Wettability Alteration in Functional Capillary Tube for Visual Quantitative Point of Care Testing

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Experimental Section

The N - phenylaminopropyltrimethoxysilane (PhAPTMS), Phenyltrimethoxysilane and toluene were purchased from Sigma Company. Ethanol, phenol, sodium chloride, disodium hydrogen phosphate dodecahydrate, and citric acid were purchased from Sinopharm Chemical Reagent Co. Ltd. All solutions were prepared with ultra-pure Milli-Q water (resistance>18 MΩ cm^{-1}). Glass capillaries from Suzhou City Crystal Glass Co., Ltd were used. The inner radius of these capillaries is constant and equal to 200±5μm.

In order to get more silicon hydroxyl, glass capillary tube were cleaned by piranha solution (mixture of 7:3 (v/v) 98% H_2SO_4 and 30% H_2O_2) at 100℃ for 1 h and followed by thorough ultrasonication for 10 min in acetone and ethanol. Then the glass capillary tube was rinsed three times in Milli-Q water and blown dry with nitrogen gas. Next, in order to get a responsive surfaces with switchable wettability in the capillary tube, the

inner surface was further modified with PhAPTMS molecules. The glass capillary tube was immersed in anhydrous toluene (99.8%) solution containing a certain amount of PhAPTMS (0.05%, 0.5% and 5%) for 24 h at room temperature under N_2 atmosphere (instead of using 0.5% phenyltrimethoxysilane for the detection of phenol). Subsequently, the capillary tube was rinsed with toluene, ethanol, and Milli-Q water, respectively, and blown dry with N_2, followed by baking at 120℃ for 30 min. The treatment of the glass slides in experiment is the same as the described capillary tubes. The use of HCS devices is as simple as using a thermometer. The HCS device in a vertical position contact with the liquid surface of the solution to be detected (10^{-7} M-1 M HCl solution), then we can get the height result until the liquid column is no longer rising for about 10 minutes. Then, the reusable property of the HCS is confirmed by the following experiments. The same one HCS (0.5% PhAPTMS-modified capillary) device was used to detect 10^{-7} M and 1 M HCl solution, then the HCS device inhaled 10^{-8} M H^+ solution (borate buffer solution), placed in a horizontal position 20min, and then washed with 50% ethanol twice, and then washed with ethanol solution twice, and blown dry with N_2 then 120℃ drying 20min.

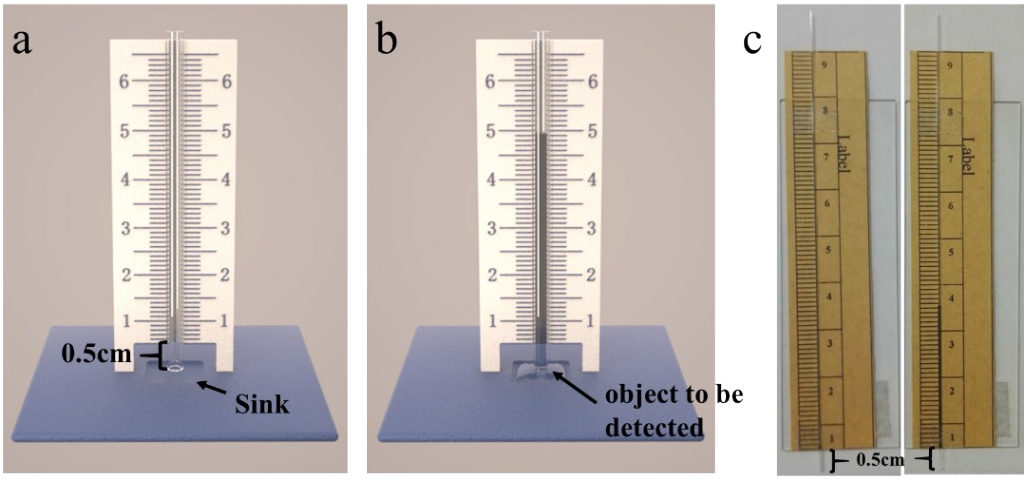
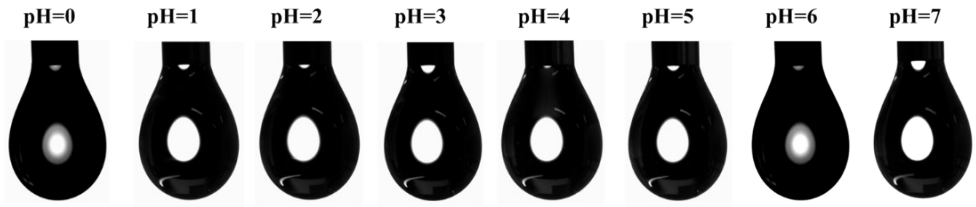


