

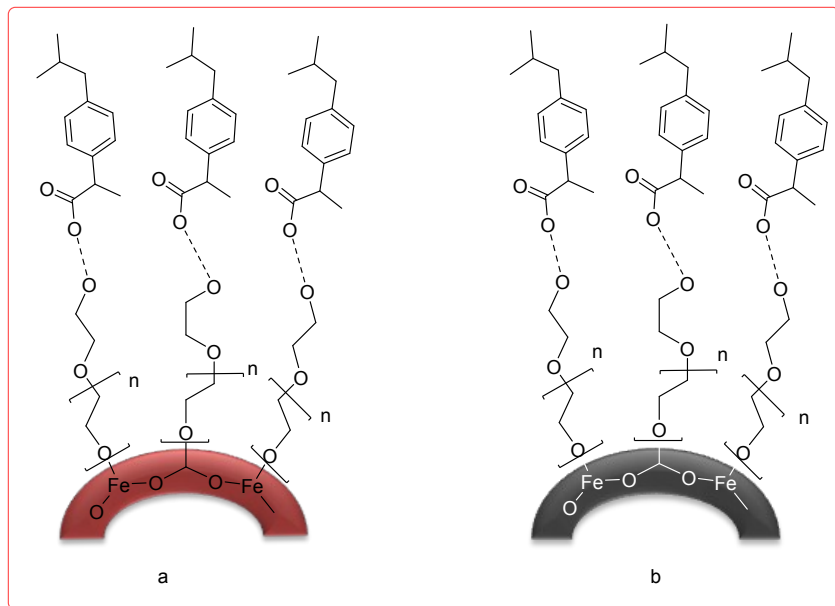
## **The Role of Hollow Magnetic Nanoparticles in Drug Delivery**

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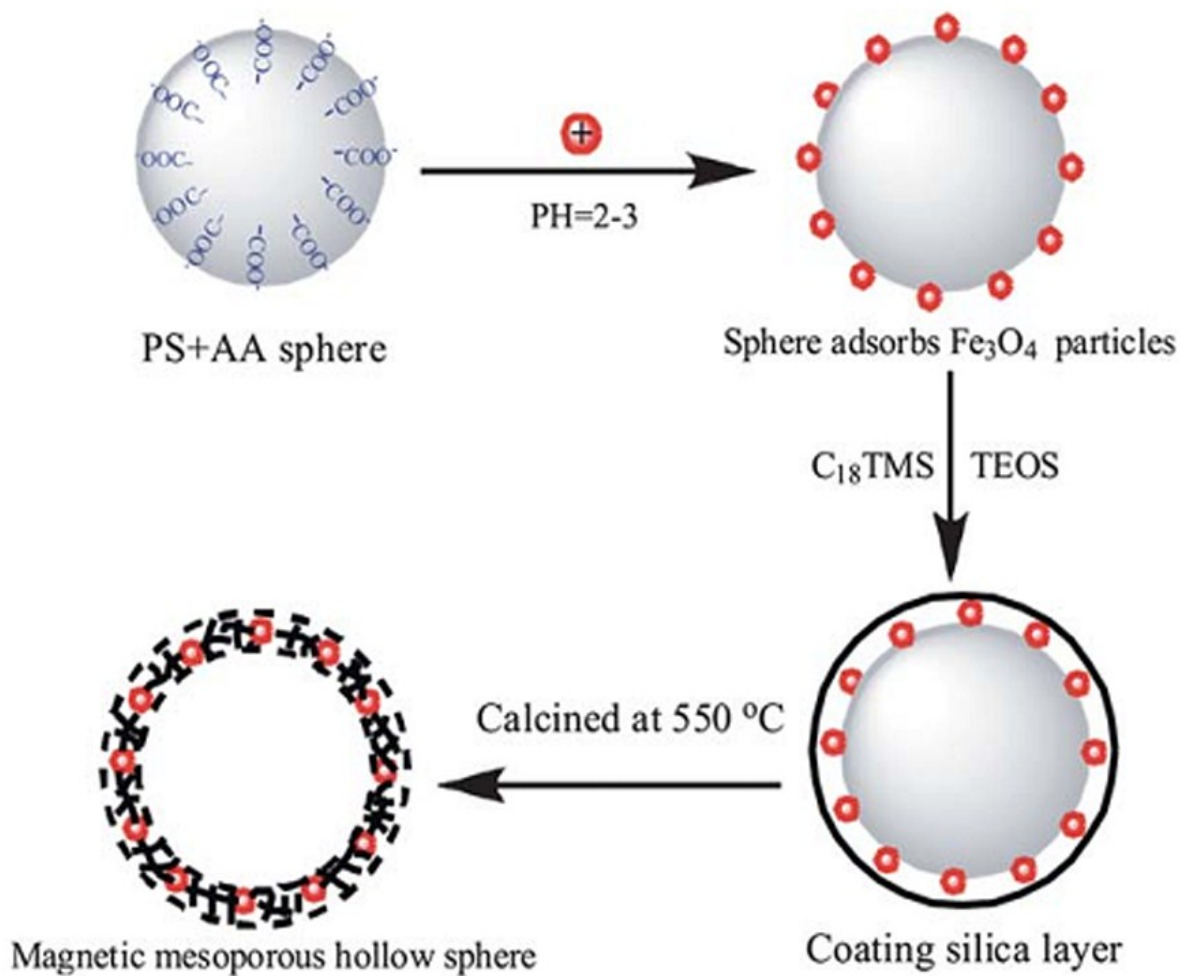
*gmziarani@hotmail.com; gmohammadi@alzahra.ac.ir*

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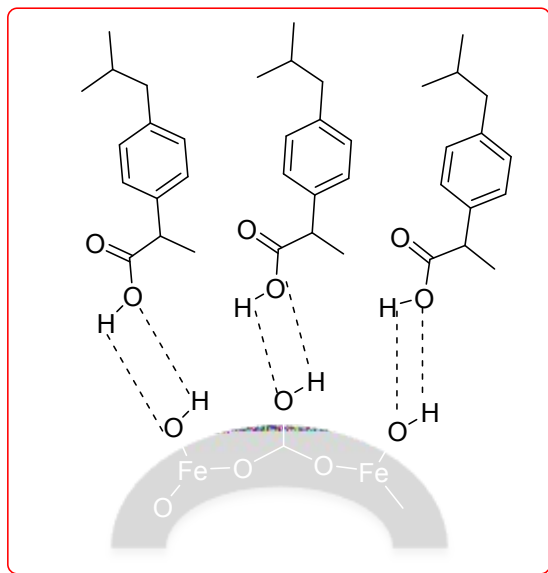
**Figure S1.** The structure of IBU-PEG-coated  $\text{Fe}_2\text{O}_3$  (a) and IBU-PEG-coated  $\text{Fe}_3\text{O}_4$  (b) <sup>1</sup>

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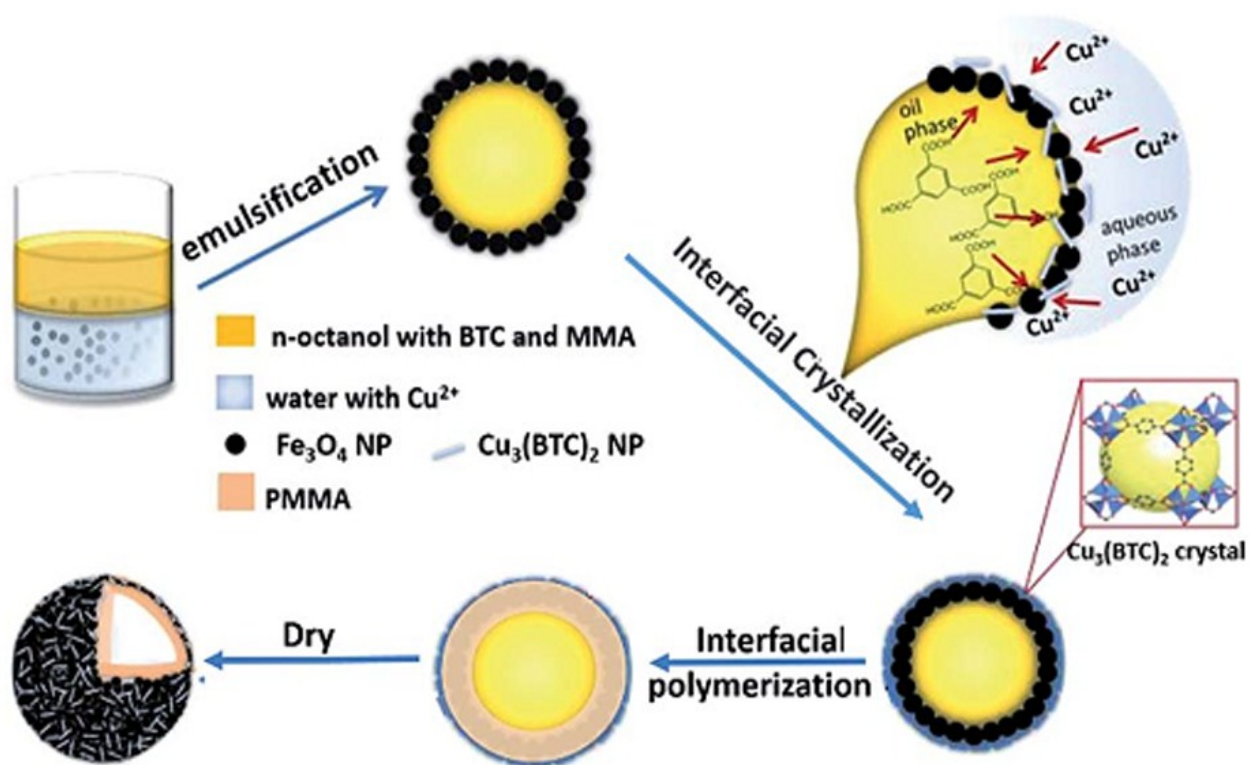
**Figure S2.** Scheme of the synthetic procedure for the preparation of hollow magnetic mesoporous spheres <sup>2</sup>

