Electronic Supplementary Material (ESI) for RSC Advances.

Electronic Supplemental Information (ESI)

Title

Short Polyethylene Glycol Chains Densely Bound to Soft Nanotube Channels for Inhibition of Protein Aggregation

Authors

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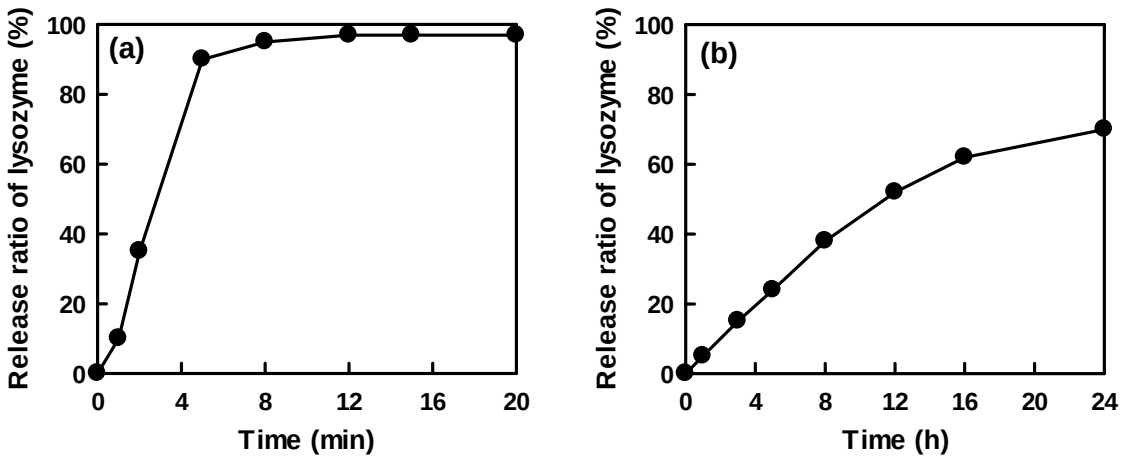

Fig. S1 (a) Release of the encapsulated lysozyme (3.0 mg/ml) in the PEG_8-NT channel to the bulk solution by cooling to 25 ^{o}C. The sample solution was prepared by heating at 90 ^{o}C of the mixing dispersion of the PEG_8-NT (25 mg/ml) and lysozyme (3.0 mg/ml). (b) Release of the encapsulated lysozyme (3.0 mg/ml) in the PEG_8-NT channel to the bulk solution by standing at 25 ^{o}C. The sample solution was prepared as follows: The lysozyme solution (3.0–9.0 mg/ml) was added into the lyophilized PEG_8-NT (25 mg/ml). The resultant mixture was filtered by the polycarbonate membrane with 200 nm pore size. The residual PEG_8-NT was washed several times with PBS buffer to remove lysozyme existing outside of the PEG_8-NT.

