

Fabrication of MMP2-Responsive Nano-sized Particles Using Coaxial Electrospray-Template Removal Method

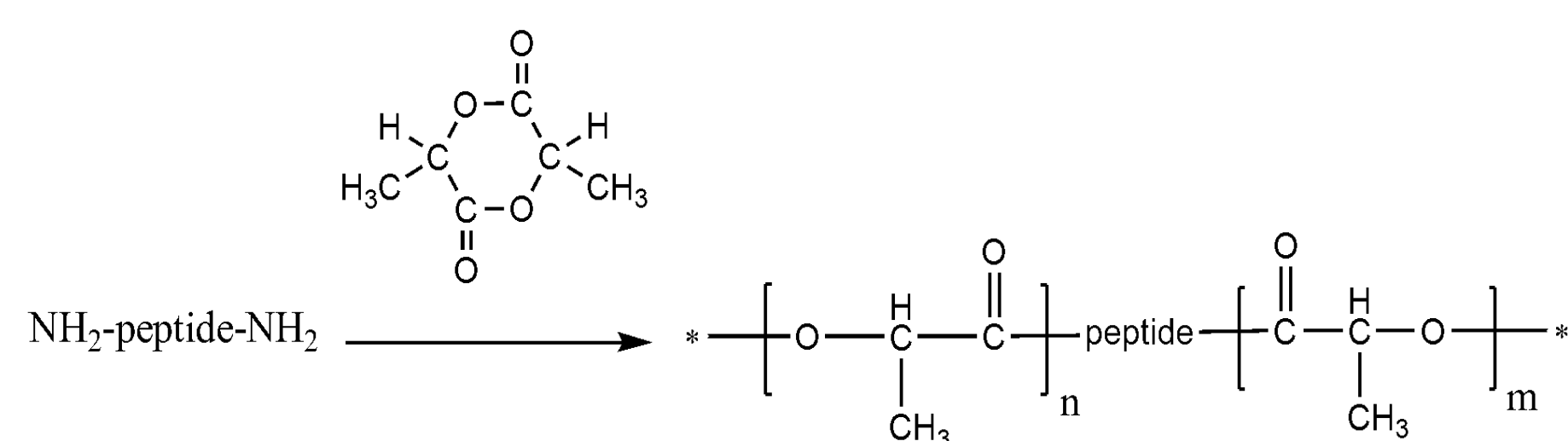
21429016 Xixi Zheng, Li-Qun Wang*

MOE Key Laboratory of Macromolecular Synthesis and Functionalization, Department of Polymer Science and Engineering, Zhejiang University, Hangzhou China