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**Figure S3.** The structure of IBU-Fe<sub>3</sub>O<sub>4</sub><sup>2</sup>

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**Figure S4.** Fabrication of the hollow magnetic-MOF composite through the interfacial growth approach induced by  $\text{Fe}_3\text{O}_4$  stabilized Pickering emulsion <sup>3</sup>

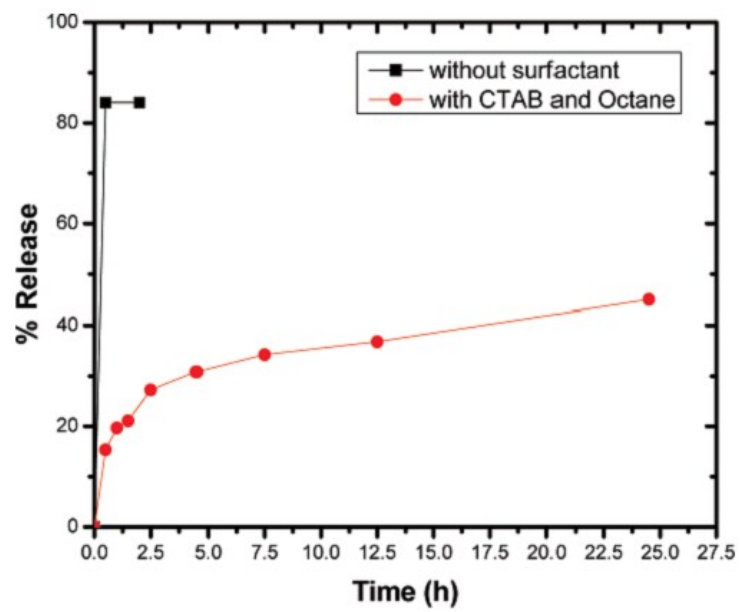
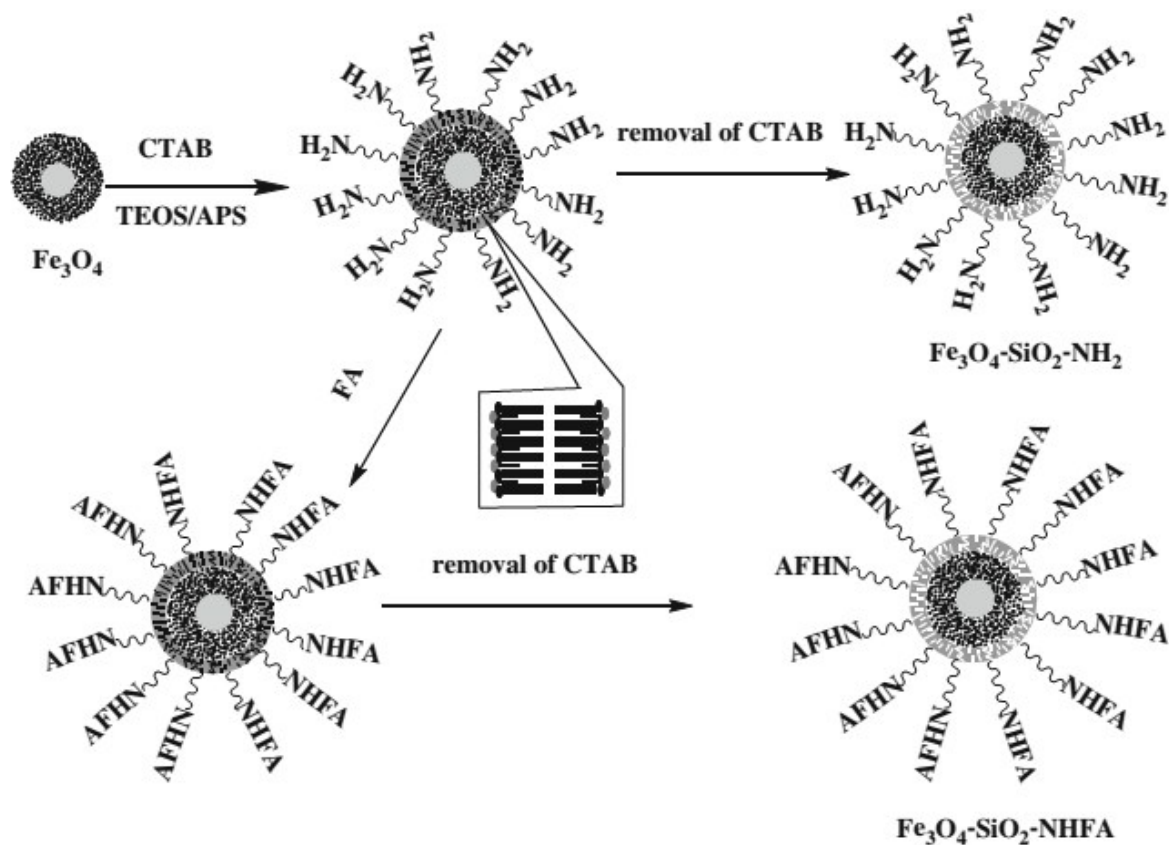


Figure S5. Drug release of ibuprofen from the porous MHSNs showing slow release <sup>4</sup>

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**Figure S6.** The schematic synthesis process of magnetic magnetite mesoporous silica microspheres  $\text{Fe}_3\text{O}_4\text{-SiO}_2\text{-NH}_2$  and

$\text{Fe}_3\text{O}_4\text{-SiO}_2\text{-NHFA}$  <sup>5</sup>

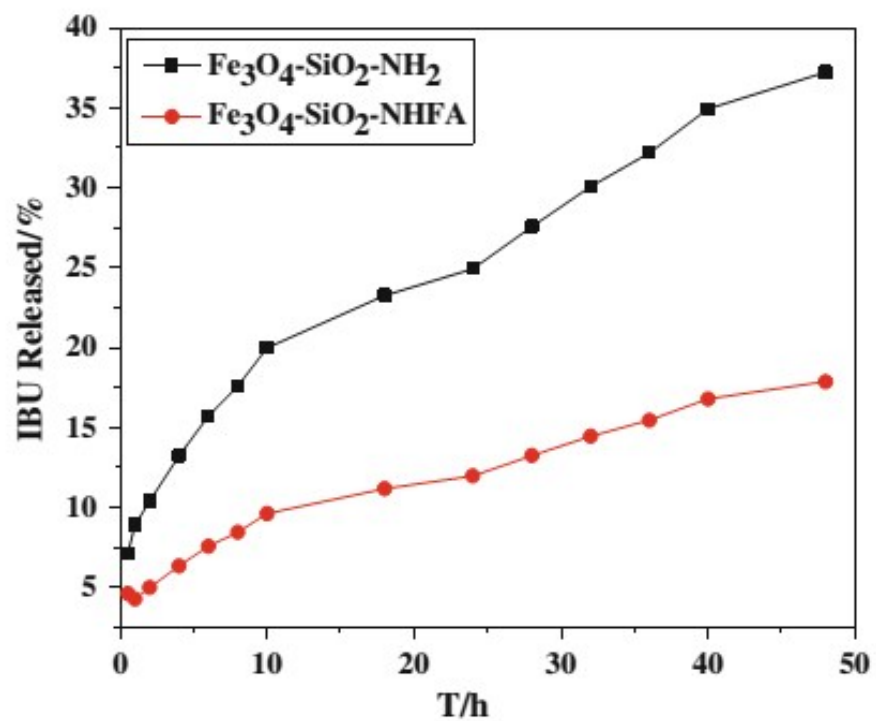
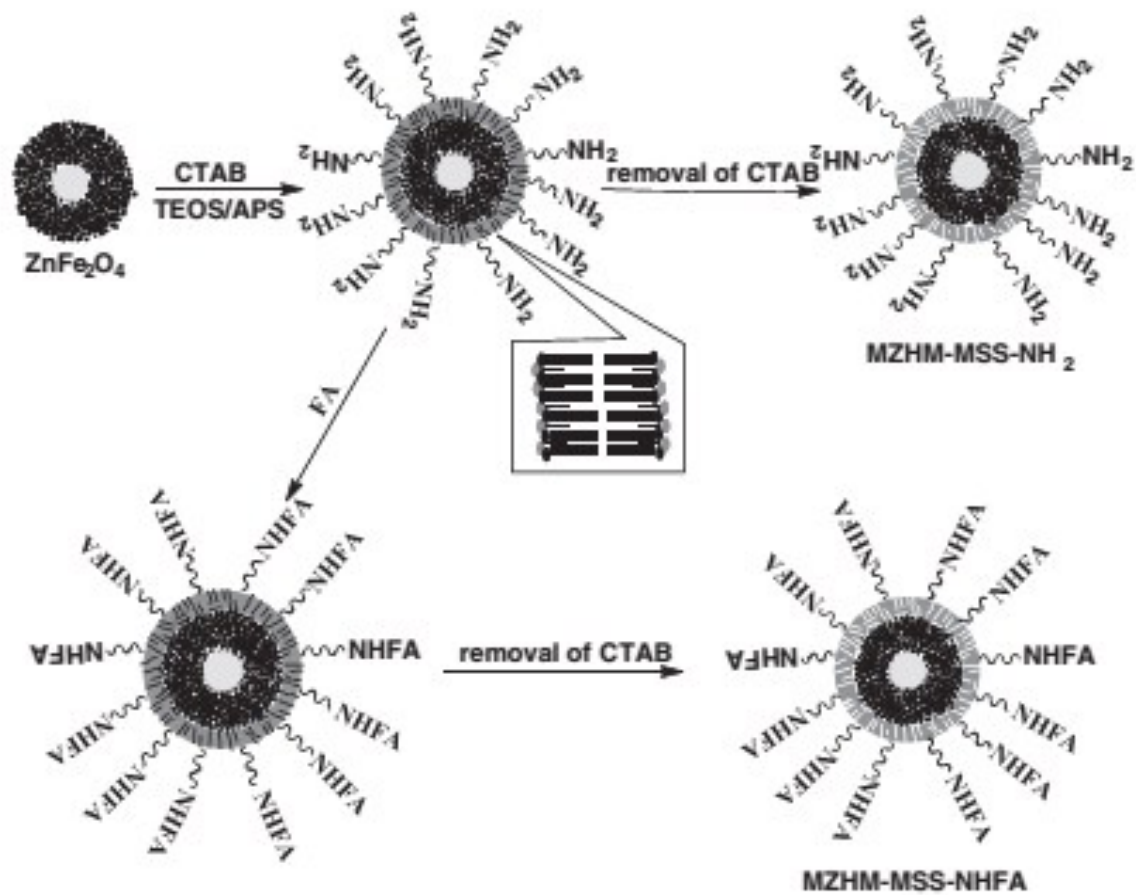


