

## Supporting Information for

# **Water Actuated Reversible Shape-Memory Polydimethylsiloxane for Potential Biomedical Application**

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### **Section S1. Fabrication Methods**

#### **Materials and methods**

Sylgard 184 was supplied by Dow Corning Co. Deionized water was offered by Wuxi city Yasheng Chemical. Sodium chloride was provided by Macklin Chemical. An Nreeohy J-E98 metallographic microscope was used to collect optical microscopic images. An Nreeohy Y-E68 fluorescence microscope was used to capture fluorescent microscopic images. A Shimadzu UV-2600i ultraviolet spectrophotometer was used to collect the absorption data of the aspirin released in water. An Zwick 1446 (Zwick/Roell, with 200 N sensor, Germany) was used to measure the mechanical performance of the materials, and the tensile tests were conducted with a 10 mm/min tensile speed at room temperature.

#### **Fabrication of the samples of RSMPDMS**

PDMS base and PDMS linker (Sylgard 184) were combined in vibration at a mass ratio of 10:1 to obtain a homogeneous mixture. 10wt.% sodium chloride solution (0.5:1 weight ratio of solution to PDMS precursor) was added to this emulsion with stirring until forming an opaque emulsion, which was then casted on the substrate and cured in sealed condition in 80°C oven for 10 min to stabilize the droplets of the sodium chloride solution in the PDMS matrix. After that the mixture of PDMS base and PDMS linker was casted successively. The double layer composite was further put in 80°C oven for 8 h for the complete curing and water evaporation, obtaining the plane sample. The belt sample was obtained by tailoring the plane sample.

The fabrication of the coil and the spring samples of RSMPDMS follows the similar procedure. After the casting of the mixture of PDMS base and PDMS linker on the PDMS-salt layer, the composite was put in the 80°C oven for 10 min for procuring, after which the composite was shaped in coil and spring and put in 80°C oven for another 8 h curing.

## Section S2. Figures and related results

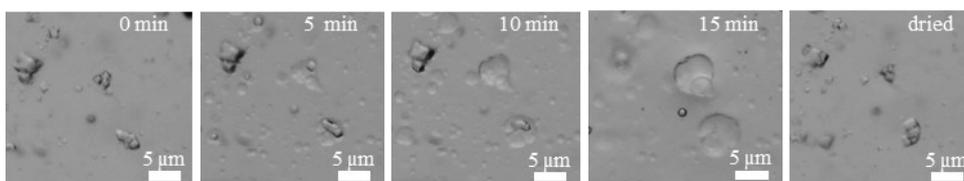


Figure S1. The optical microscope images for in situ observation of the internal structure of PDMS-salt layer during the water absorption at 37°C.

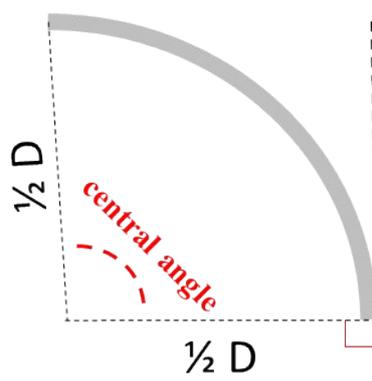


Figure S2. The schematic for the definition of central angel of the belt RSMPDMS sample.



Figure S3. The chemical structure of the fluorescent dye molecule.

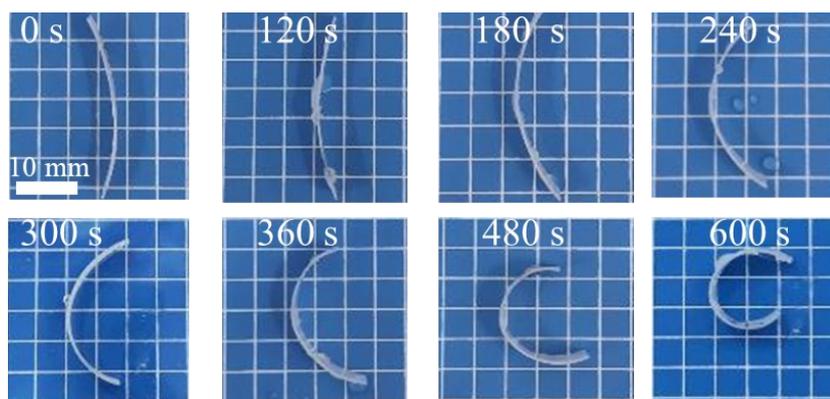


Figure S4. The photographs of the belt sample of RSMPDMS in 37°C water bath for different times.

