation with PA molecules, the distinctive characteristic peak of -CH\(_3\) at 1398 cm\(^{-1}\) appeared in the spectrum of HMSNs-PA (Figure S1, c). It was contributed to the successful introduction of PA molecules. Meanwhile, functionalized HA molecular (HA-NHNH\(_2\)) shows a broad bond at 3435 cm\(^{-1}\) (O-H stretching), a shoulder peak at 2930 cm\(^{-1}\) (C-H stretching), and the distinctive absorption peak at 1729 cm\(^{-1}\) (C=O) in the spectra of HA-NHNH\(_2\) (Figure S 1e). After HA-NHNH\(_2\) was conjugated into HMSNs-PA, the produced HMSNs-PA-HA not only exhibit typical bonds at 3435 cm\(^{-1}\) (O-H) and 2930 cm\(^{-1}\) (C-H stretching) from HA, but also the similar absorption peaks with that of HMSNs-PA with slight shift, moreover, the carboxyl groups signals (1729 cm\(^{-1}\)) was disappeared (Figure S 1d), which was consistent with a previous study,\(^{53}\) suggesting that the HA was successful conjugated into HMSNs, in other words, HMSNs-PA-HA was successfully synthesized.
Figure S2. The quantification analysis of nanoparticles in HepG2 cells after treatments with FITC, HMSNs@FITC and HMSNs-PA-HA@FITC (0.12 mg/mL) for 12 and 24 h, respectively. Error bars represent means ± SD (n=4), **p < 0.01.
Figure S3. The quantification analysis of nanoparticles in HepG2 cells pretreated with HA, A3D8 or not for 2 h and then incubated with 0.12 mg/mL HMSNs-PA-HA@FITC at 37 °C for 4 h. Error bars represent means ± SD (n=4), **p < 0.01.
### Figure S4

FCM quantitative analysis of HepG2 cells treated with TCPS (control, a), HMSNs-PA-HA (b), DOX (c), HMSNs@DOX (d), and HMSNs-PA-HA@DOX (e), respectively.

<table>
<thead>
<tr>
<th></th>
<th>a</th>
<th>b</th>
<th>c</th>
<th>d</th>
<th>e</th>
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<tr>
<td></td>
<td>1.46%</td>
<td>2.14%</td>
<td>21.72%</td>
<td>15.14%</td>
<td>25.21%</td>
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</table>
**Table S1.** BET and BJH parameters of HMSNs, HMSNs-PA and HMSNs-PA-HA nanoparticles.

<table>
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<tr>
<th>Materials</th>
<th>$S_	ext{BET} (\text{m}^2/\text{g})$</th>
<th>$V_p (\text{cm}^3/\text{g})$</th>
<th>BJH</th>
<th>$W_	ext{BJH} (\text{Å})$</th>
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<tbody>
<tr>
<td>HMSNs</td>
<td>907.3481</td>
<td>0.895968</td>
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<td>26.6768</td>
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<td>HMSNs-PA</td>
<td>497.6089</td>
<td>0.435486</td>
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<td>HMSNs-PA-HA</td>
<td>190.5998</td>
<td>0.26985</td>
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<td>13.4501</td>
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Table S2. Zeta potentials of different HMSNs nanoparticles.

<table>
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<th>Materials</th>
<th>Zeta potential (mV)</th>
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<tr>
<td>HMSNs</td>
<td>-13.6±3.37</td>
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<tr>
<td>HMSNs-NH₂</td>
<td>24.4±4.04</td>
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<td>HMSNs-PA</td>
<td>8.6±4.17</td>
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<td>HMSNs-PA-HA</td>
<td>-16.2±2.83</td>
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</table>

References