Figure S7. Ibuprofen released from Fe<sub>3</sub>O<sub>4</sub>-SiO<sub>2</sub>-NH<sub>2</sub> and Fe<sub>3</sub>O<sub>4</sub>-SiO<sub>2</sub>-NHFA microspheres curves <sup>5</sup>

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**Figure S8.** The schematic preparation process of magnetic mesoporous silica microspheres MZHM-MSS- $\text{NH}_2$  and MZHM-

MSS-NHFA <sup>6</sup>

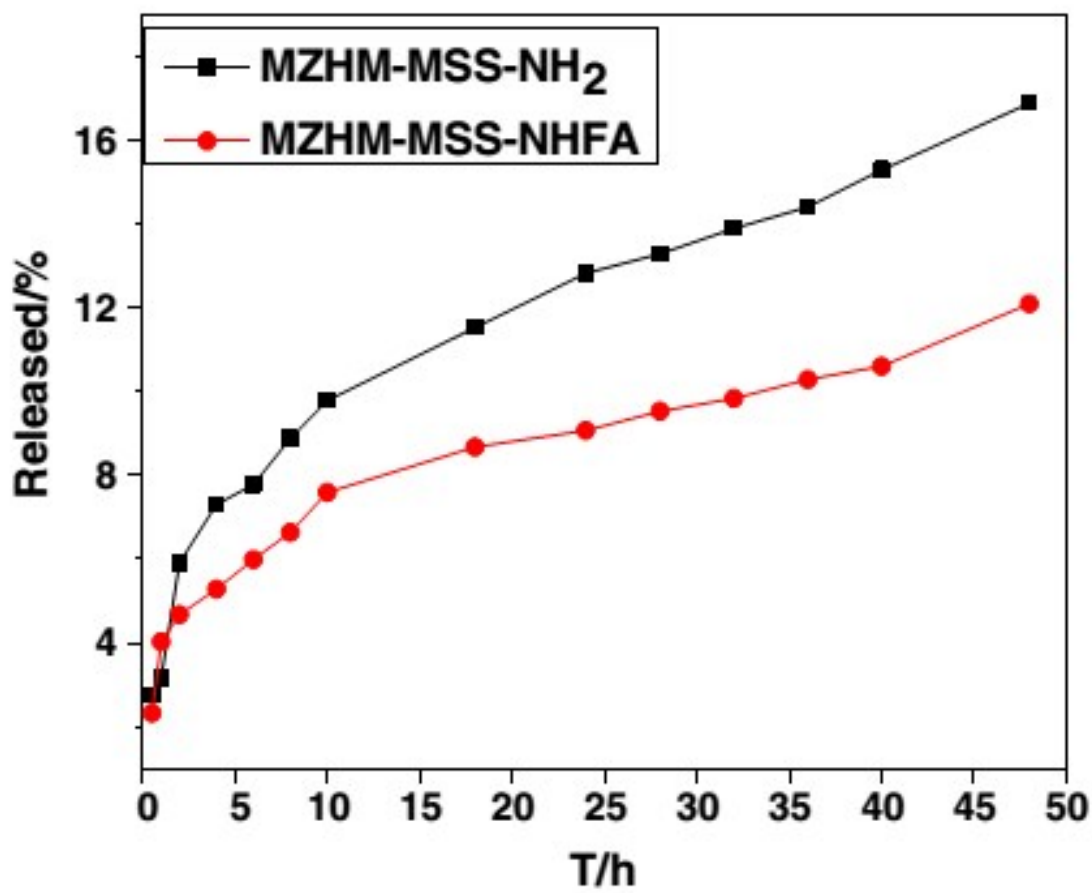
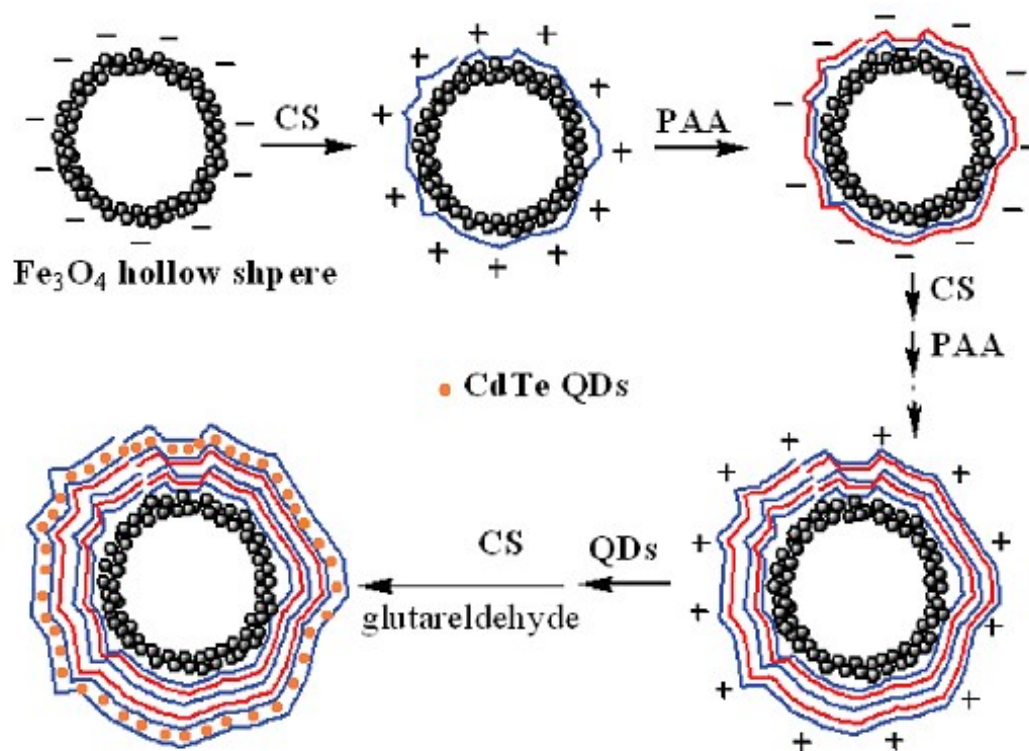
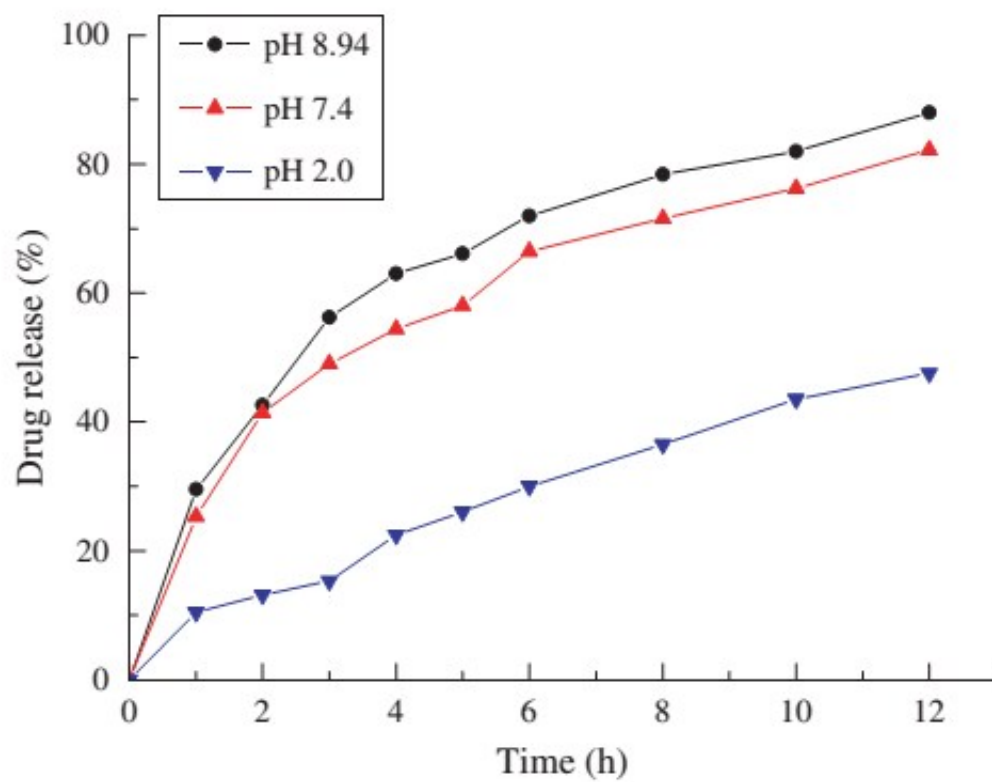


Figure S9. Cumulative ibuprofen release from MZHM-MSS-NH<sub>2</sub> and MZHM-MSS-NHFA in PBS solution at room temperature