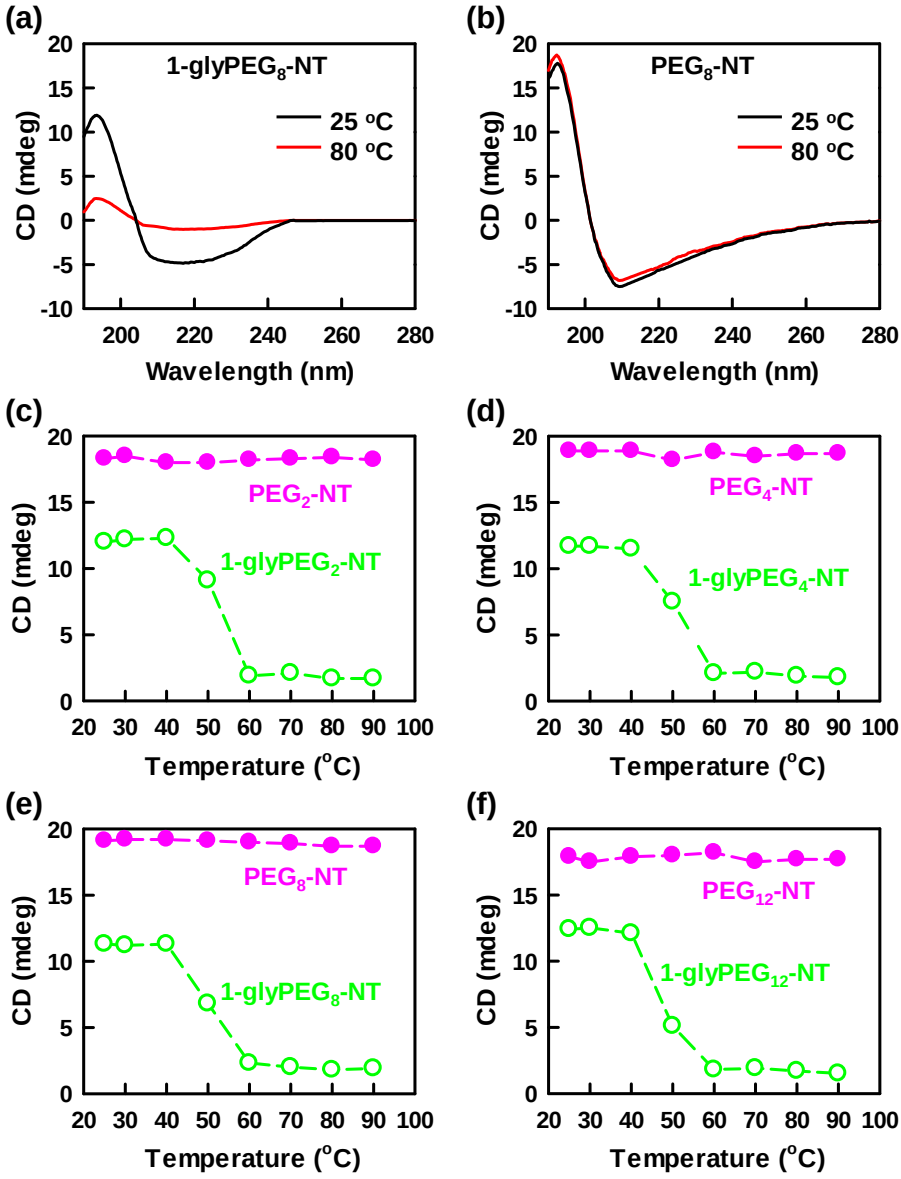

Fig. S2 (a, b) CD spectra of the 1-glyPEG$_8$-NT and the PEG$_8$-NT dispersed in water at 25 ^{o}C and 80 ^{o}C. The wavelength region of the Cotton bands corresponds to the absorption band of the conjugated amide linkages in co-assembly of **1** with the chiral source ($_D$-glucose moiety), achiral glyPEG$_8$ and **2** with the chiral source ($_D$-glucose moiety). The decrease of the CD intensity of the 1-glyPEG$_8$-NT at 80 ^{o}C means that the chiral molecular packing is destructed by the gel-to-liquid crystalline phase transition of the nanotube monolayer membrane. (c, d, e, f) Temperature dependence of the CD intensities at 195 nm for the 1-glyPEG$_n$-NTs and the PEG$_n$-NTs dispersed in water. The gel-to-liquid crystalline phase transition temperatures ($T_{g\text{-}l}$) of the 1-glyPEG$_n$-NTs were estimated to be about 50 ^{o}C. All PEG$_n$-NTs showing no decrease of the CD intensities have higher thermal stabilities.

