Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary data

The model of the resistance between the electrodes was demonstrated in figure S1-S2. The cross-sectional area of the conductive material between the electrodes (S) depended on the height of the droplet (h) and width (w), S=h × w. Assume the concentration of the solution is evenly everywhere, and the solution can be divided into small units. The resistance of the solution between electrodes can be modeled as a resistance network (figure S1). Then their resistances can be calculated as in figure S1 (the height and width of the unit is 200 nm (equal to electrodes' height) and 10 μm (typical distance of electrodes), respectively). The resistance versus height was plotted into figure S2. When the height >4 μm, the resistance nearly remains the same value, which means the equivalent height (h) can be considered as a constant (~4 μm). Similarly, When the width > a certain value, the resistance nearly remains the same value, which means the equivalent width (w) can be considered as a constant. So the equivalent cross-sectional area S can be considered as a constant at early stage of evaporation, too.

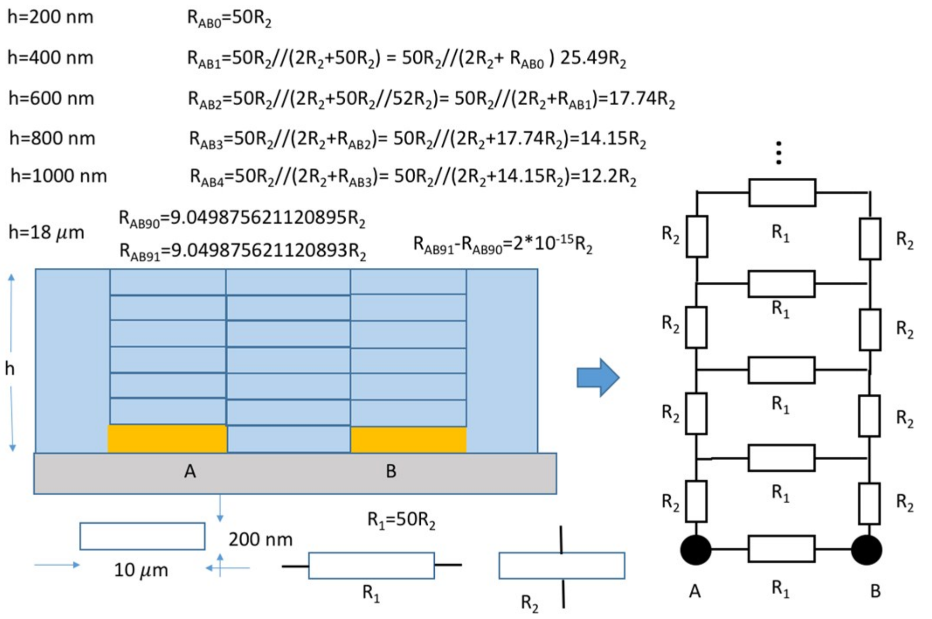

Figure S1. Model of the resistance of electrolyte solution (blue) on the electrodes. The solution can be divided into rectangular units, and the resistance of each unit can be defined. Then the resistance between the electrodes (A and B, yellow) can be calculated. h represents the height of the solution; R_1, R_2 represent the resistance of the unit when connected into right-left or up-down direction, respectively; $R_{AB0,}$ $R_{AB1,}$ …R_{AB90} represent resistance between electrodes A and B. According to the size of the unit (width = 10 μm, height = 200 nm), R_1=50R_2.

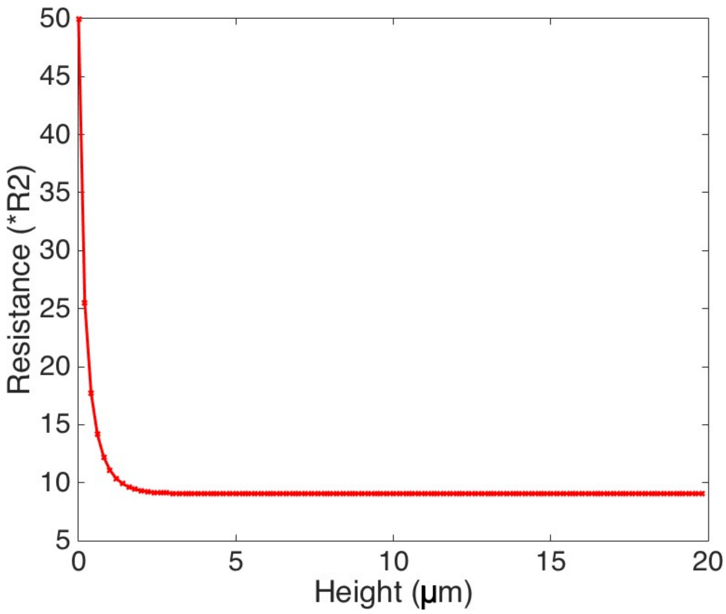

Figure S2. The resistance between electrodes (A and B in figure S1) versus the height of the droplet.

The impedance of NaCl solution of different concentrations shows in figure S3. The impedance value decreases with the increase of concentration, however the decreasing is not linear. The impedance changes most in the concentration range of 0.0001-0.01 mol/L, which means the impedance sensitivity is the highest. As the evaporation related concentration changes 10 times while the volume decreases 90%, the most part of the evaporation process can be monitored by the impedance value. And the optimal concentration for NaCl droplet evaporation sensing is 0.0001-0.001 mol/L.

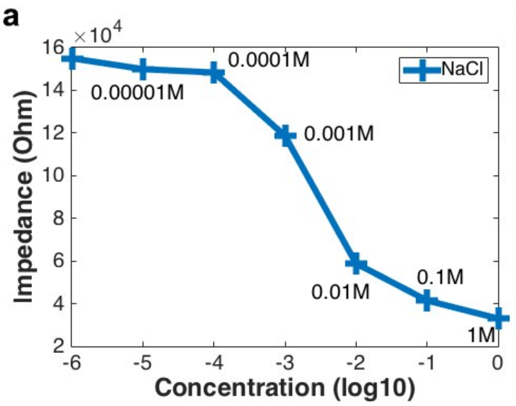

Figure S3. Impedance sensing results of NaCl solutions, concentration range: 0.00001-1 mol/L.

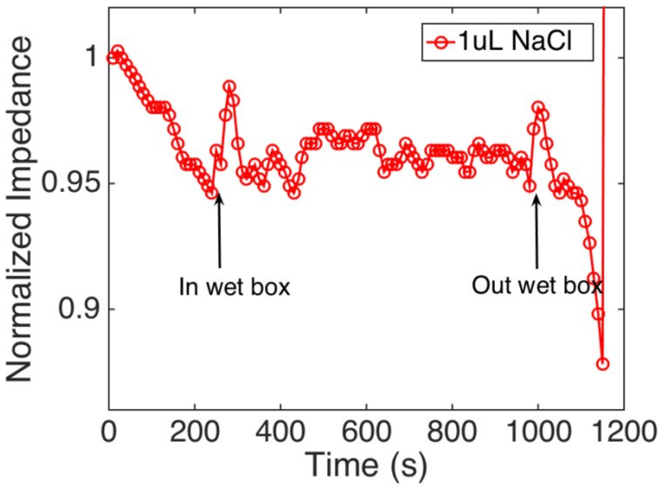

Figure S4. Impedance sensing of a NaCl droplet (1 μL) by the electrodes array in a room (30% humidity) and a wet box (~100% humidity) under the same temperature (the impedance value were normalized by the original value=1). Arrows indicate the time to set the array in and out of the wet box. The wet box can delay the evaporation obviously.