Figure S1. a) The HCS without the solution to be detected, b) The HCS with the solution to be detected. c) The photo of HCS device in practice.



pH	0	1	2	3	4	5	6	7
Surface tension (dyn/cm)	72.4	72.1	71.5	72.3	71.9	72.4	72.0	71.9
Density (g/cm^3)	1.01	1.01	1.00	1.00	1.00	1.00	1.00	1.00

Figure S2. The surface tension and density of H^+ solution (from pH 0 to pH 7).

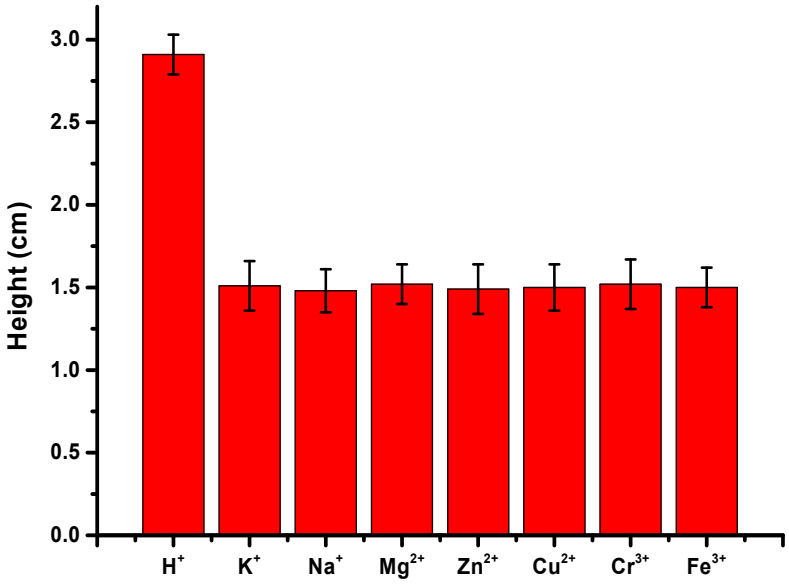


Figure S3. The selectivity of HCS for H^+ detection (the concentrations of these cations are 0.001M).

