Electronic Supplementary Information (ESI)

for

Transdermal delivery of allopurinol on acute hyperuricemic mice via polymer microneedles for regulation of serum uric acid levels

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The actual AP loading in PVP/PCL MNs was determined at the wavelength of 251 nm by using UA spectrophotometer. The PBS (pH = 7.4) was chosen to prepare the standard solutions and being used as the release medium. First, the AP-loaded PVP/PCL MNs were placed into a beaker and dissolved in the solution of PBS. Then, a 3 mL aliquot was taken out from the beaker at the pre-determined time intervals and supplemented with the same amount of PBS. Finally, the absorbance value of this aliquot is measured by UV. The relationship between absorption and concentration was linear in the range of 0.78-25.0 μg/mL, and the respective regression equation was y=0.02457x-0.01435 (R^2 = 0.99966) (Figure S1). Therefore, the actual drug loading can be obtained by this equation.

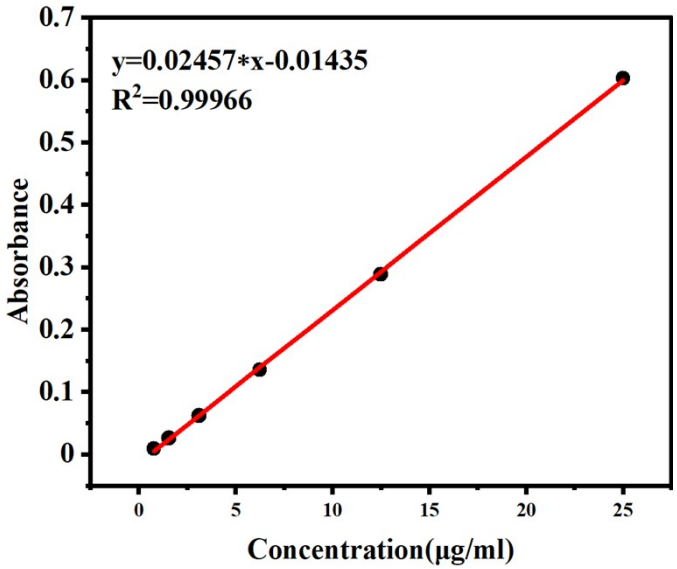

Figure S1. The standard curve of AP.

In order to further verify the accuracy of the actual drug loading, the drug loading efficiency (DLE) of PVP/PCL MNs with different doses of AP (1%, 3%, 5%, 7%, 9%) was calculated by the following equation:

$$\text{DLE}\ (\%) = \frac{\text{actual amount of drug loaded in MNs}}{\text{theoretical amount of drug loaded in MNs}} \times 100\%$$

As shown in Figure S2, after half an hour, the DLE value of each sample is about 80%, and there is no significant difference between these groups. The results indicate that the drug loaded in MNs can be precisely controlled by adjusting the concentration of AP suspension, and the manufacturing process of MNs has little impact on it.

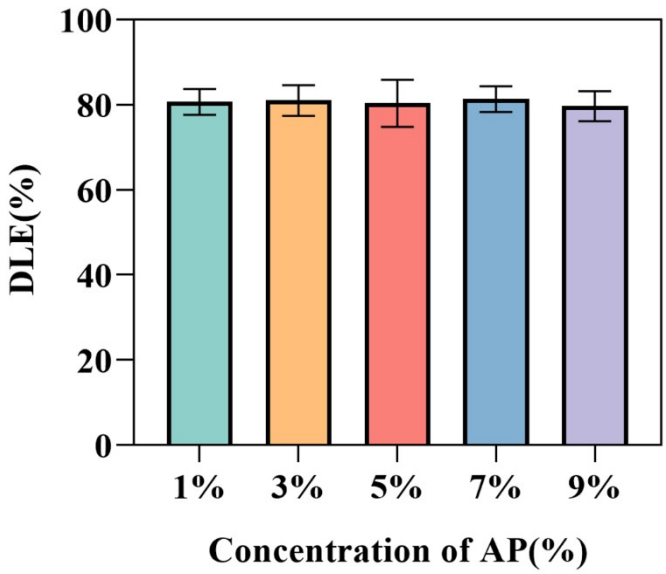

Figure S2. The drug loading efficiency of MN samples.

