Electronic Supplementary Material (ESI) for Biomaterials Science
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Supporting Information

Dimethysiloxane Polymer for the Effective Transdermal Delivery of Donepezil in Alzheimer's Disease Treatment

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This PDF file includes:

1. Materials and Methods

1.1. General information

Chemical reagents were purchased from Aldrich (USA), TCI (Japan), and Alfa Aesar (USA). Ethanol (Product No. E0223) was sourced from Samchun Chemicals (Seoul, Rep. of Korea). 2,2,5,5-tetramethyl-2,5-disila-1-oxacyclopentane (Product No. SIT7540) was obtained from Gelest (Morrisville, PA, USA). Trifluoroacetic acid (Product No. T0431) was procured from TCI (Tokyo, Japan). Donepezil was purchased from Megafine Pharma (Maharashtra, India). Oil Red O (Product No. 00625) was acquired from Sigma-Aldrich (St. Louis, MO, USA). Methylene blue (Product No. A18174) was purchased from Alfa Aesar (Haverhill, MA, USA). Phosphate-buffered saline (PBS, 10×, Product No. 70011-044) was procured from Gibco (Waltham, MA, USA). Deionized water (DI H_2O, Ultra370, Younglin Co., Rep. of Korea) was used to prepare aqueous solutions. The CCK-8 (cell counting kit 8, Dojindo Molecular Tech. Inc., Japan) was used to assess cellular toxicity. Dulbecco's modified Eagle's media (DMEM) and fetal bovine serum (FBS) were obtained from Hyclone (Utah, USA) for cell culture (B.End3, HEK293). Penicillin-streptomycin was purchased from Gibco Industries Inc. (Auckland, NZ) for use in cell cultures (B.End3, HEK293). Cell culture dishes (96-well plate, 24-well plate, 6-well plate, and 100-Ø dish) were acquired from SPL Life Science (Rep. of Korea). UV/vis absorption spectra were recorded using a spectrophotometer (Agilent Technologies Cary 8454, Santa Clara, CA, USA). Attenuated Total reflection-Fourier transform infrared (ATR-FITR) spectroscopy was conducted using a Thermo Scientific Nicolet™ iS™ 5 FT-IR spectrometer (16 scans, Waltham, MA, USA). Confocal laser scanning microscope (CLSM) imaging was performed using an LSM-800 instrument (Carl Zeiss, Germany). NMR spectra were measured on a JNM 500 MHz NMR spectrometer (JEOL, Tokyo, Japan). Thermal stability of the monomer and T2 was evaluated using thermogravimetric analysis (TGA, SDT Q600, TA Instruments, DE, USA) at Hanyang University (Seoul, Rep. of Korea). The viscosity of the monomer, T2, and DNZ-loaded T2 was evaluated using a rheometer (ARES-G2, TA Instruments, DE, USA) at Sungkyunkwan University (Suwon, Rep. of Korea). Gel permeation chromatography (GPC) analysis was performed using an Agilent Infinity 1260 (Agilent, Santa Clara, CA, USA) at Sungkyunkwan University. Hyaluronic acid sodium salt from *Streptococcus equi* was purchased from Merck (CAS 9067-32-7, USA).