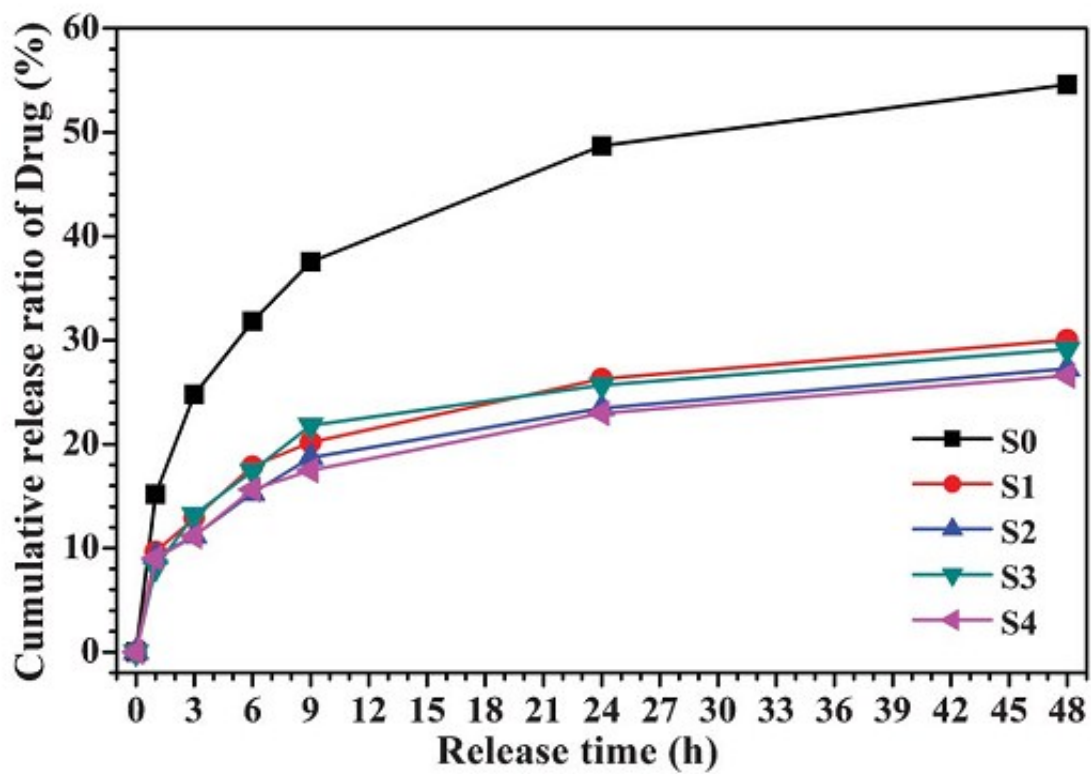


**Figure S10.** The Schematic representation of the fabrication process of the magnetic and fluorescent nanocomposites <sup>7</sup>



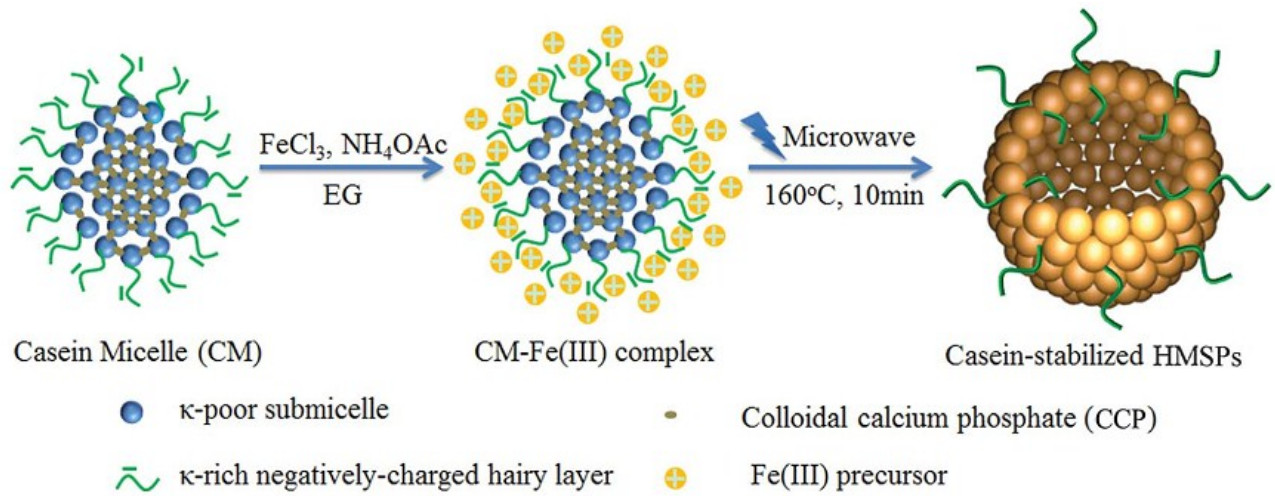
**Figure S11.** In vitro cumulative drug release of cefradine from the  $\text{Fe}_3\text{O}_4/\text{PE}_5/\text{CdTe}/\text{PE}_1$  in release media of different pH values <sup>7</sup>

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**Figure S12.** The cumulative vancomycin release ratio from the control HAp nanoparticles (S0) and HAp hollow microspheres (S1), and the fabricated magnetic HAp hollow microspheres (S2–S4) in PBS at pH = 7.40<sup>8</sup>

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**Figure S13.** The schematic formation mechanism of the CM-mediated, microwave-assisted HMSPs <sup>9</sup>

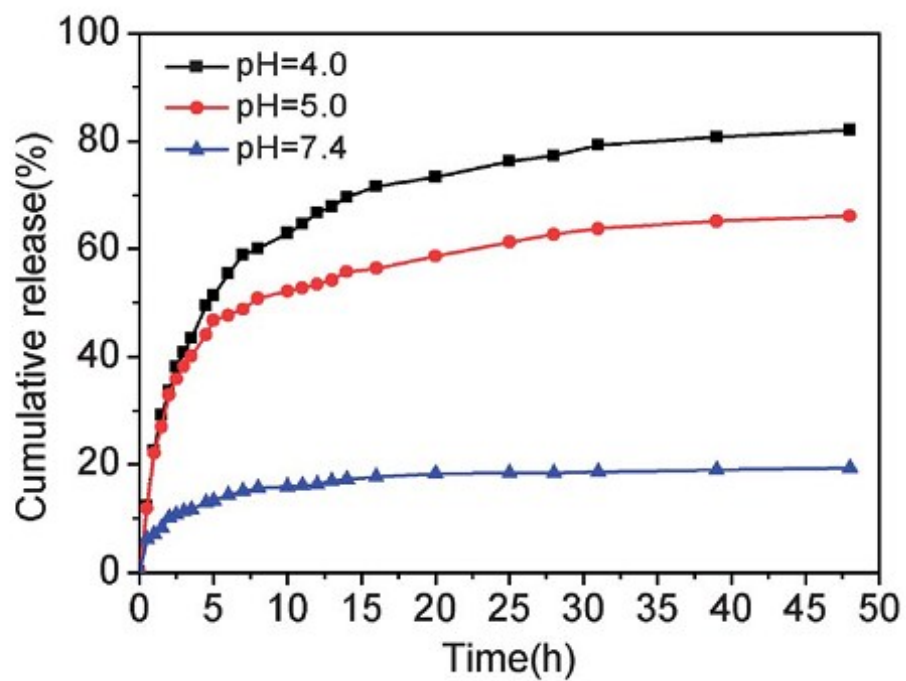
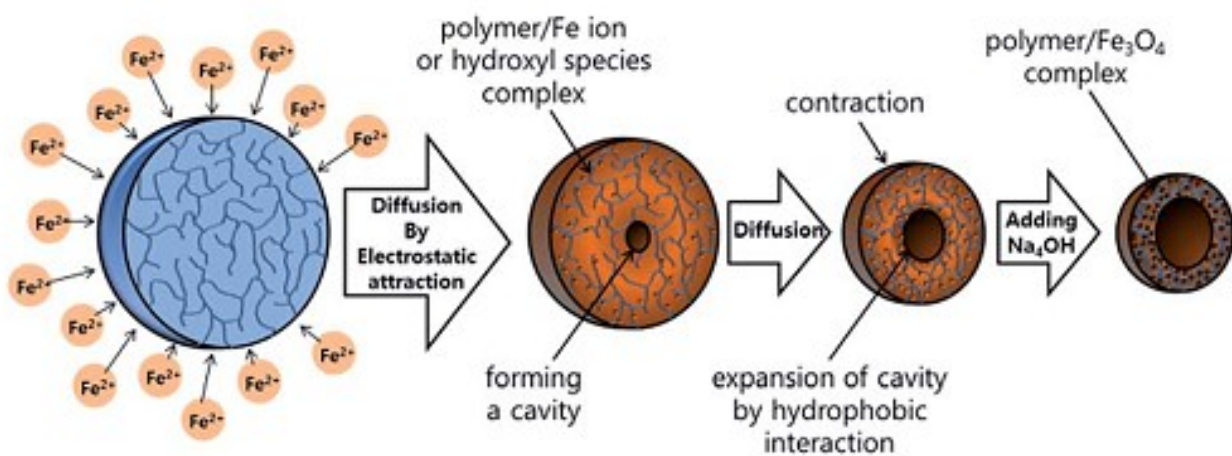


Figure S 14. Drug release profiles of DOX from HMSPs as a function of time at pH 4.0, 5.0 and 7.4 at 37 °C<sup>9</sup>