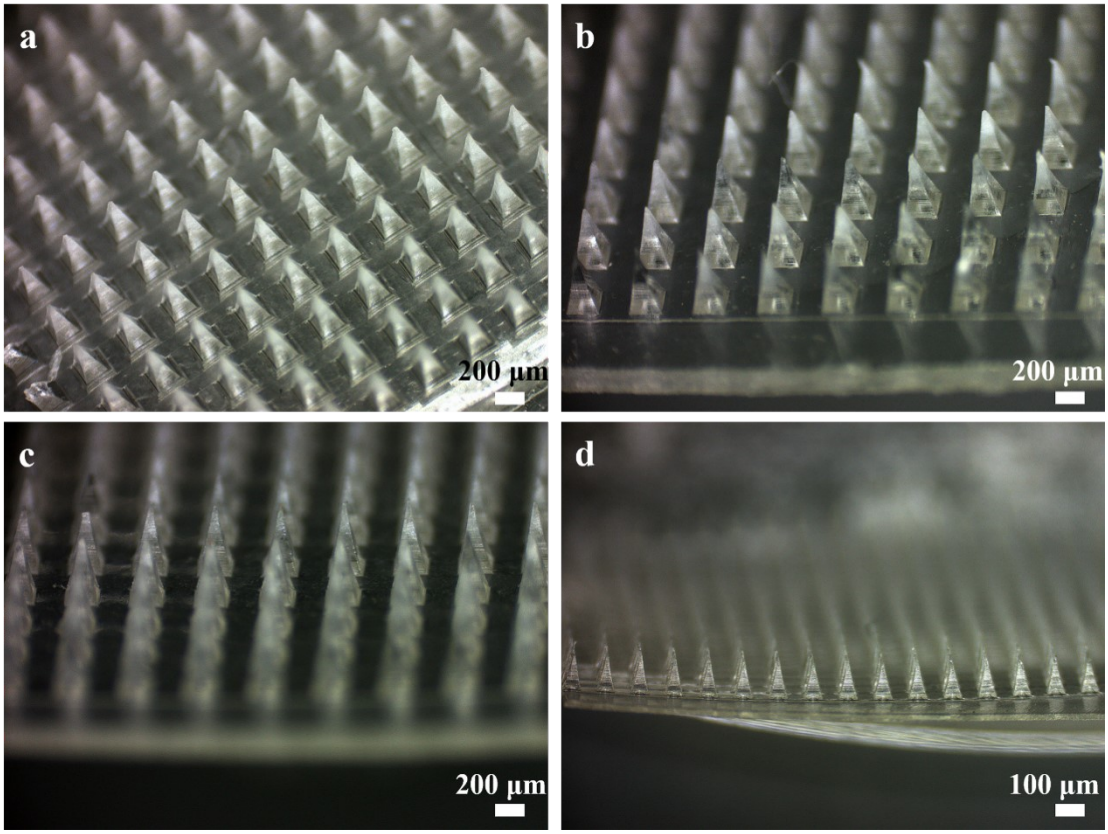

Figure S3. Stereomicroscope images of PVP/PCL MNs.

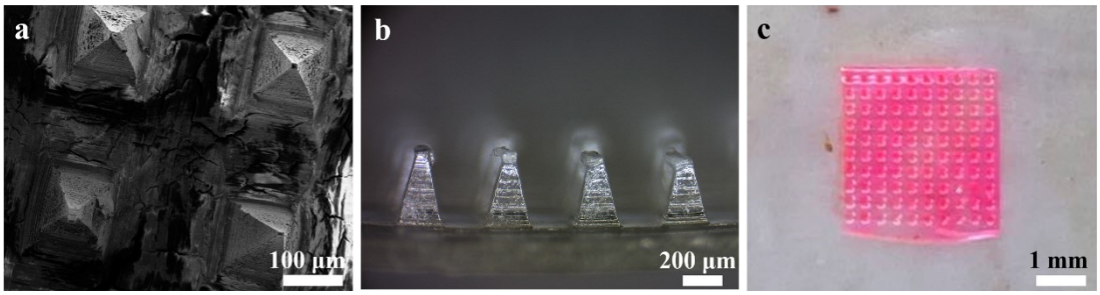

Figure S4. The porous structure of MNs formed by the rapid dissolution of PVP (a), stereomicroscope images of PVP/PCL MNs (b) after the mechanical property test, and digital image of MNs inserted into cadaveric mouse skin (c).