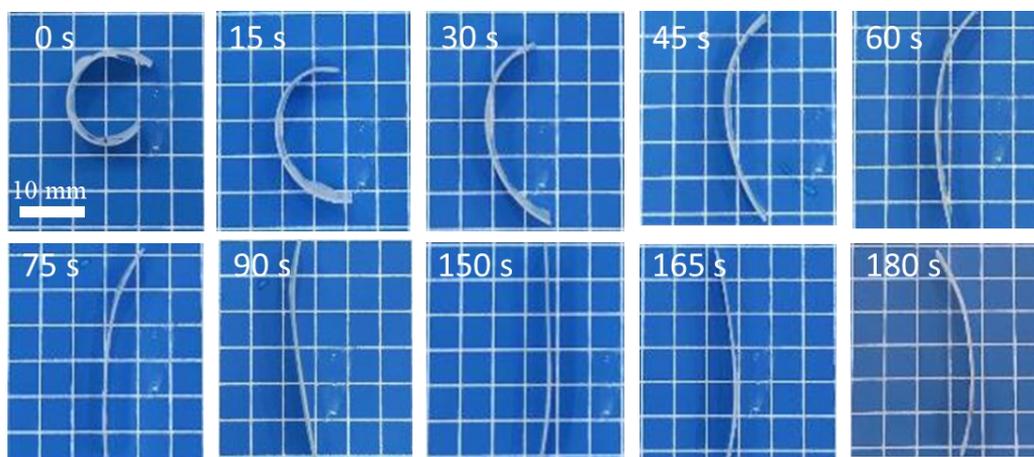


Figure S5. The photographs of the wet belt sample of RSMPDMS in 80°C air for different times.

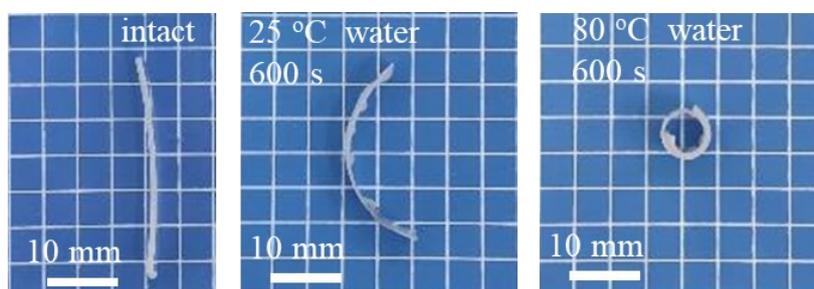


Figure S6. The photographs of the belt sample of RSMPDMS in the water baths with different temperatures.

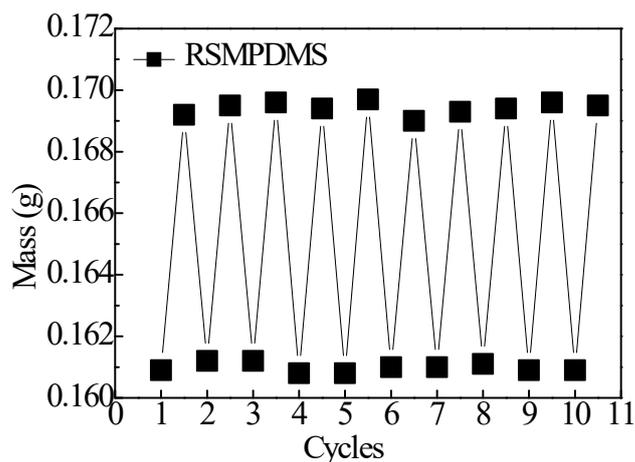


Figure S7. The mass changes of the belt sample of RSMPDMS in 10 cycles treatment. In every cycle, the RSMPDMS sample was put in 37°C water bath for 300 s and then in hot air for 180 s for recovering the shape.