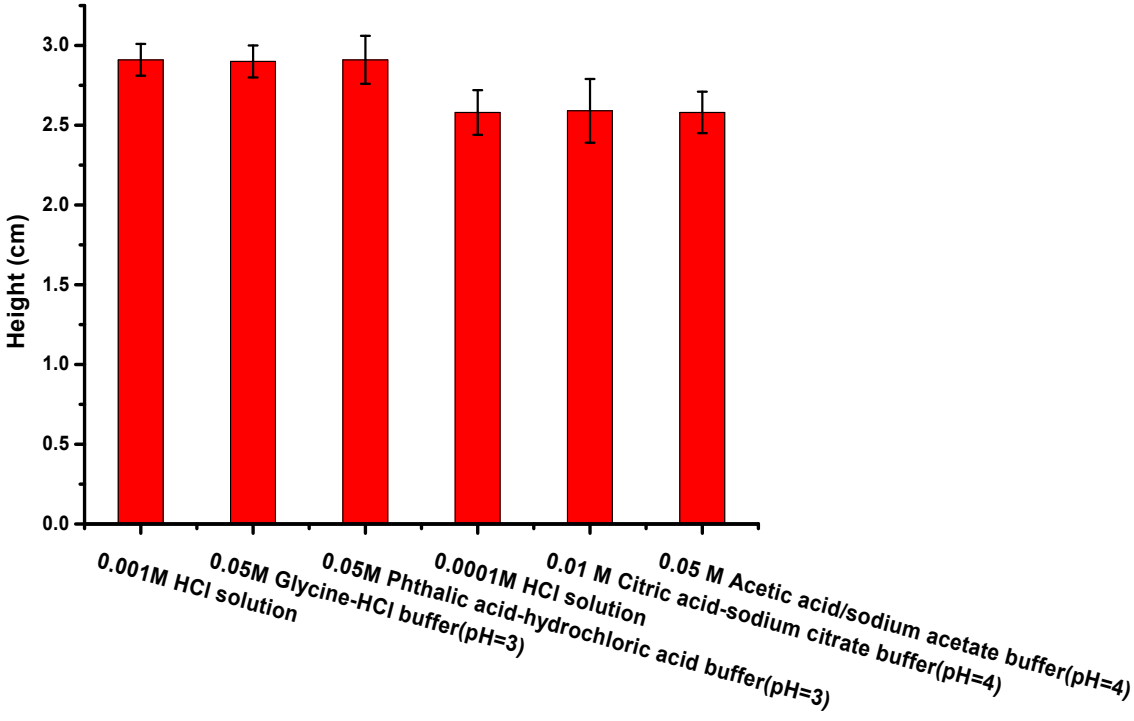


Figure S4. The selectivity of HCS for H^+ detection

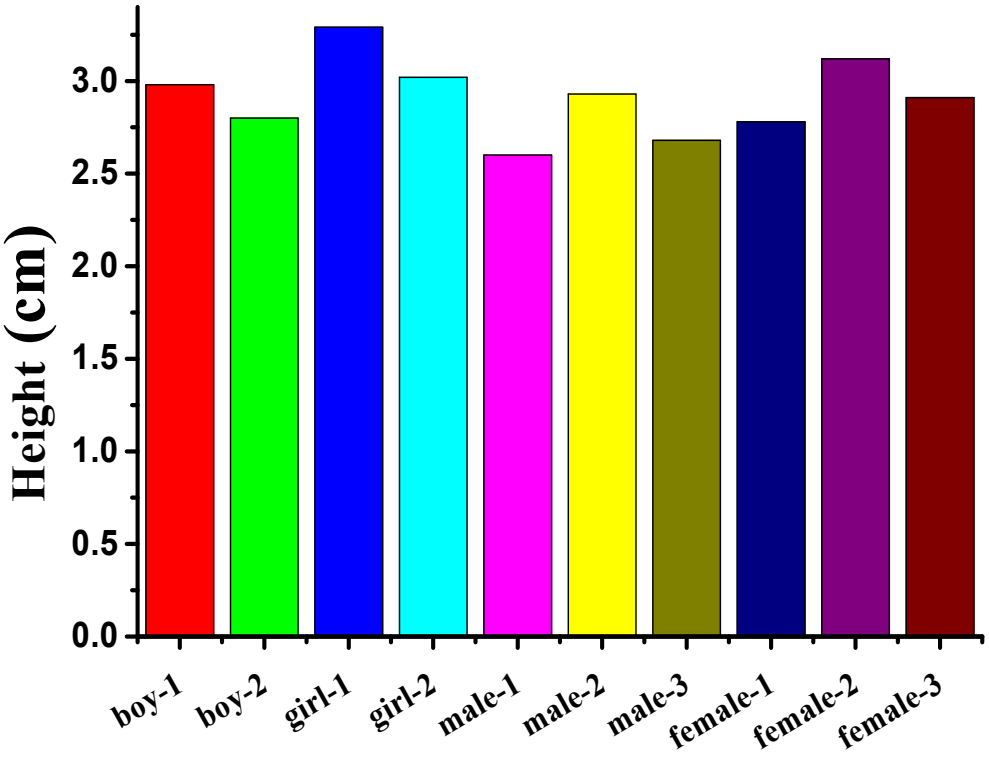


Figure S5. Response of HCS operated by 10 volunteers to 10^{-3} M H^{+}.