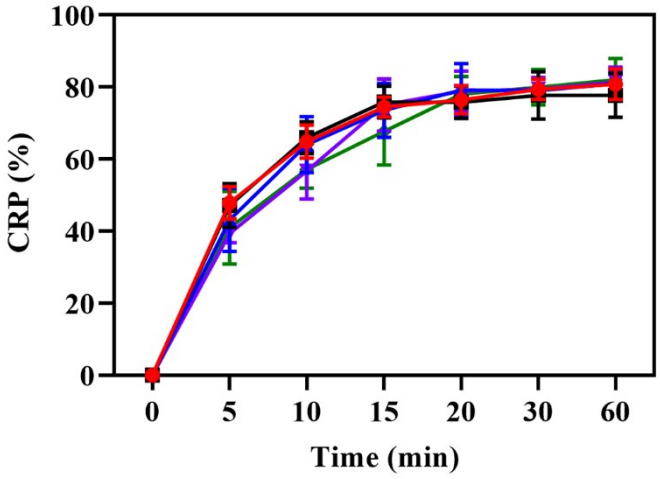

Figure S5. *In vitro* AP release curves of all samples in PBS.

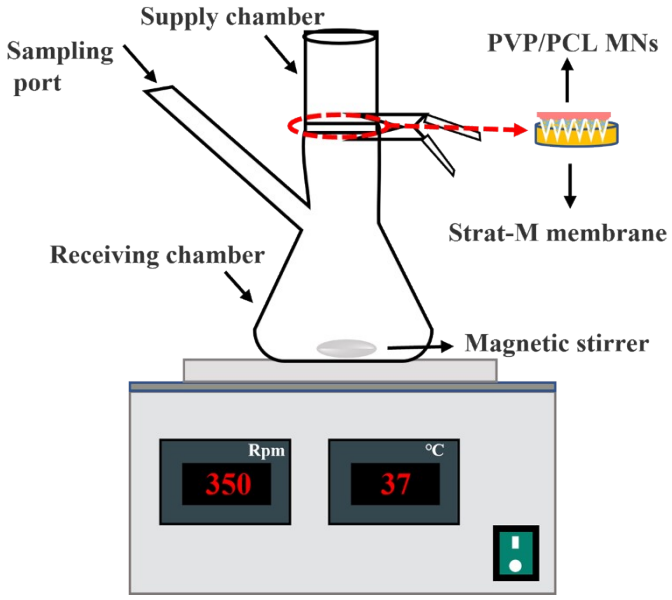

Figure S6. The schematic of Franz diffusion cell.

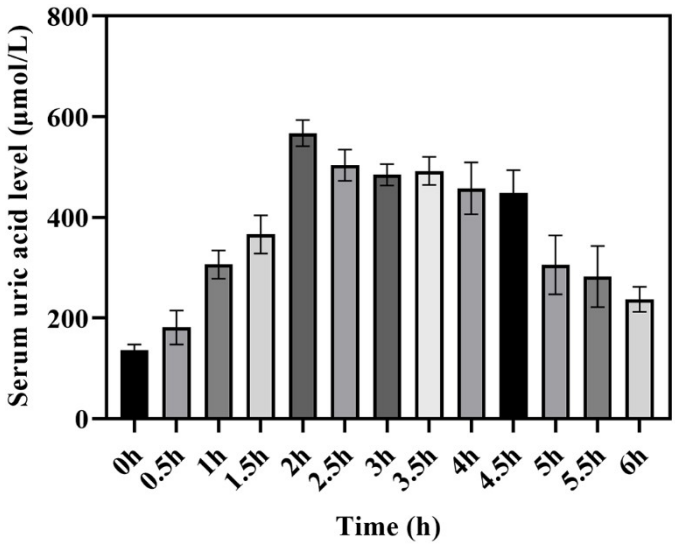

Figure S7. The SUA levels of the mice after induction by intraperitoneal injection of hypoxanthine at 500 mg/kg body weight combined with subcutaneous injection of potassium oxonate at 100 mg/kg body weight.

