Supporting Information

Artificial Synapses with Short- and Long-Term Memory for Spiking Neural Networks Based on Renewable Materials

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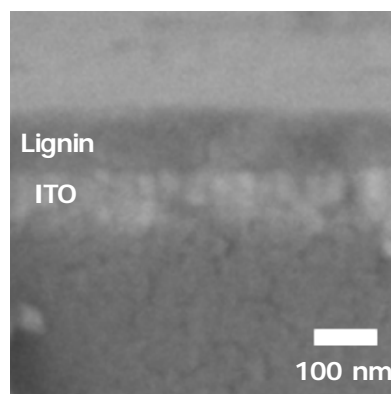
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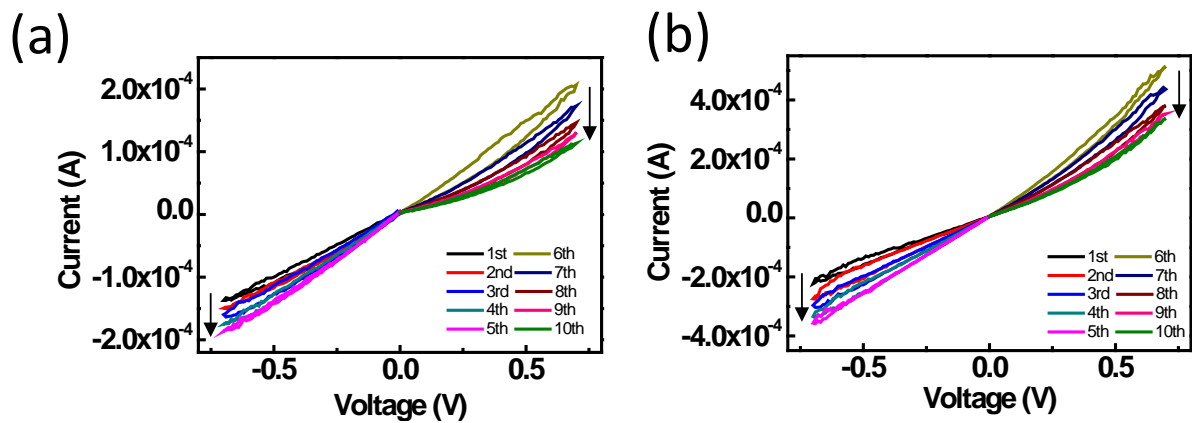**Figure S1**. Cross-sectional SEM image of lignin thin film on ITO electrode.