2. Supporting Figures

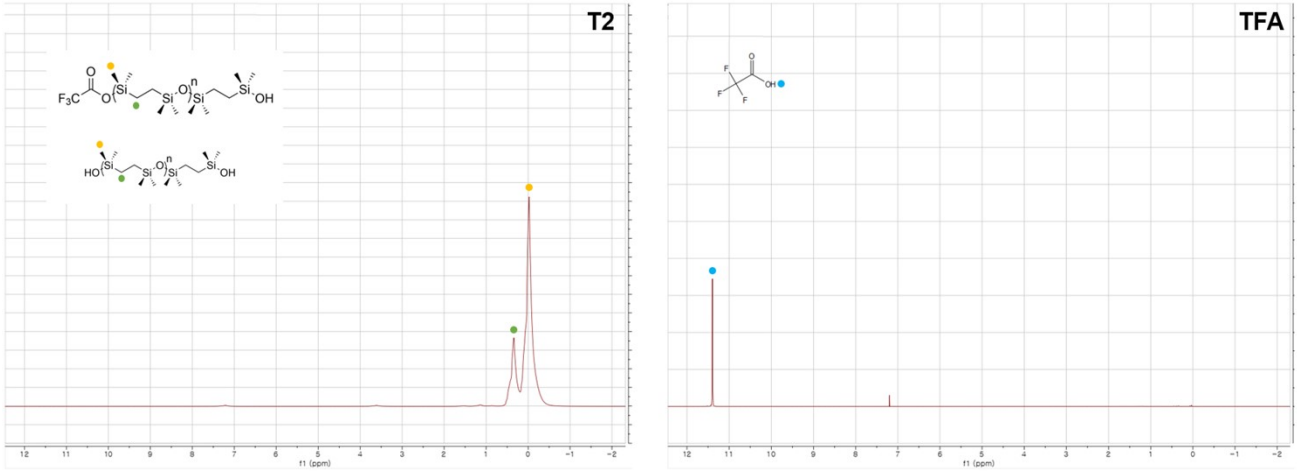

Fig. S1. ^{1}H NMR spectra of the T2 polymer and trifluoroacetic acid (TFA). NMR solvent: $CDCl_3$.

Fig. S2. ^{19}F NMR spectra of the T2 polymer and trifluoroacetic acid (TFA). NMR solvent: $CDCl_3$.

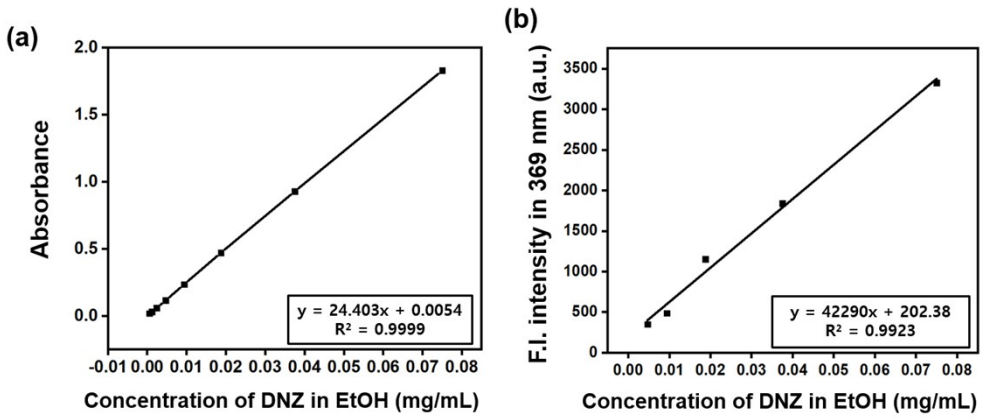

Fig. S3. (a) Concentration-dependent absorbance plot of DNZ at 314 nm in EtOH. (b) Concentration-dependent fluorescence intensity plot of DNZ at 385 nm in EtOH.

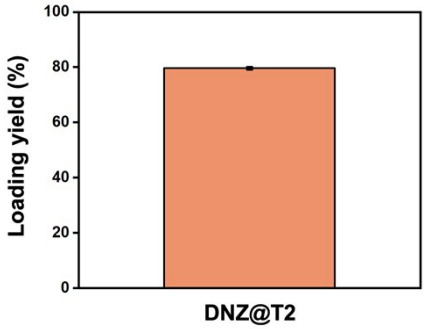

Fig. S4. Calculated drug loading yield of DNZ in the T2 polymer. Loading efficiency was calculated from the standard absorbance curve.