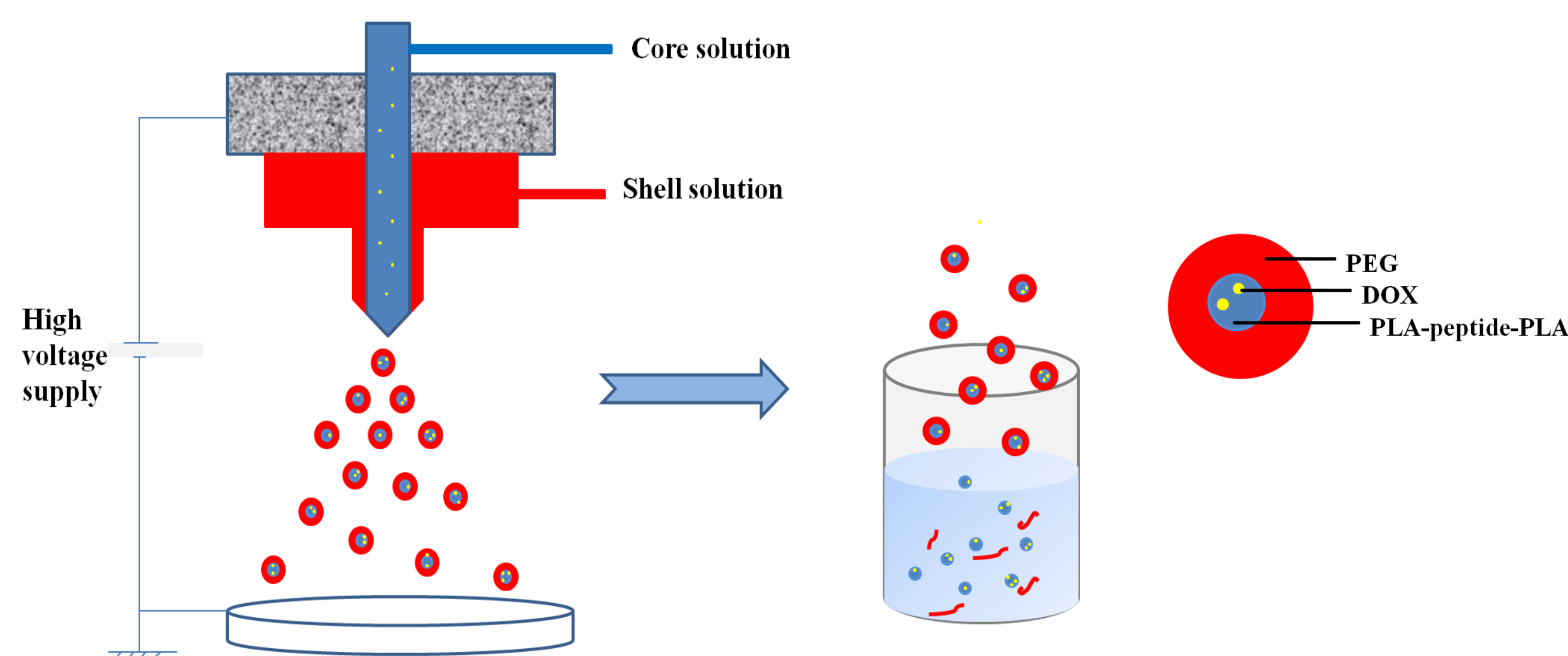
Introduction

In this work ,a coaxial electrospray and template removal method was used to prepare MMP2-responsive nano-sized particles for encapsulating of DOX. Polyethylene glycol (PEG) was used as shell materials ,the mixture of poly (L-lactide-co-MMP2 cleavable peptide)and DOX was used as core materials. Microparticles with core-shell structure were first prepared through coaxial electrospray, the shell layer was subsequently removed to decrease the particle size from micro scale to nanometer scale. DOX-an anticancer drug released in response to the environment of tumor cell because of excessive secreted protease MMP-2 of cancer cells. The morphologies of the microparticles were characterized, and the result of the laser scanning confocal microscope(LSCM) demonstrated that the microparticles prepared were with core-shell structure. Nano-sized particles after removing PEG template and the MMP-sensitive behaviors of nanoparticles were also studied.

Experimental



Scheme 1. Synthesis of the poly (L-lactide-co-MMP2 cleavable peptide) copolymer



Scheme 2. Preparation of nanoparticles by coaxial electrospray and template removal method