Figure S6. The excellent convenience of HCS compared with the pH meter.

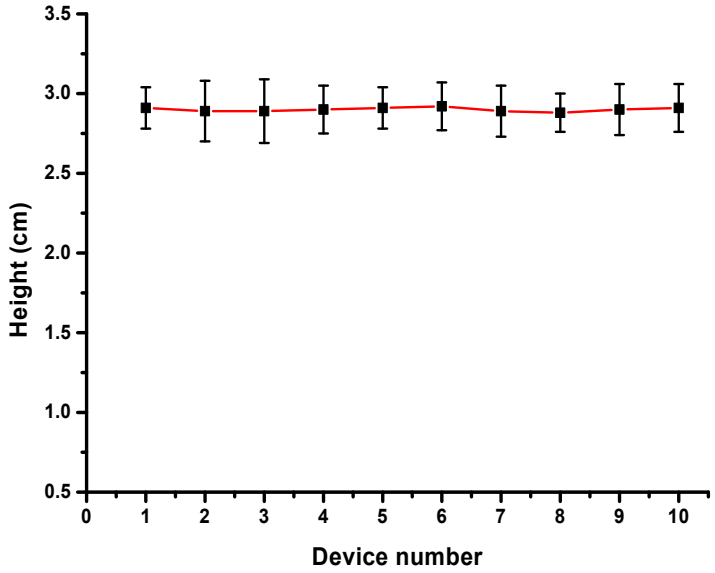


Figure S7. Ten HCSs were fabricated and tested in parallel using 10^{-3} M H^+ solution

Table 1 Recovery results of testing real normal human gastric juice samples

Sample No.	pH meter (pH)	HCS found (pH)	Recovery (%)	RSD (%)
1	1.71	1.65	96.5%	7.3%
2	2.23	2.32	104.0%	5.6%
3	1.92	2.05	106.8%	5.9%
4	2.25	2.24	98.7%	9.5%
5	3.16	3.15	99.7%	7.8%
6	2.25	2.28	101.3%	4.8%
7	3.24	3.25	100.3%	4.3%
8	3.80	3.75	98.7%	3.2%
9	1.65	1.78	107.9%	8.4%
10	3.78	3.69	97.6%	2.7%

Each of real normal human gastric juice samples was diluted 10 times with water before use; RSD[a], relative standard deviation obtained from five replicates.

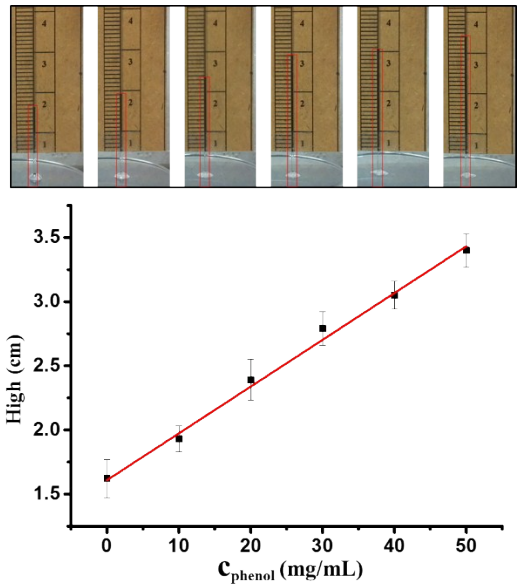


Figure S8. Linear response of the capillary height to the concentration of phenol.