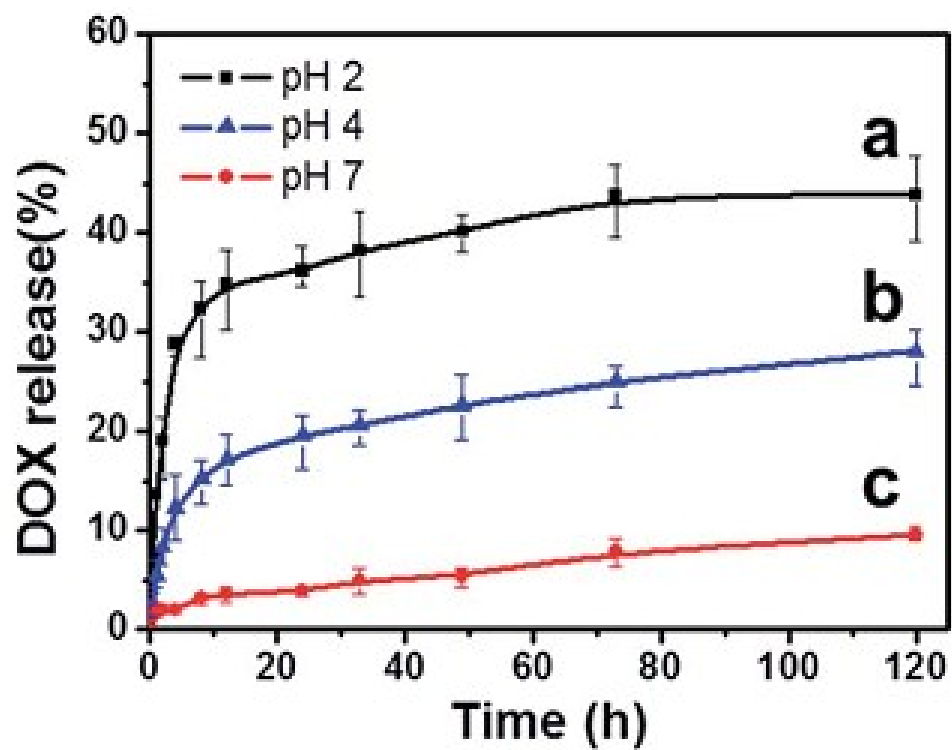
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**Figure S 15.** The Schematic illustration of the mechanism of formation of the poly(MAA/EGDMA)/ $\text{Fe}_3\text{O}_4$  composite microcapsules with hollow structure <sup>10</sup>

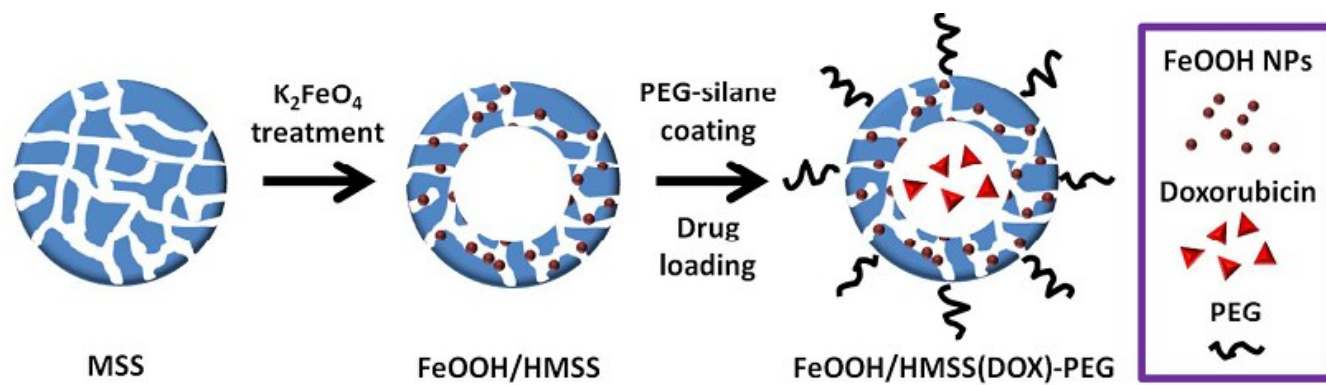
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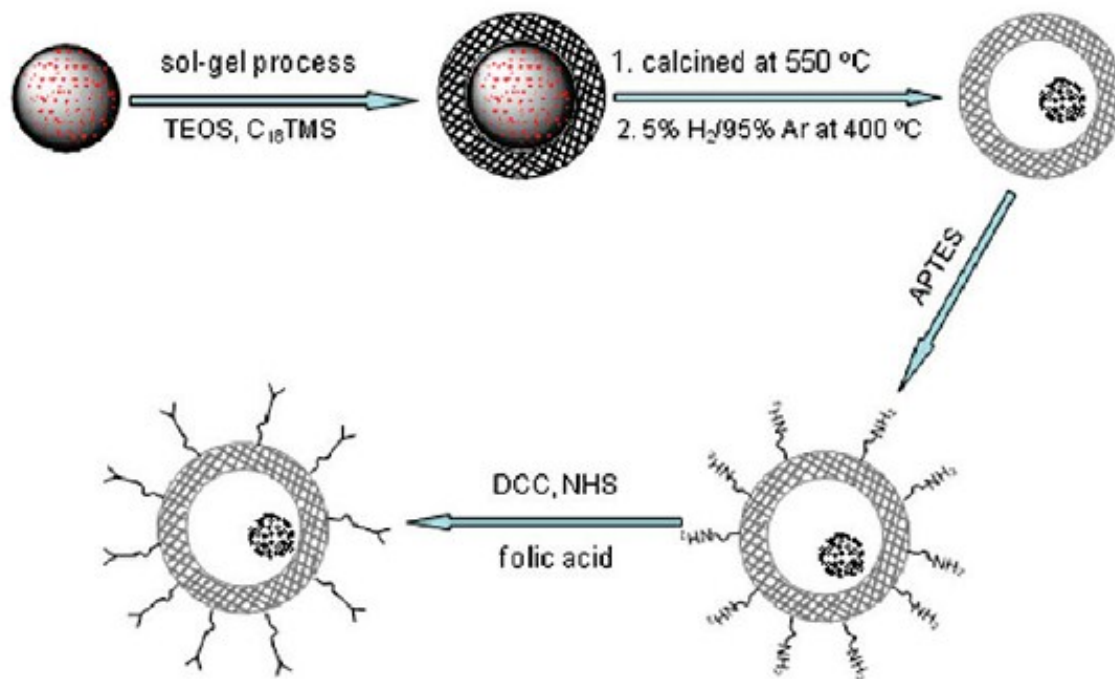
**Figure S16.** Doxorubicin cumulative release from the hollow poly(MAA/EGDMA)/Fe<sub>3</sub>O<sub>4</sub> composite microcapsules versus incubation time. Release profiles at different pH values (a) pH = 2, (b) pH = 4 and (c) pH = 7. <sup>10</sup>

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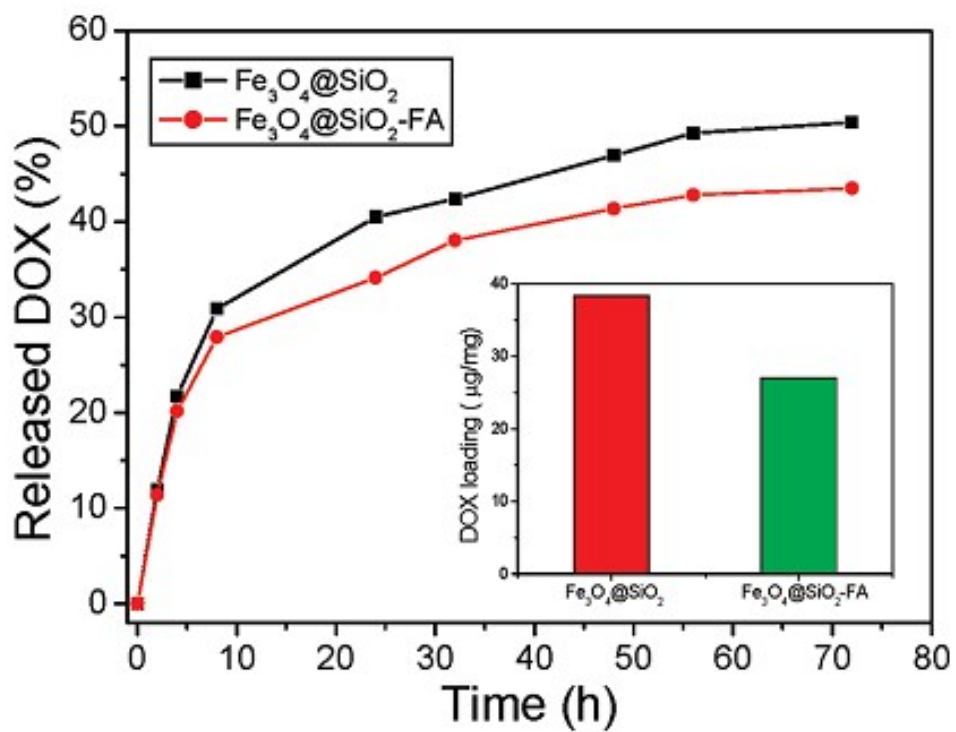
**Figure S17.** Illustration of the synthetic procedure of FeOOH/HMSS(DOX)-PEG <sup>11</sup>

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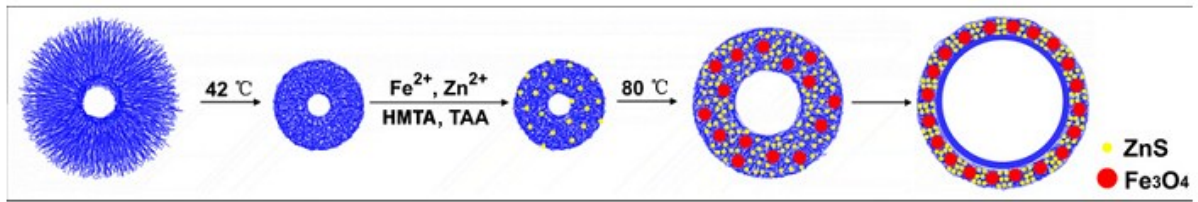


**Figure S18.** Schematic procedure for preparation and folate conjugation of Fe<sub>3</sub>O<sub>4</sub>@SiO<sub>2</sub> hollow mesoporous spheres <sup>12</sup>