Figure S2. I-V characteristics of lignin-based artificial synapse fabricated using different spin coating speeds at (a) 800 rpm and (b) 1000 rpm.
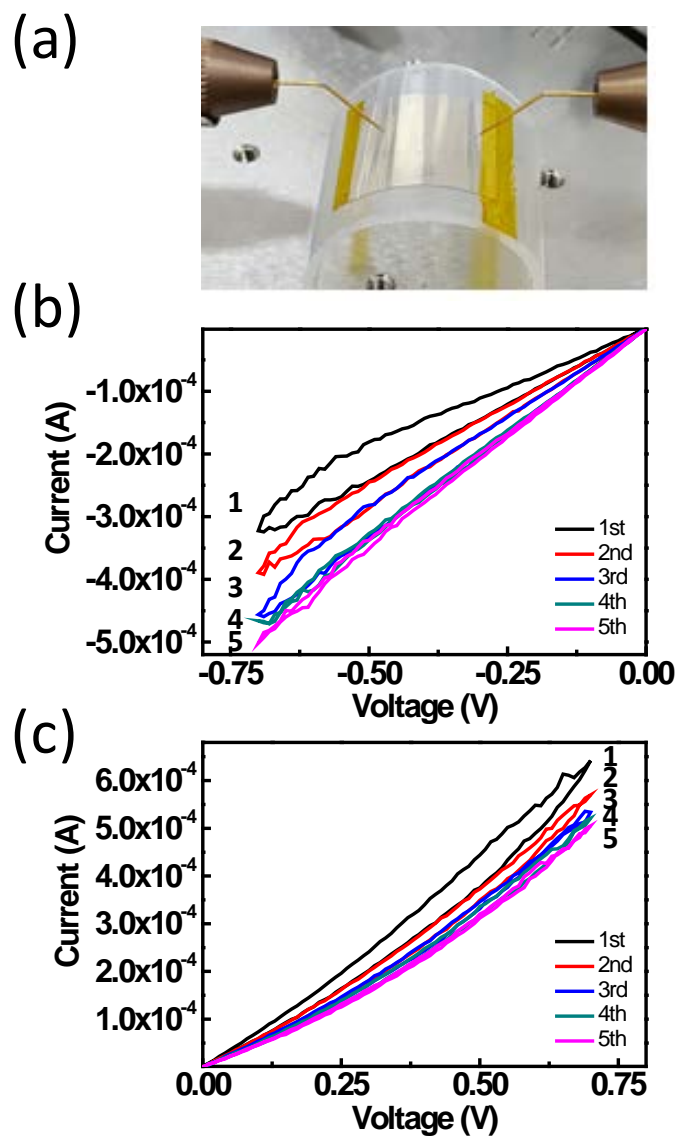
Figure S3. Measurement of electrical characteristics under bent state. (a) Photograph image of artificial synapse device. I-V curves of 5 consecutive sweeps at (b) negative and (c) positive directions.
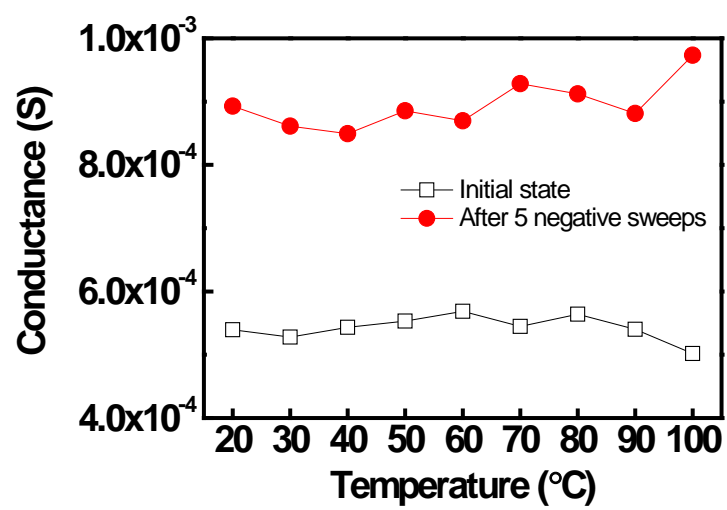
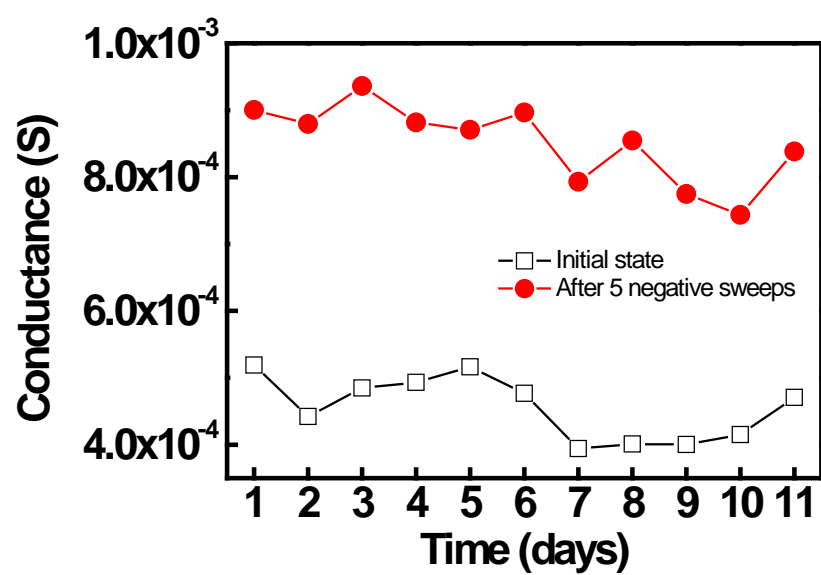**Figure S4** Temperature stability of lignin-based artificial synapse.