Results and discussion

1. Synthesis of the PLA-peptide-PLA copolymer

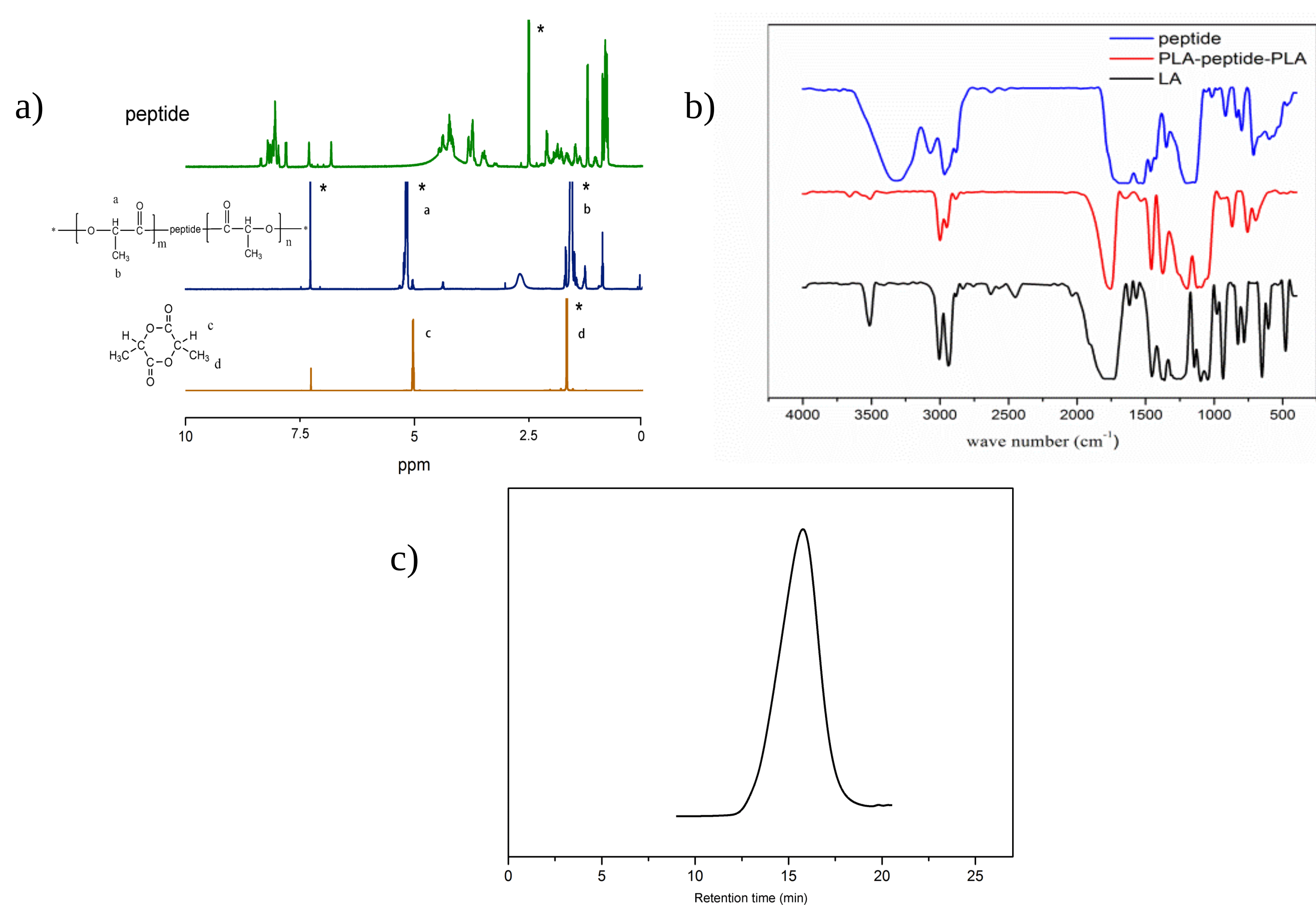


Fig 1. (a) ^1H NMR spectra of peptide,PLA-peptide-PLA and LA.(b) FTIR spectra of peptide,PLA-peptide-PLA and LA.(c)GPC spectra of PLA-peptide-PLA.

2.Preparation of microparticles with core-shell structure by electrospray technique