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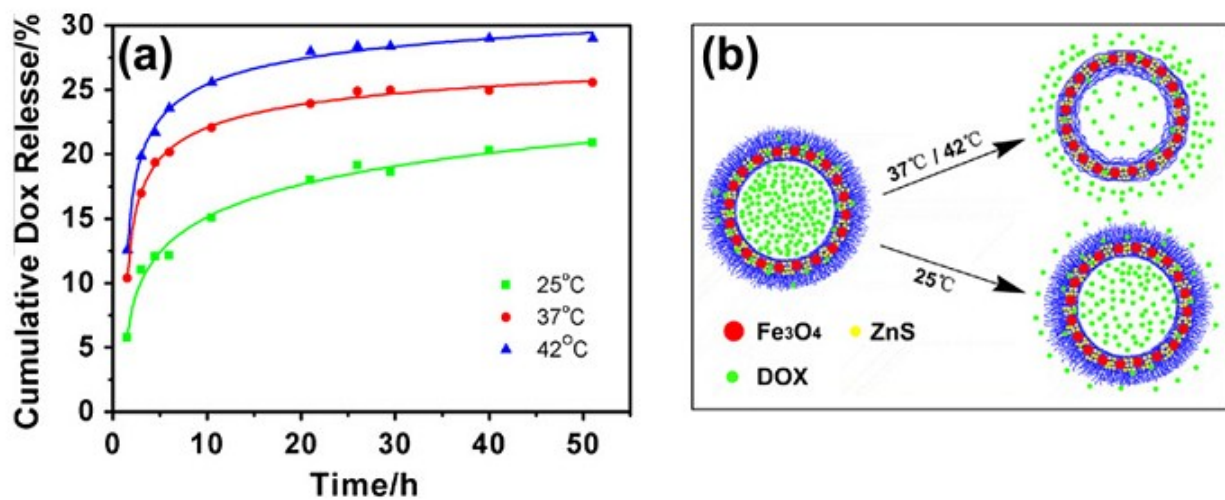


**Figure S19.** DOX release from  $\text{Fe}_3\text{O}_4@\text{SiO}_2$  and  $\text{Fe}_3\text{O}_4@\text{SiO}_2\text{-FA}$  spheres in PBS at 37 °C (inset, DOX loading capacity in  $\text{Fe}_3\text{O}_4@\text{SiO}_2$  and  $\text{Fe}_3\text{O}_4@\text{SiO}_2\text{-FA}$  spheres) <sup>12</sup>

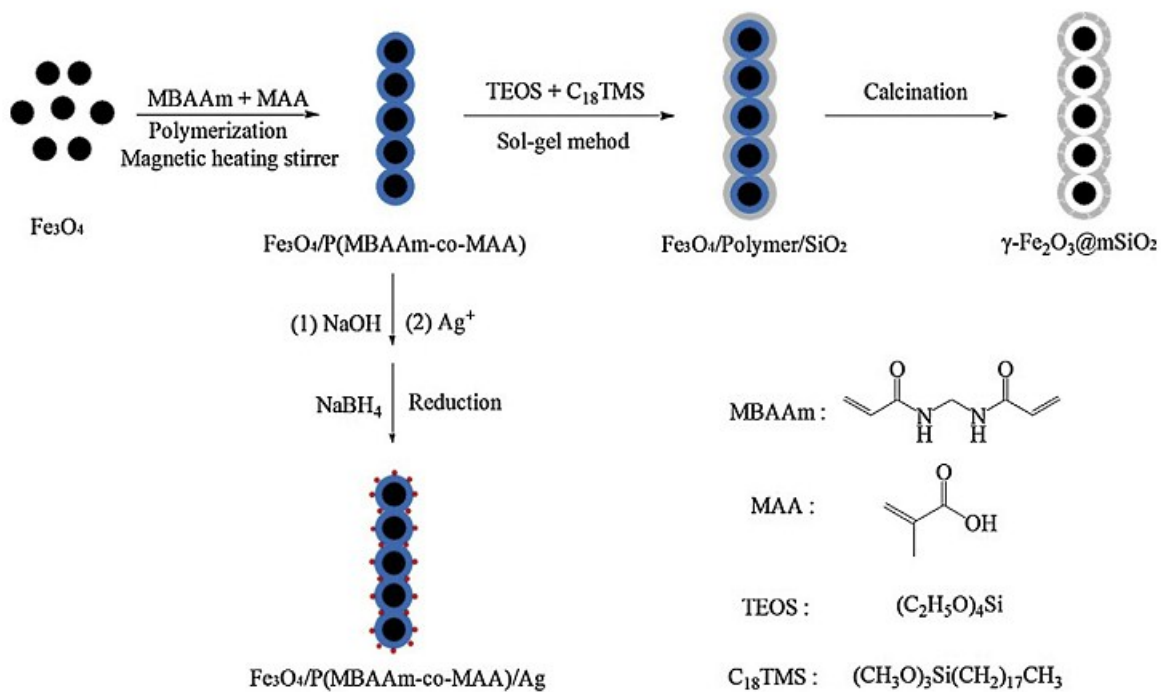


**Figure S20.** Schematic illustration for the fabrication of the PNIPAM/Fe<sub>3</sub>O<sub>4</sub>-ZnS hybrid hollow spheres <sup>13</sup>

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**Figure S21.** (a) The release behaviour of DOX-loaded PNIPAM/Fe<sub>3</sub>O<sub>4</sub>-ZnS hollow spheres in PBS at different temperatures and (b) Schematic diagram for the DOX releasing process <sup>13</sup>



**Figure S22.** The procedure for the synthesis of the 1D magnetic  $\text{Fe}_3\text{O}_4/\text{P}(\text{MBA-co-MAA})/\text{Ag}$  and  $\gamma\text{-Fe}_2\text{O}_3@m\text{SiO}_2$  nanochains

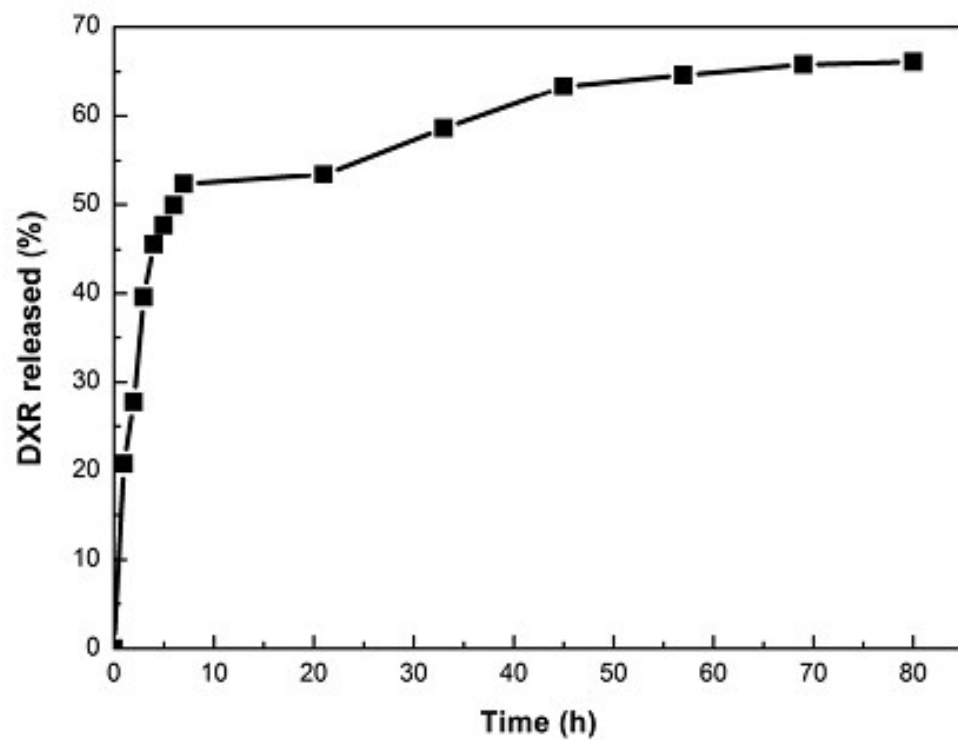
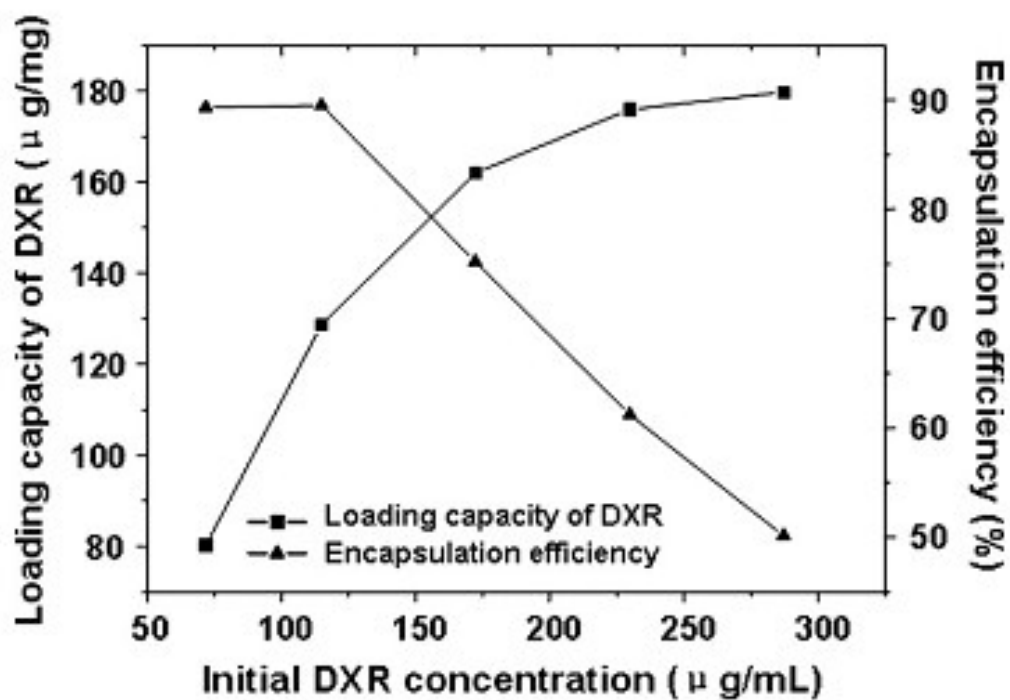


Figure S23. Drug released kinetic curve of  $\gamma\text{-Fe}_2\text{O}_3@m\text{SiO}_2$  nanochains <sup>14</sup>