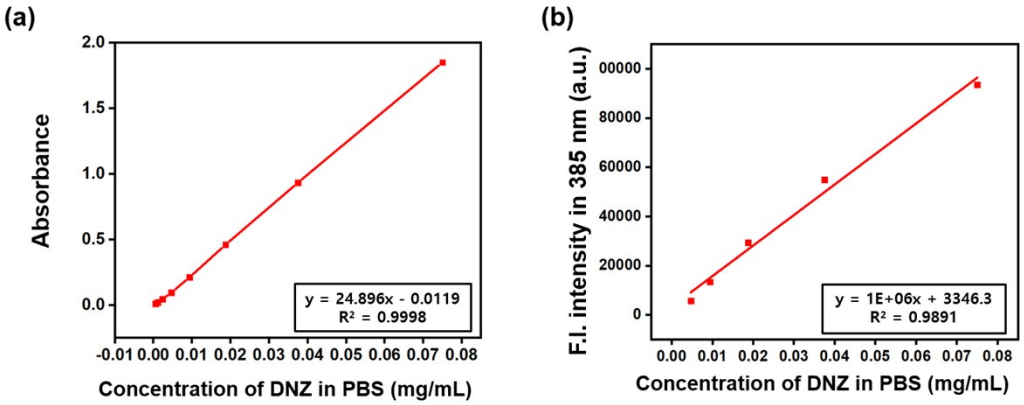

Fig. S5. (a) Concentration-dependent absorbance plot of DNZ at 314 nm in PBS (pH 7.4). (b) Concentration-dependent fluorescence intensity plot of DNZ at 385 nm in PBS (pH 7.4).

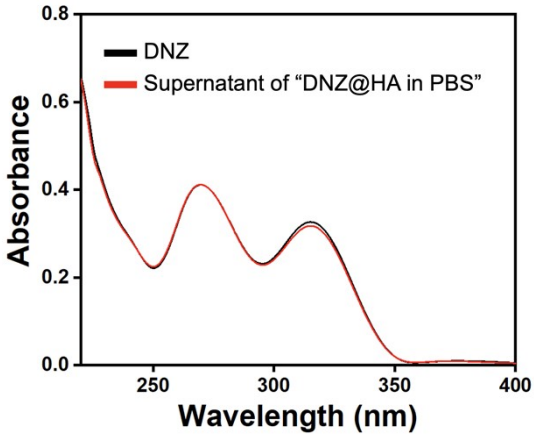

Fig. S6. UV/vis absorption spectra of DNZ (0.6 mg/mL) and supernatant of "DNZ@HA (DNZ concentration: 0.6 mg/mL) in PBS (pH 7.4)".

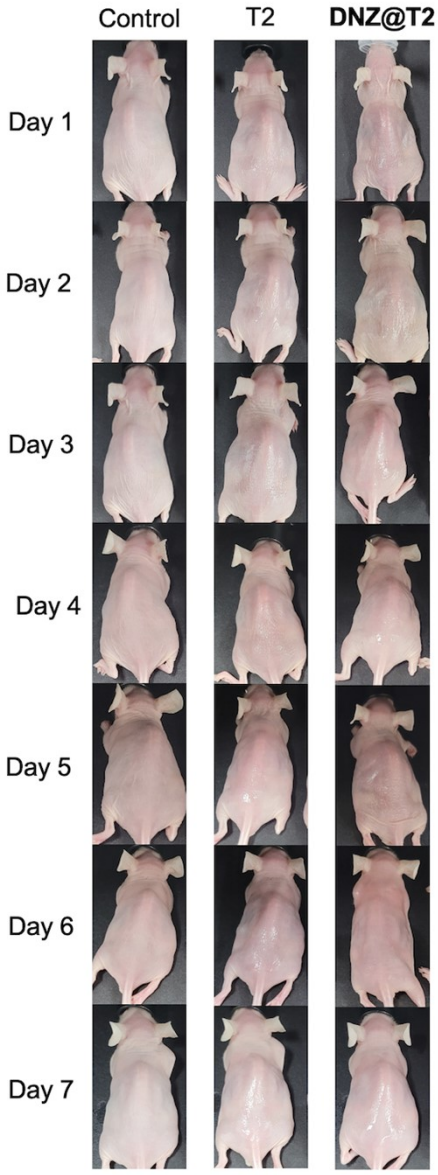

Fig. S7. Photographs of Balb/c nude mice over a 7-day period following treatment with 100 μL of different samples: control (non-treated set), T2 (T2-treated set), and DNZ@T2 (DNZ@T2-treated set).

