Lysosome-Targeting Magnetic-Plasmonic Hybrid Nanoparticles for the Imaging and Isolation of Intact Lysosomes

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The proteomic analyses of lysosomal protein defects are crucial tasks to understand the role of lysosomal dysfunction in pathological conditions.[1] The key factor for generating comprehensive lysosomal proteome datasets requires a novel isolation technique with high yield and purity. Commonly used methods for lysosome fractionation are density-gradient centrifugation and antibody-based pulldown assay, which often result limited yield and low purity.[2] In addition, long isolation times are needed, and thus the functional loss of lysosomal proteins during separation would be caused. Recently, superparamagnetic nanoparticles-based isolation has emerged as an approach to separate 'intact' lysosomes.[3] In this technique, nanoparticles are required to be delivered into the lumen of lysosomes through a endocytic pathway. The intracellular fate of nanoparticles strongly affects to the yield and purity of lysosome fractionation.

Herein, we synthesized dextran (Dxt) modified magnetic-plasmonic Ag@FeCo@Ag core@shell@shell nanoparticles (MPNPs) with the hydrodynamic size of around 50 nm in PBS buffer (Fig. 1a) and demonstrated a magnetic separation of lysosomes in COS-1 cells using the Dxt-modified MPNPs which are targeted to the lumen of lysosomes through the endocytic machinery. Unlike other existing magnetic fractionation techniques, the plasmonic scattering from MPNPs enables us to trace the localization of MPNPs in the endocytic pathway by confocal laser scanning microscopy (CLSM) (Fig. 1b). In this talk, we will show the results of plasmonic imaging and magnetic separation of lysosomes using Dxt-modified MPNPs.

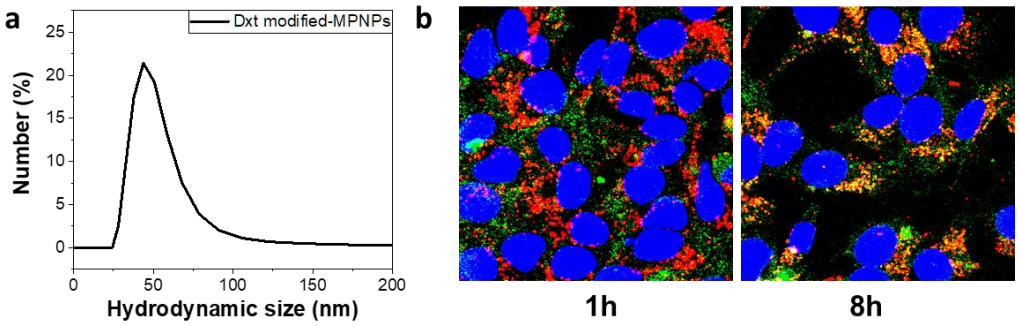

Fig. 1. (a) Hydrodynamic size distribution of Dxt-modified MPNPs dispersed in a PBS buffer. (b) CLSM images of Dxt-modified MPNPs in COS-1 cell after 1 (left) and 8 (right) hours incubation (blue: nuclei, green: MPNPs, red: lysosomes).

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