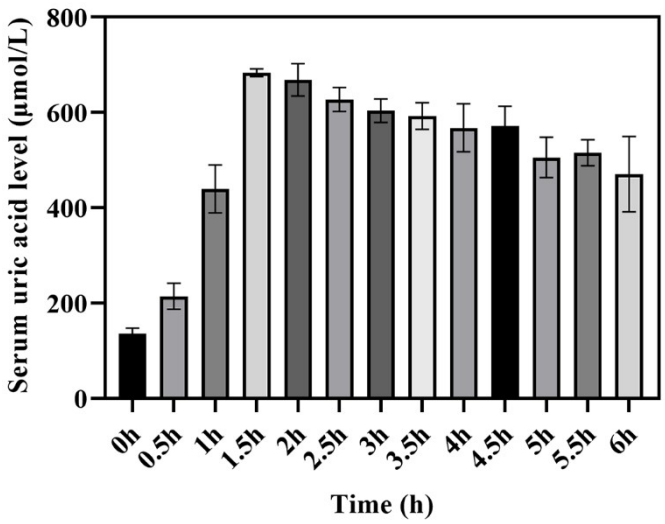

Figure S8. The SUA levels of the mice after induction by intraperitoneal injection of hypoxanthine at 500 mg/kg body weight combined with subcutaneous injection of potassium oxonate at 400 mg/kg body weight.

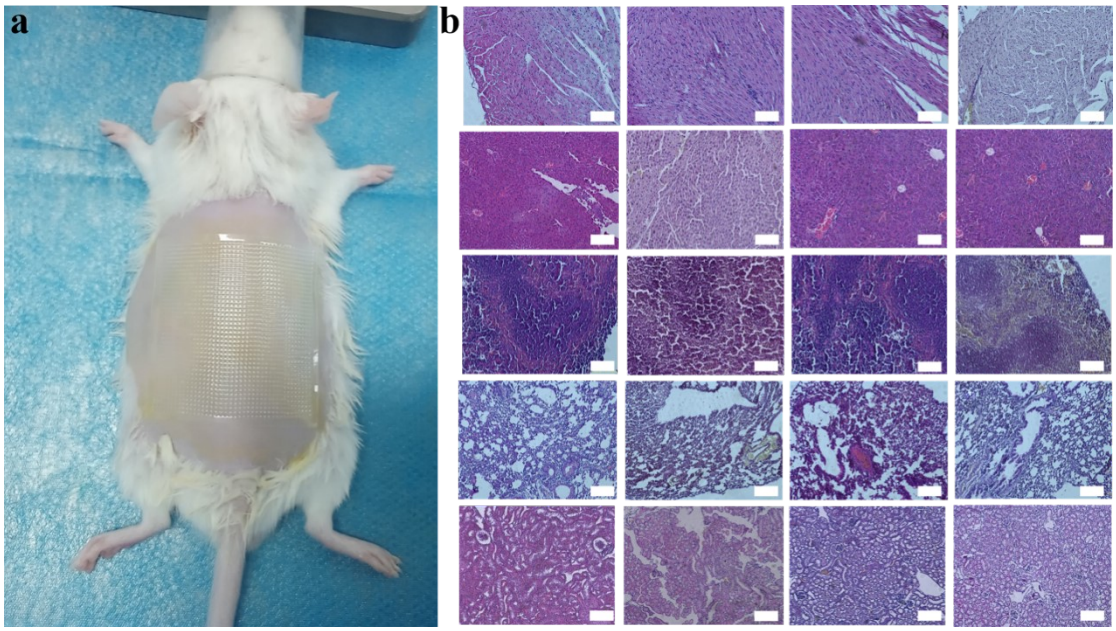

Figure S9. Representative photograph of the mouse dorsum after application of the PVP/PCL MNs (a), and H&E staining images of tissues from the heart, liver, spleen, lung and kidney, characterized by an OM. Scale bar = 100 μm.