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**Figure S24.** The effects of initial DXR concentrations on the drug loading capacity and encapsulation efficiency of magnetite and tumour dual-targeting hollow P(MBAAm-coMAA) microspheres. <sup>15</sup>

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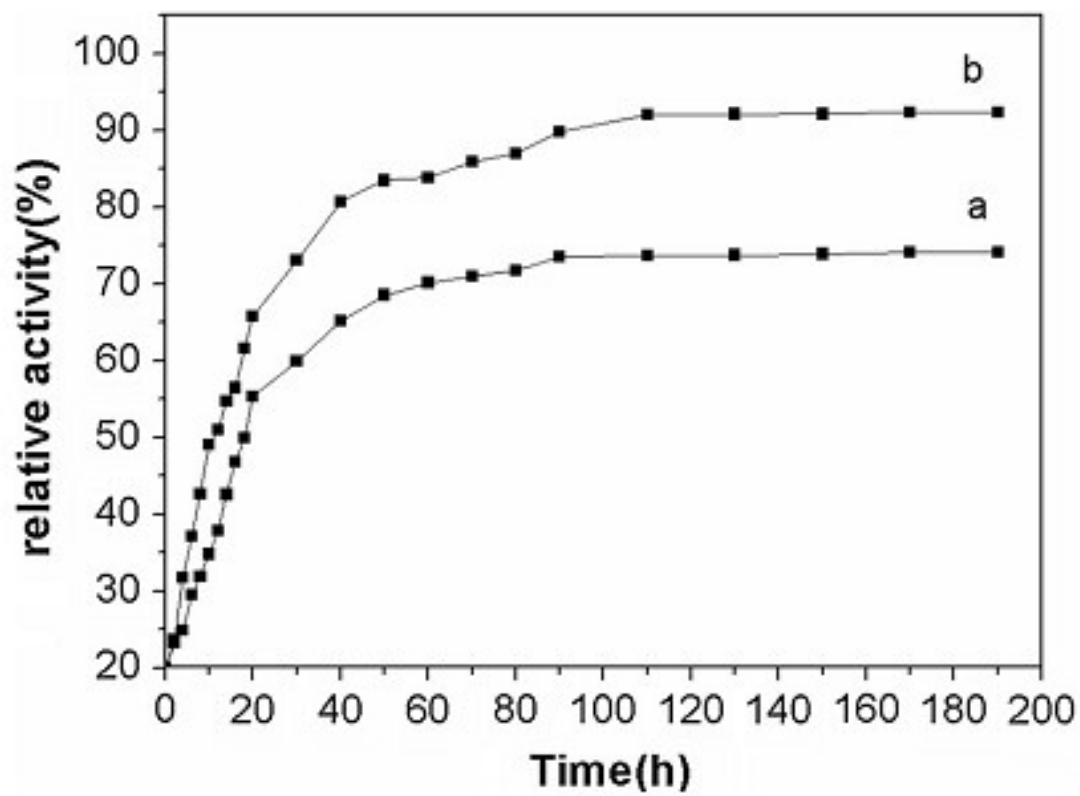


Figure S25. CDDP release from (a) HMS, (b) HMS-CMCS spheres in PBS at 37°C <sup>16</sup>

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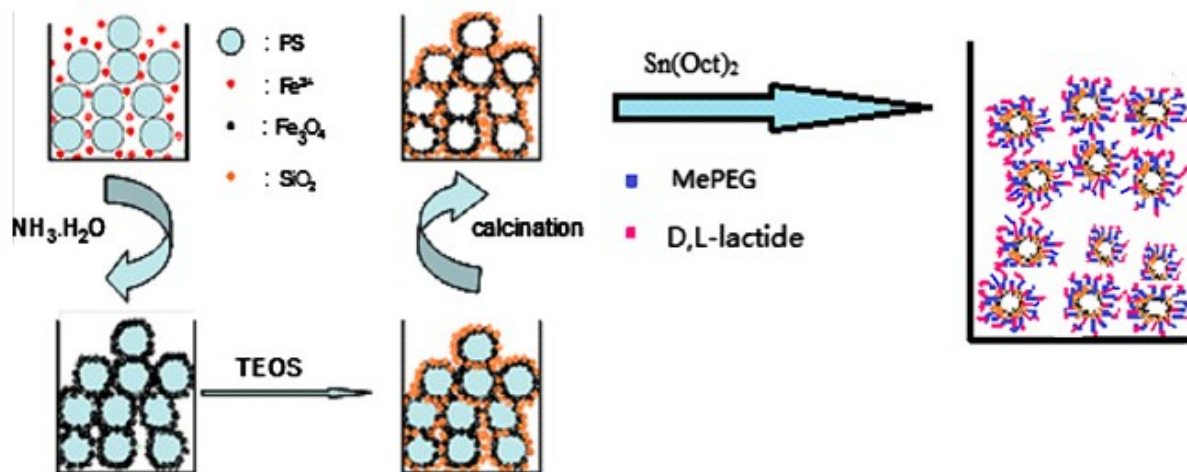


Figure S26. The synthesis procedure of hollow  $\text{Fe}_3\text{O}_4/\text{SiO}_2@$ PEG-PLA <sup>17</sup>

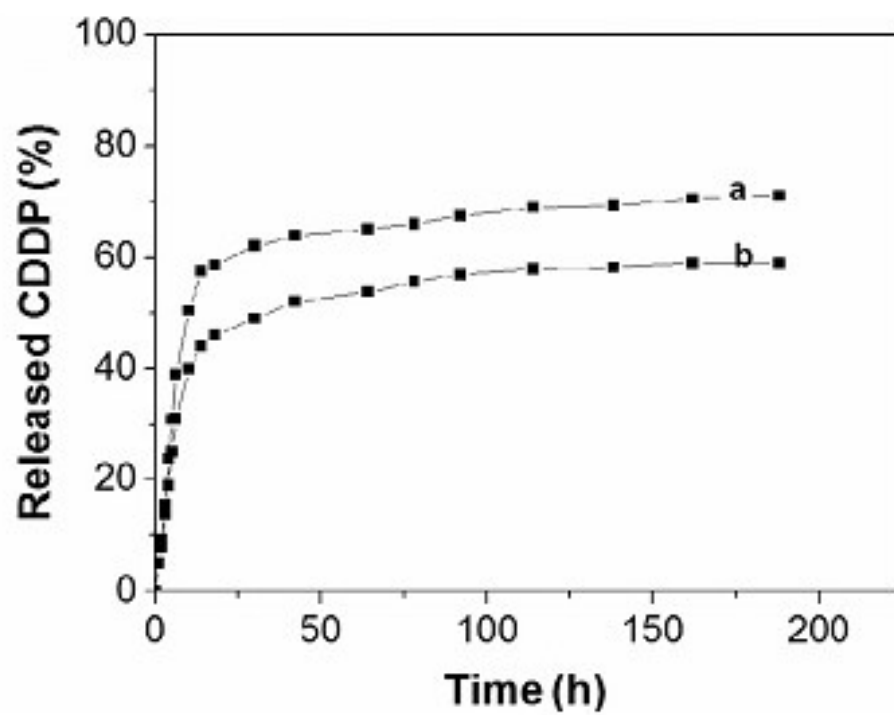
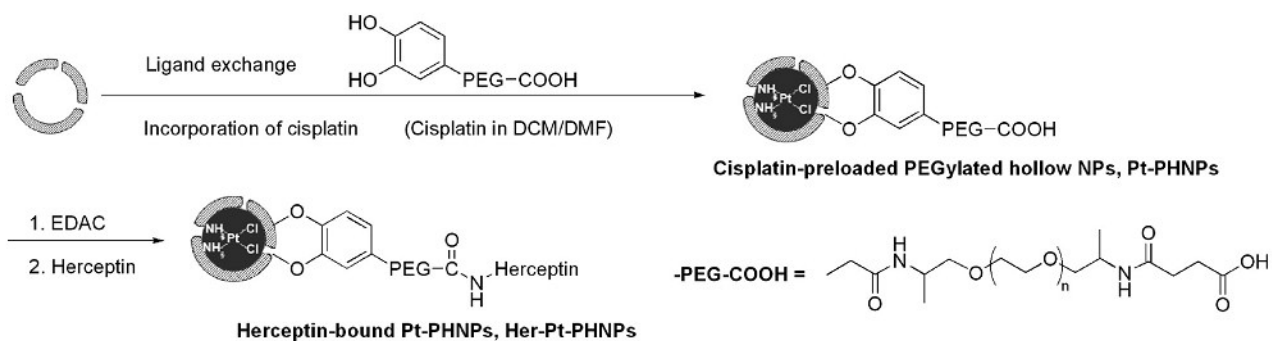


Figure S27. CDDP release from (a) HMS; (b) HMS@PEG-PLA spheres in PBS at 37 °C <sup>17</sup>

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**Figure S28.** Schematic illustration of simultaneous surfactant exchange and cisplatin loading into a PHNP and functionalization of this PHNP with Herceptin. <sup>18</sup>