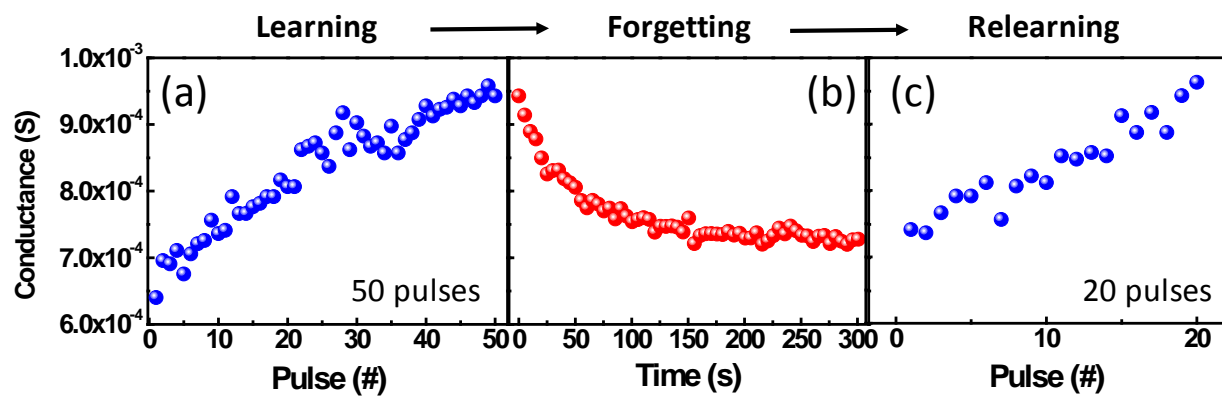**Figure S5.** Long-term stability of passivated lignin-based device.

Figure S6. Learning experience of the lignin-based device plotted with conductance level. (a) Increase of conductance with 50 consecutive pulses. (b) Spontaneous decay of conductance with time. (c) Increase of conductance with consecutive 20 pulses.
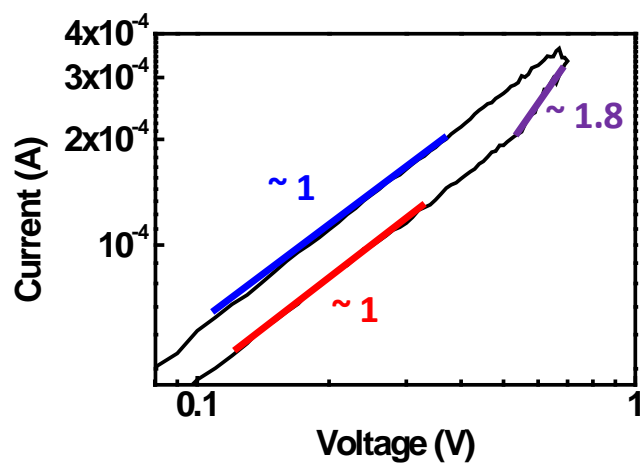
Figure S7. Double logarithmic plot of *I-V* curve for 1st negative direction sweep.
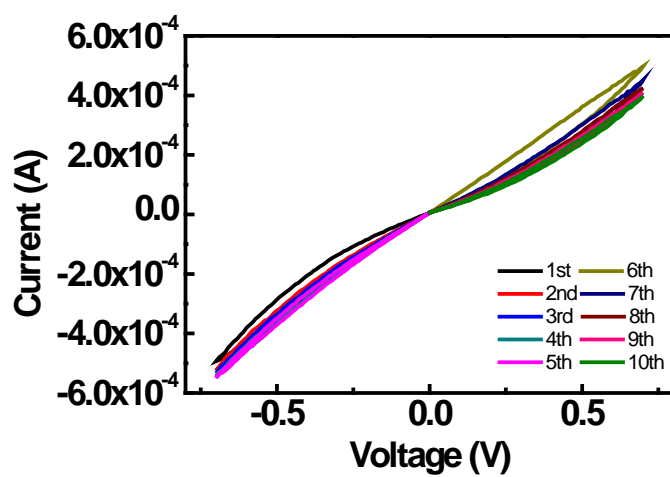
Figure S8. *I-V* characteristics of fabricated artificial synapse with Al top electrode.