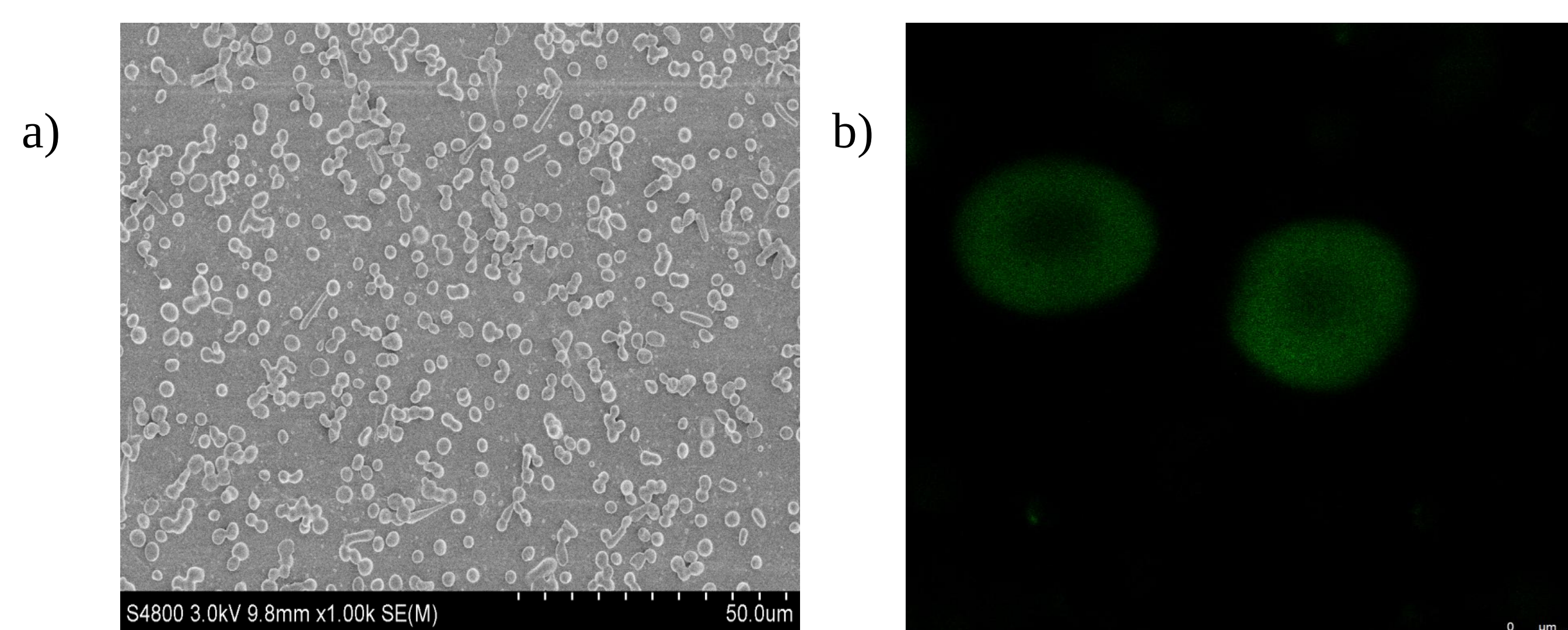


Fig 2. (a) SEM images (b) LSCM images of electrospray microparticles with core-shell structure

3.Preparation of nanoparticles through removing PEG template

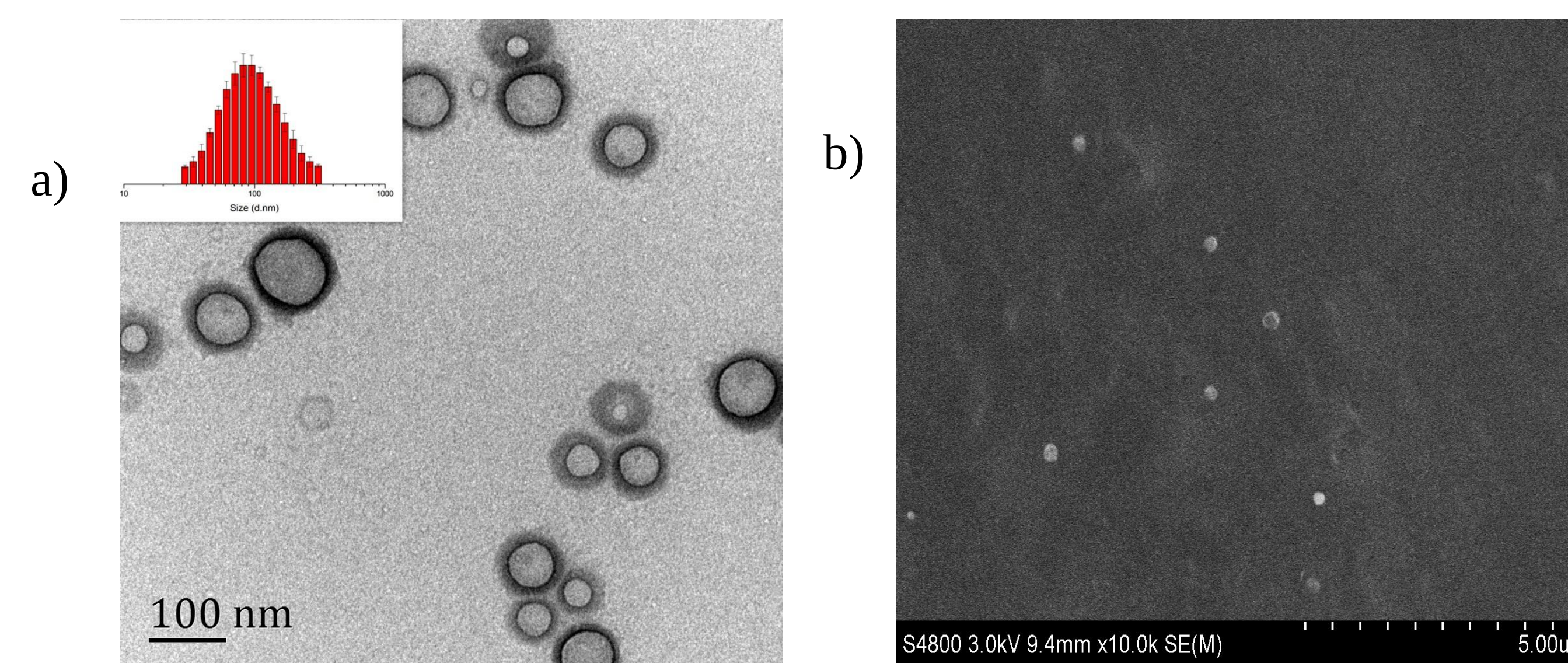


Fig 3. (a) TEM images and size distribution (b)SEM images of nanoparticles after removing PEG template

