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Electronic Supplementary Information

Ion Transportation by Prussian Blue Nanoparticles Embedded in a Giant Liposome

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1. Materials

1,2-dioleoyl-sn-glycero-3-phosphocholine (DOPC) was purchased from Avanti Polar Lipids, Inc. Alabaster, Alabama, USA. 8-hydroxy-1,3,6-pyrenetrisulfonate (Pyranine dye) was purchased from Tokyo Chemical Industry Co. Ltd., Japan. Sucrose, D-(+)-glucose and methanol were purchased from Nacalai Tesque, Inc., Japan and used as received. Super-dehydrated chloroform and sodium hydroxide was purchased from Kanto Chemical Co. Inc., Japan and Wako Pure Chemical Industries Ltd., Japan, respectively and were used without further purification. Deionized water collected from a Millipore Milli-Q purification system (Direct-Q 3UV with pump).

2. X-ray diffraction pattern of PBNPs

The crystal structure of PBNPs were checked by X-ray diffraction measurements (Rigaku MiniFlexII, Japan). Figure S1 shows the X-ray diffraction profiles of the obtained nanoparticles (black) and reported Prussian blue (red line), $Fe_4[Fe(CN)_6]_3 \cdot 14H_2O$, from the X-ray database (no. 01-070-0557). Both peak position and intensity matched well. Therefore the PBNPs were found to be successfully synthesized.

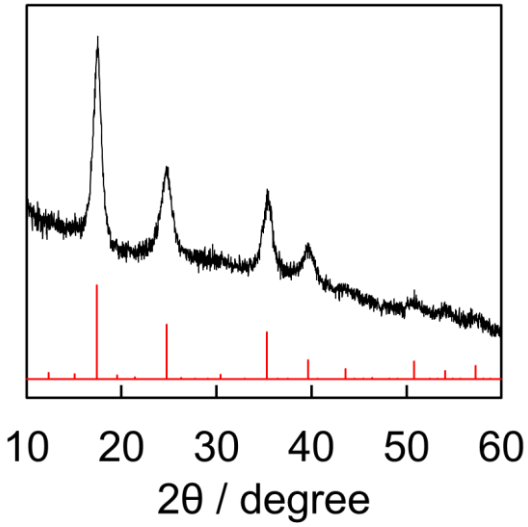

Figure S1 X-ray diffraction profiles of the obtained nanoparticles (black) and reported Prussian blue (red line), $Fe_4[Fe(CN)_6]_3 \cdot 14H_2O$, from the X-ray database (no. 01-070-0557).

3. Ion Transport Check by Fluorescence Microscopy

The ion transport property of PB NPs-liposome was investigated in terms of fluorescence response of pH-sensitive pyranine dye with optical microscopy. Phase contrast and fluorescence microscopy (Nikon TE-2000-S) was used with a Plane Fluor ELWD 60× objective leans, filter sets (UV, ex. 340-380 nm, dicroic mirror 400 nm, em. 420 nm and FITC, ex. 465-495 nm, dicroic mirror 505 nm, em. 515-555 nm), and a CCD camera (WAT-120N+, Watec). We selected the same area (256 pix) in the middle portion of liposomes to measure the fluorescence intensity by using ImageJ software.

4. Chemical Stability Test for PBNPs

Chemical stability of embedded PB NPs into liposome was checked in a basic media condition. PB NPs without liposome was gradually degraded with time under pH ~ 9 because the color of the solution turned from light blue to colorless in 10 minutes. Figure S2 shows time dependence of the PB NPs solution with liposomes under pH ~ 10. This pH was adjusted as well as our experimental condition. The light blue color of the PB NPs solution did not change for 45 minutes. Results suggest that the embedded PB NPs into liposome is chemically stable in weak-basic media under pH ~ 10 by at least 45 minutes.

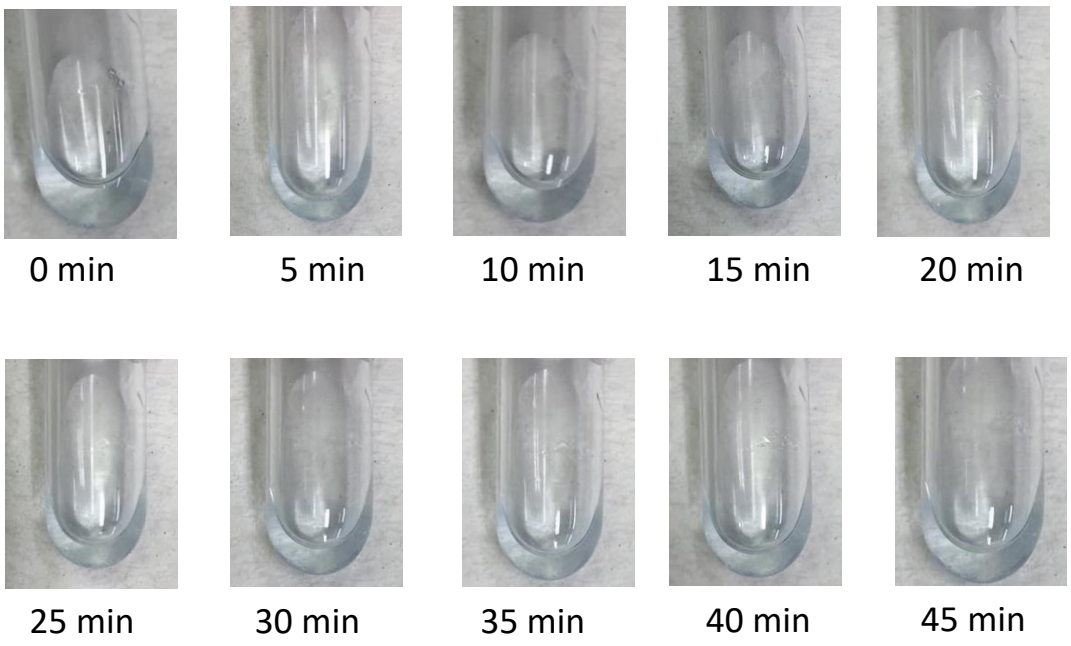

Figure S2 Time dependence of the PB NPs solution with liposomes under pH ~ 10.