**Supporting information**

**Hyper-branched Multifunctional Carbon Nanotubes Carrier for Targeted Liver**

**Cancer Therapy**

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**1. Characterizations**

**1.1. Fourier Transformed Infrared Spectroscopy (FT-IR)**

 The FT-IR spectroscopy used to analyze the structural elucidation of MWCNT-COOH, MWCNT-PEG, MWCNT-PEG-AA, MWCNT-PEG-AA-HBPLL-FA, and DOX/MWCNT-PEG-AA-HBPLL-FA were performed using hydraulic pressure compressed KBr pellet method in FT-IR spectrophotometer, Spectrum GX-1, Perkin Elmer, USA. The scanning ranges from 400-4000 cm-1.

**1.2. X-ray diffraction (XRD)**

 XRD analysis of MWCNT-COOH, MWCNT-PEG, MWCNT-PEG-AA, MWCNT-PEG-AA-HBPLL-FA, and DOX/MWCNT-PEG-AA-HBPLL-FA carrier crystalline phase identifications was analyzed by Philips 1710 X-ray diffractometer (Philips Electronic Instruments, Inc., Mahwah, NJ).

**1.3. Scanning Electron Microscopy (SEM)**

For the surface morphology of MWCNT-COOH, MWCNT-PEG, MWCNT-PEG-AA-HBPLL-FA, and DOX/MWCNT-PEG-AA-HBPLL-FA carriers’ solution were ultra-sonicated for 10 min. The solution was drop cast onto a sample holder, air-dried, and subjected to a Carl Zeiss Ultra Plus Field emission scanning electron microscope (FE-SEM).

**1.4. Transmission electron microscope (HR-TEM)**

The MWCNT-COOH, MWCNT-PEG, MWCNT-PEG-AA-HBPLL-FA, and DOX/MWCNT-PEG-AA-HBPLL-FA carriers (1 µL) solution was placed for particle size and shape on formvar coated grids, air-dried, and viewed at 100 kV to conduct transmission electron microscopy (JEOL 1010 TEM using a Mega view III camera and TEM software) studies. The JEM-2100 is a multipurpose, 200 kV analytical electron microscope.

**1.5. Thermogravimetric Analysis (TGA)**

 Thermal gravimetric analysis (TGA) was measured on Shimadzu-TA 60 instrument with a heating rate of 25 °C min-1 using crucibles of aluminum under N2 atmosphere.

**1.6. Particles size measurements analysis**

 The hydrodynamic particle size and surface charge of the MWCNT-PEG-AA-HBPLL- FA and DOX/MWCNT-PEG-AA-HBPLL-FA were studied at 25℃ in a Zetasizer (Malvern instruments DTS Ver.4.10) equipped with He-Ne laser (633 nm) as a light source at room temperature.