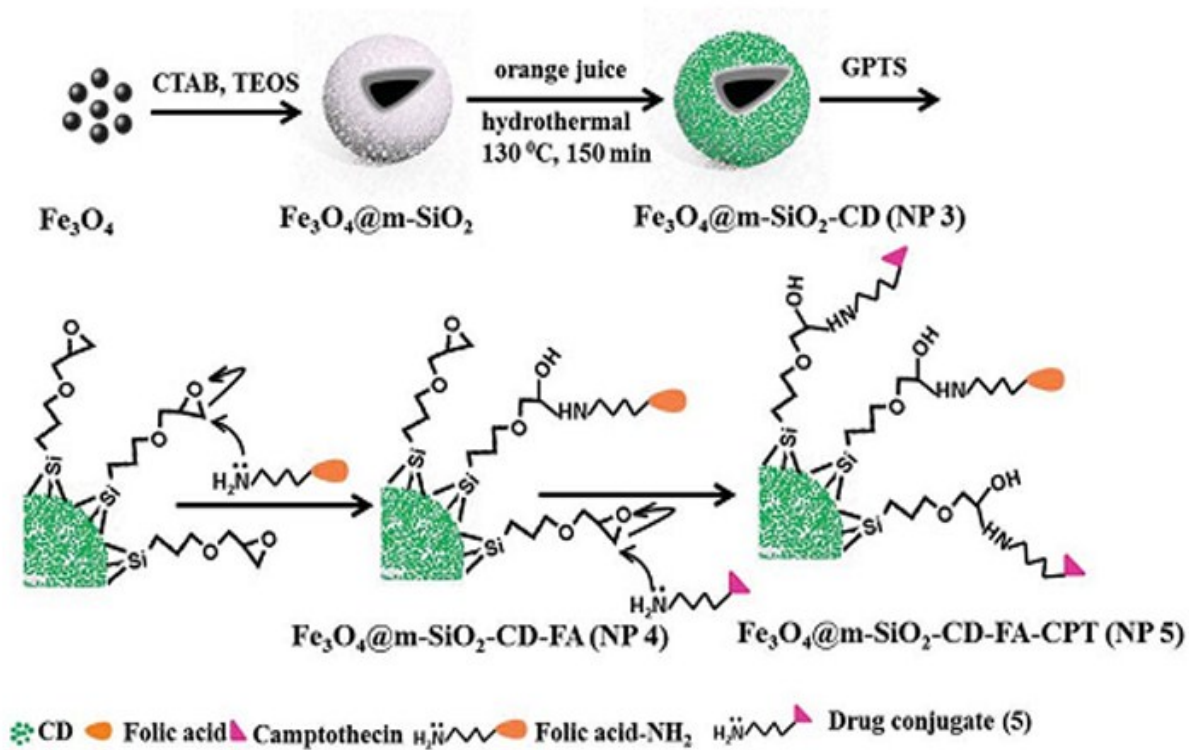
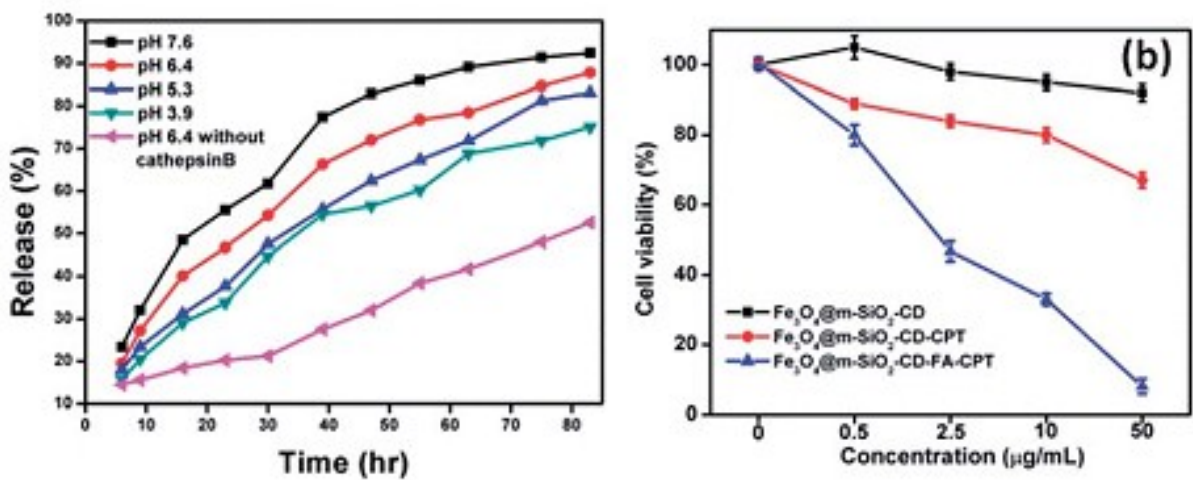


Figure S29. Synthesis of fluorescent magnetic nanoparticles conjugated with CPT and folic acid <sup>19</sup>



**Figure S30.** (a) Cumulative CPT releases from Fe<sub>3</sub>O<sub>4</sub>@m-SiO<sub>2</sub>-CD-FA-CPT, (b) in vitro cell viability of HeLa with as-prepared Fe<sub>3</sub>O<sub>4</sub>@m-SiO<sub>2</sub>-CD, Fe<sub>3</sub>O<sub>4</sub>@m-SiO<sub>2</sub>-CD-CPT and Fe<sub>3</sub>O<sub>4</sub>@m-SiO<sub>2</sub>-CD-FA-CPT nanoparticles. <sup>19</sup>

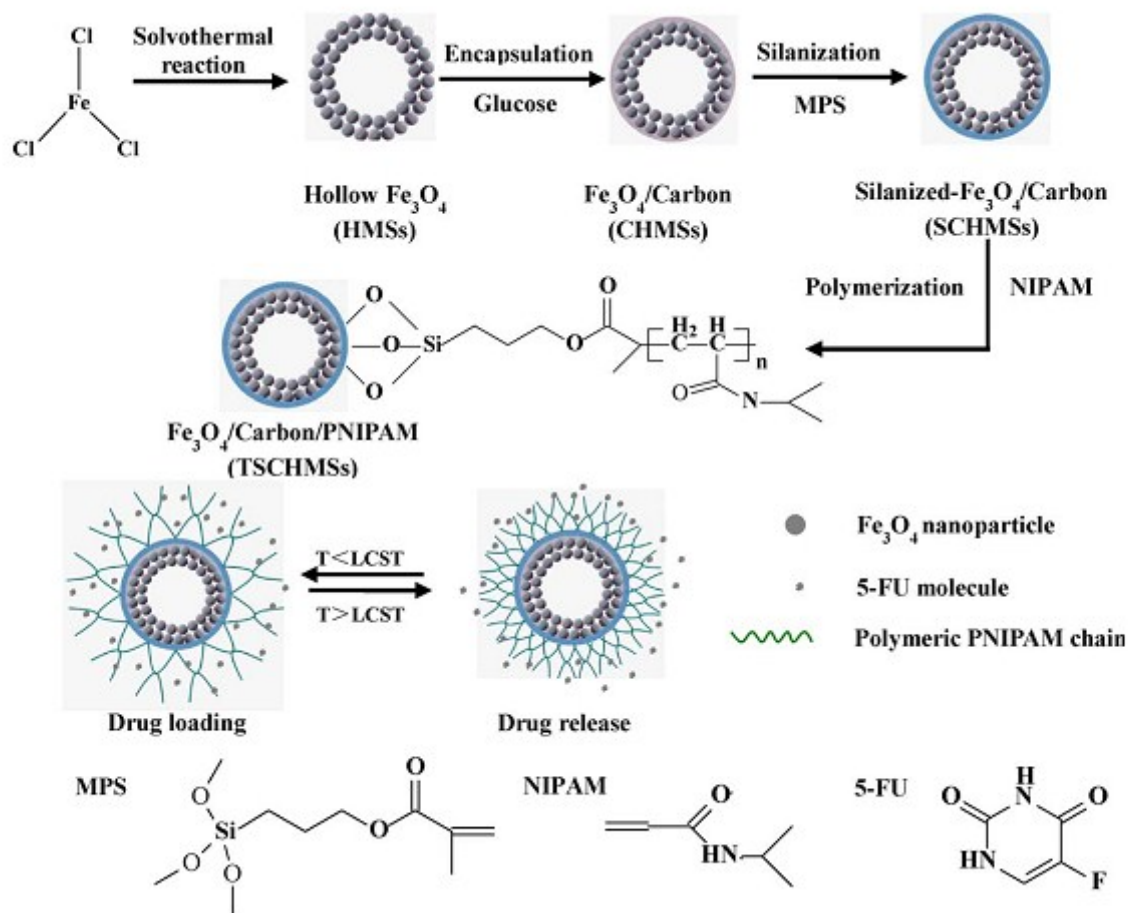


Figure S31. Schematic illustration of the drug loading and release of the hollow dual-responsive microspheres <sup>20</sup>



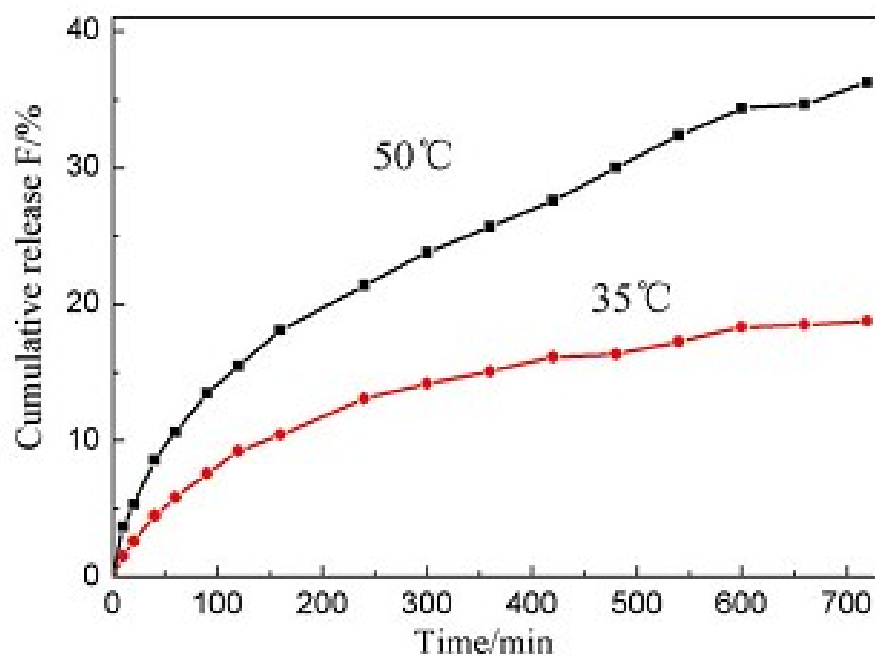


Figure S32. The release profile of the TSCHMSs at 35 and 50°C<sup>20</sup>

## Notes and references

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