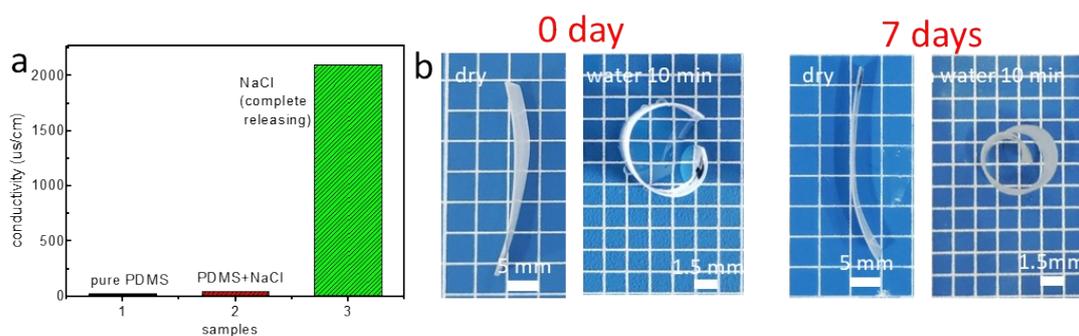


Figure S8. (a) The NaCl leakage test of the sample in water by testing the conductivity changes of the solutions. In the test, the conductivity of the solutions was traced after samples were put in water for 7 days of immersion. (b) The shape memory performance before and after the duration tests. For the duration test, the sample was firstly put in water for 7 days to continue immersion and then dried till constant weight for the shape memory test.

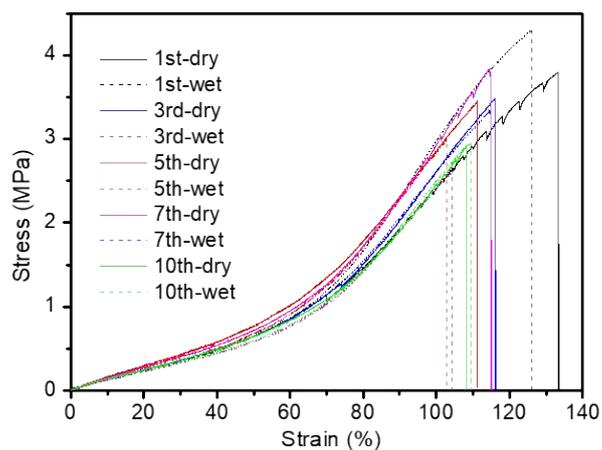


Figure S9. The stress-strain curves of the RSM PDMS samples in 10 cycles of repeated treatments. In every cycle, the RSM PDMS sample was put in the 37°C water bath for 300 s and then in hot air (80°C) for 180 s for recovering the shape. The tensile tests were conducted with a 10 mm/min tensile speed at room temperature.

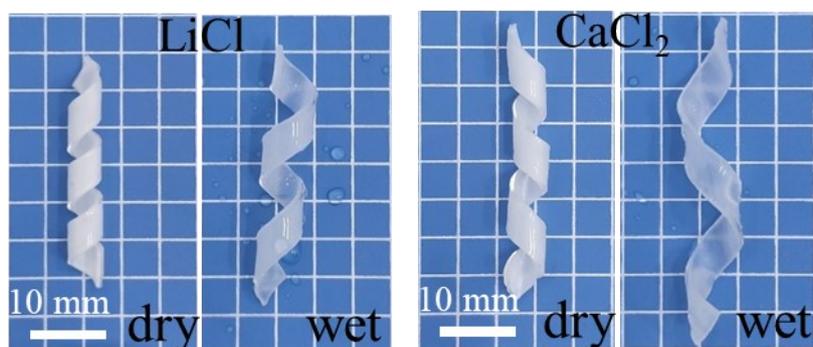


Figure S10. The photographs for the spiral samples of RSM PDMS with LiCl and NaCl inside in wet and dry states, respectively. Wet state: the sample was put in 37°C water bath for 600 s.

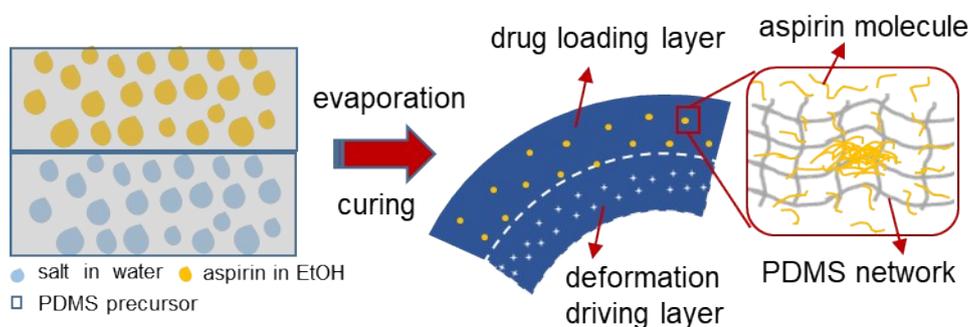


Figure S11. The schematic for the fabrication and releasing behavior of the aspirin-loaded RSM PDMS sample.