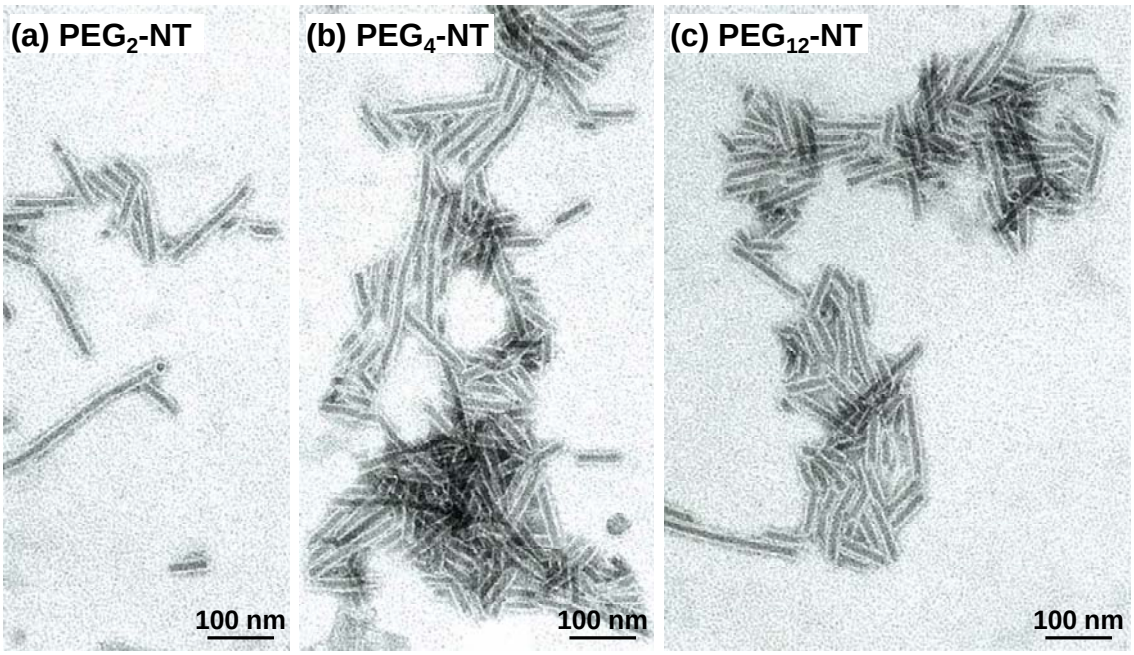

Fig. S3 TEM images of the PEG$_n$-NTs after sonication. The nanochannels of the nanotubes were visualized with 2wt% phosphotungstate as a negative staining reagent.

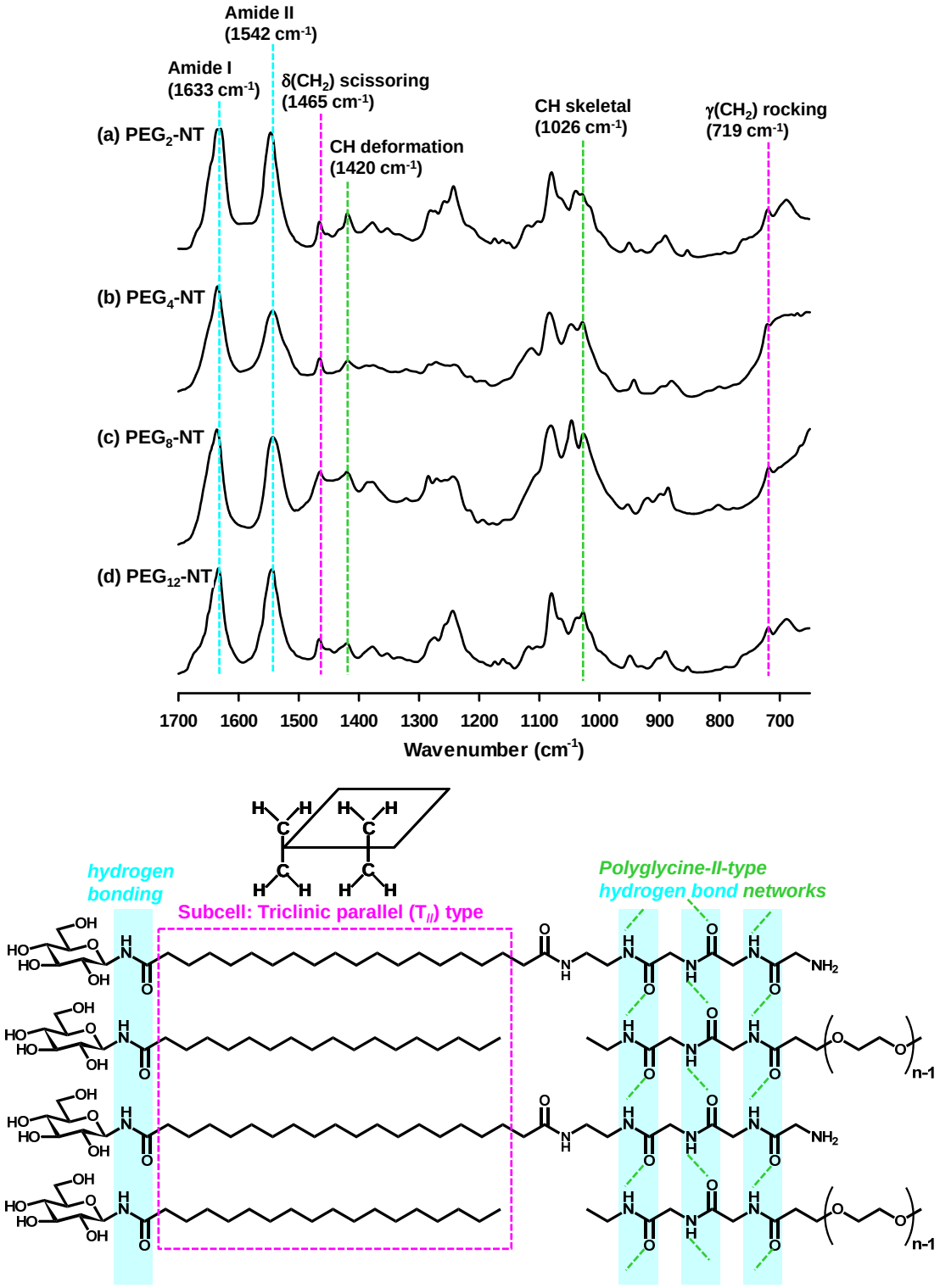

Fig. S4 IR spectra for the amide-I, amide-II, CH_2 scissoring, CH_2 rocking, CH deformation and CH skeletal bands of the PEG_n-NTs. The appearance of the CH_2 deformation and CH_2 skeletal shows that **1** and $glyPEG_n$ forms a polyglycine-II-type hydrogen bond network. The single sharp peak of the CH_2 scissoring and CH_2 rocking indicates that the lateral chain packing (subcell structure) of the oligomethylene spacer of **1** and **2** has a triclinic parallel ($T_{//}$) structure.