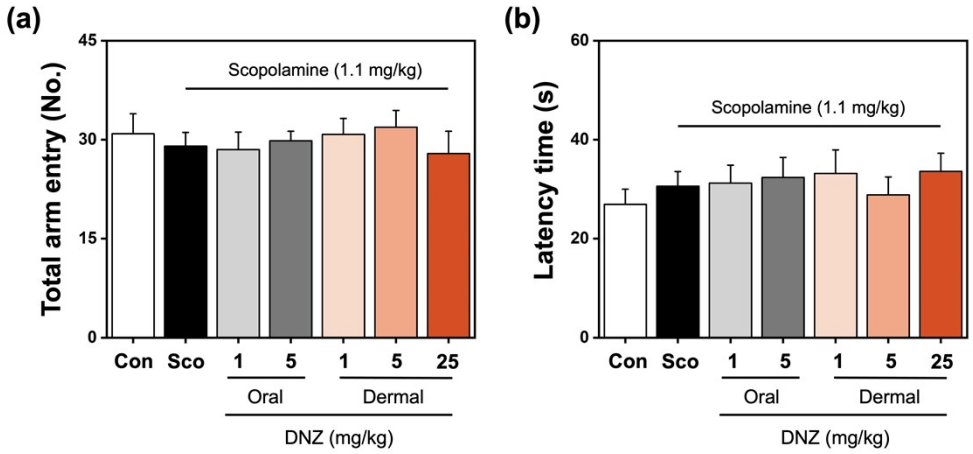

Fig. S8. (a) Total arm entry results from Fig. 5c. (b) Latency time for the acquisition day from Fig. 5d. The results were analyzed by dividing DNZ into oral and transdermal administration groups to confirm the difference based on the administration route of DNZ.

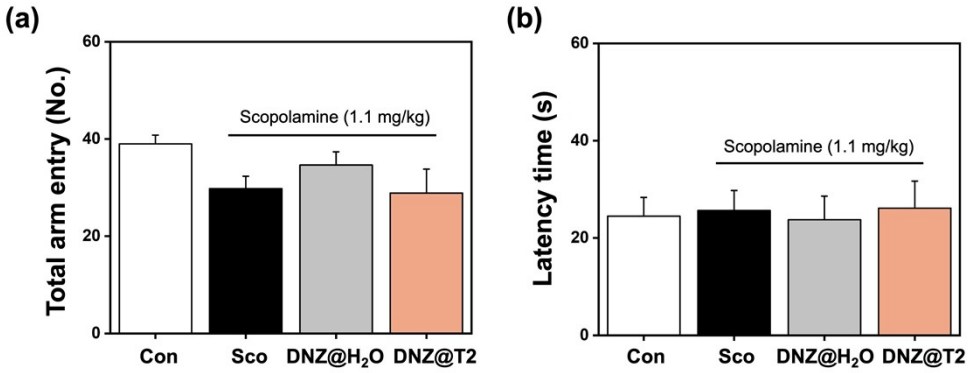

Fig. S9. (a) Total arm entry results from Fig. 5f. (b) Latency time for the acquisition day from Fig. 5g. The results were analyzed using DI H_2O containing DNZ and DNZ@T2 to determine differences in drug delivery within the transdermal administration of DNZ.

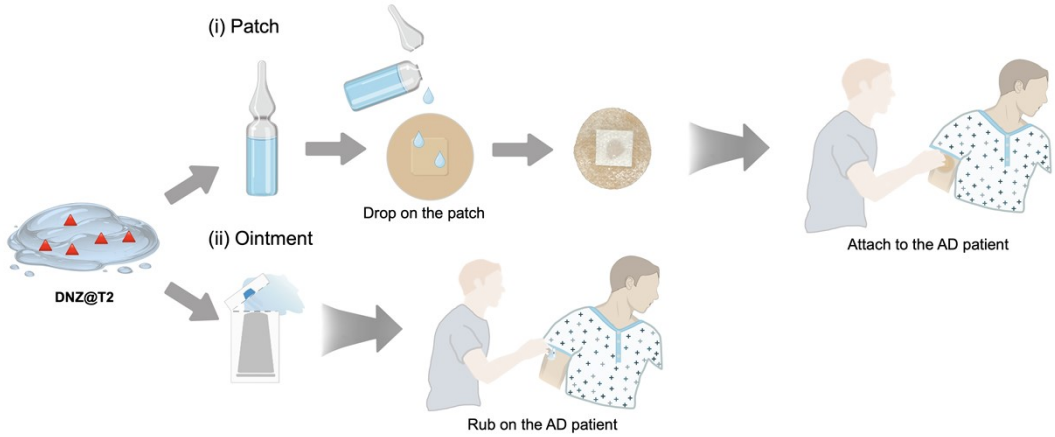

Fig. S10. Schematic illustration of the development of DNZ@T2 for practical applications.