4. The MMP-2 protease responsive behaviors of the nanozised particles

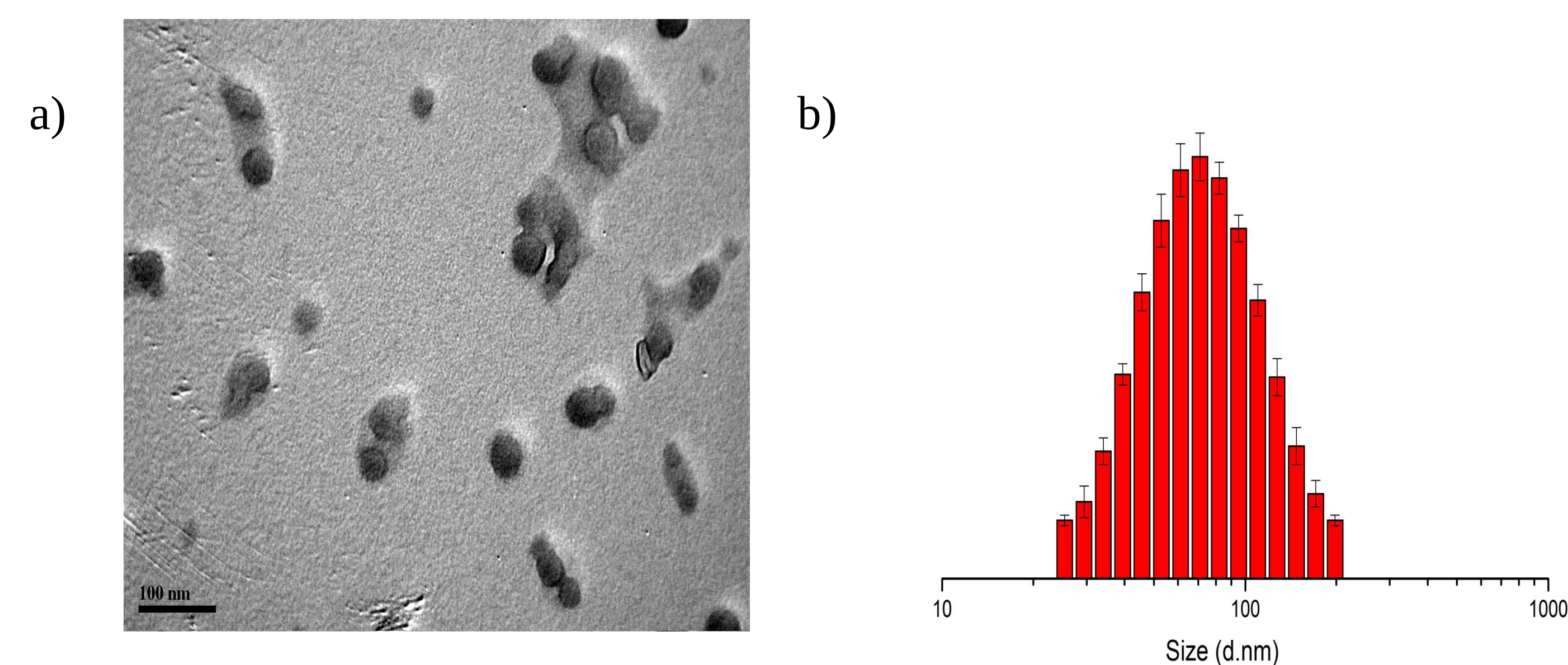


Fig 4. (a) TEM images (b) size distribution of nanoparticles treated with MMP-2 protease with 6h.

Conclusions:

In summary, we use a coaxial electrospray and template removal method to prepare nano-sized particles, which can specially respond to overexpressed MMP protease in cancer cells. DOX, an anticancer drug could be released effectively. The result demonstrates that the targeting drug delivery nano-carrier can be prepared simply and efficiently with coaxial electrospray and template removal method.

Acknowledgements:

The work was financially supported by the National Natural Science Foundation of china. (Grant No. 21474086)

References:

1. Cao LH, Wang LQ, Jiang HL. Colloids and Surfaces B: Biointerfaces, 2014, 115, 212–218
2. Chen JM, Dai HF, Wang LQ. Colloids and Surfaces B: Biointerfaces, 2016, 141: 278-283.