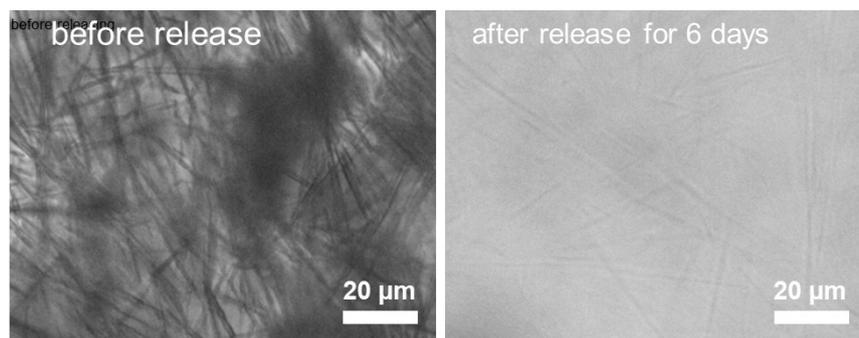


Figure S12. The optical microscope images of aspirin crystal in the PDMS matrix before and after 6 days releasing.

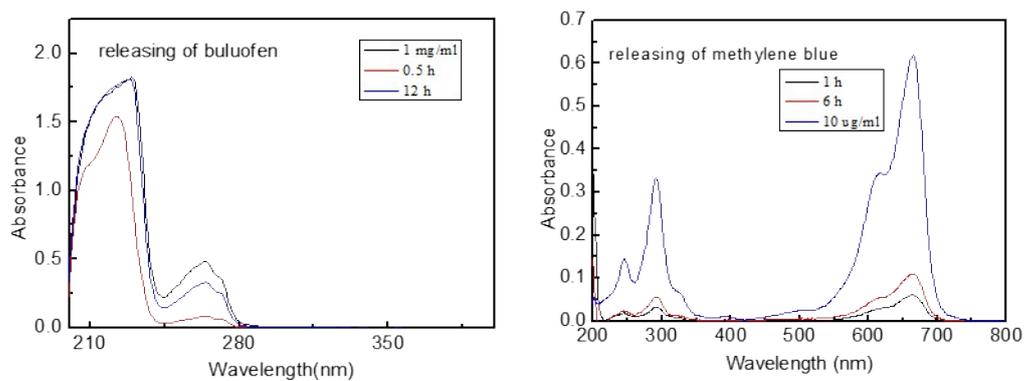


Figure S13. The UV-Vis absorption graphs of the water solutions where the samples of RSMPDMS-buluofne and RSMPDMS-methylene blue were immersed in, respectively.

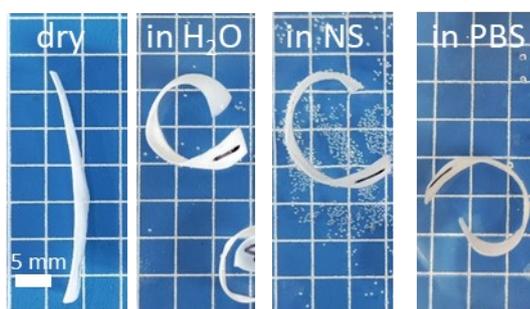


Figure S14. The shape memory performance of the aspirin loaded RSMPDMS specimen in pure water, normal saline (NS) and phosphate-buffered saline (PBS).

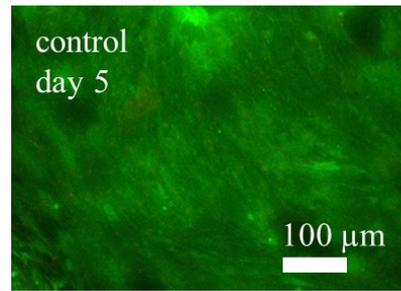
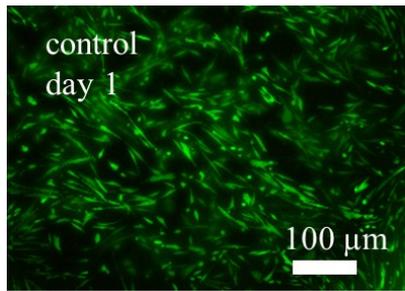


Figure S15. Cyto-compatibility assay analysis of the control condition (blank, no sample) by live/dead cell viability assay.