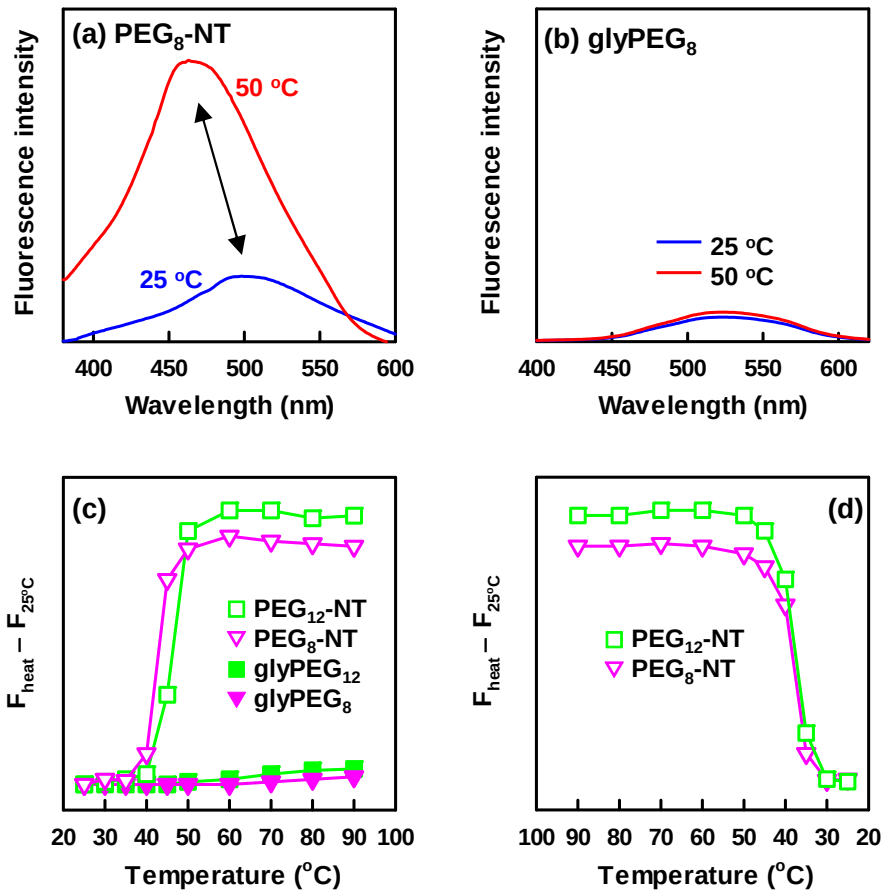

Fig. S5 (a, b) Fluorescence spectra of the encapsulated 1,8-ANS in the PEG_8-NT channel and the free 1,8-ANS in the presence of $glyPEG_8$ unit in bulk solutions at 25 °C and 50 °C. (c) Relationship between the variation of the fluorescence intensity and the elevating temperatures. (d) Relationship between the variation of the fluorescence intensity and the cooling temperatures.

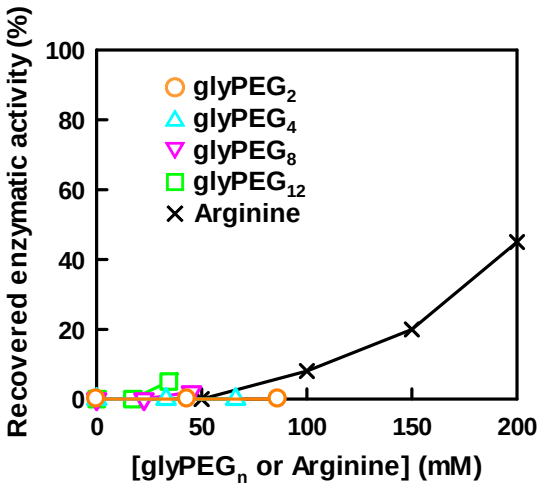

Fig. S6 Enzymatic activities of lysozyme (0.2 mM) with different concentrations of the $glyPEG_n$ unit or arginine after heating at 90 °C for 30 min.