

Supplementary information

**Surface enhanced Raman scattering microtips for  
microenvironment pH determination of semi-solid  
preparations**

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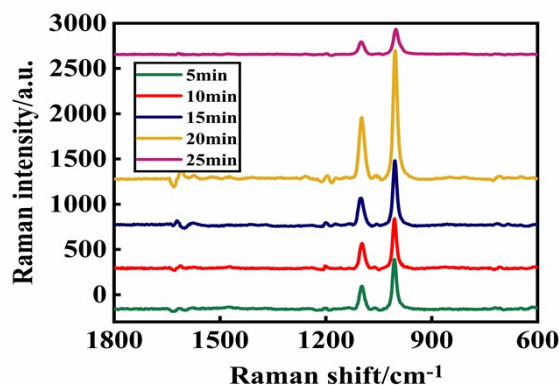


Figure S1. SERS spectra of microtips with different reaction times in  $\text{Au}^+$  growth solution.

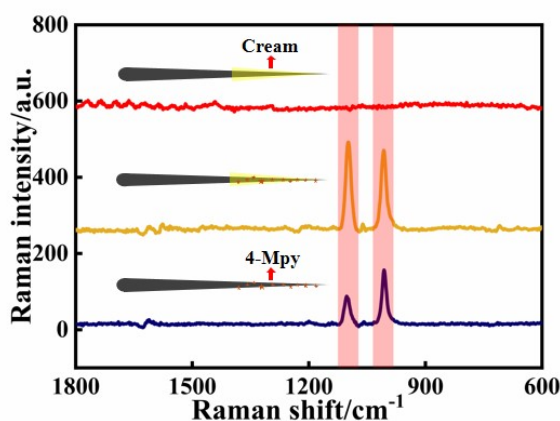


Figure S2. SERS signals of microtips at different conditions. Top: blank SERS microtip (no 4-Mpy) + cream; Middle: pH sensitive microtip + cream; Bottom: pH sensitive microtip.

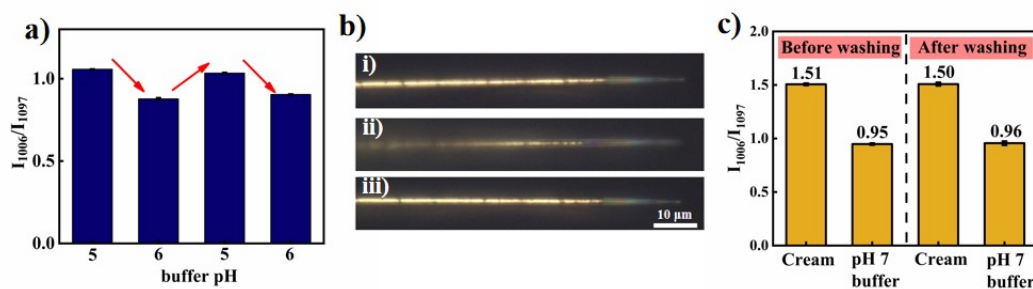


Figure S3. a) Histograms of  $I_{1006}/I_{1097}$  changes of SERS microtips in different pH solutions; b) microscopic image of SERS microtip (i), SERS microtip with cream thin layer (ii), and the same SERS microtip after washing with ethanol (iii); c)  $I_{1006}/I_{1097}$  values of creams and pH 7 buffer solution by SERS microtips before and after ethanol washing, indicated that pH assay is reversible and the microtip can be reused.

Table S1. pH detection results of 8 brands of mupirocin ointment

Brand of cream	pH meter detection	SERS microtip detection (0-40 $\mu\text{m}$ )
Benevolence	7.46	8.22
	7.53	8.49
	7.60	7.88
		8.20
		7.85
Pitbond	5.81	4.12
	5.87	3.88
	5.80	4.64
		3.82
		4.52
Mo Meishu	6.82	6.97
	6.93	6.27
	7.11	7.42
		6.03
		6.22
Aoqi	6.73	6.98
	6.84	7.23
	6.96	6.56
		7.72
Aegis	7.03	7.98
	7.18	7.83
	7.33	7.87
		7.64
		7.33
Baiduobang	6.93	7.93
	7.14	7.77
	7.23	8.11
		7.74
		7.77
Metdoxin	7.10	7.30
	7.05	7.24
	7.10	7.29
		8.13
		7.12
Kang Libang	7.10	6.33
	7.12	7.76
	7.15	7.47
		7.25
		7.05

Table S2. pH detection results of 7 brands of econazole nitrate creams

Brand of cream	pH meter detection	SERS microtip detection (0-40 $\mu\text{m}$ )
Hengjian	3.70	3.87
	3.71	4.83
	3.67	5.59
		5.74
		5.55
Xuanqing1	3.53	1.71
	3.59	1.71
	3.62	1.80
		2.33
		2.57
Wei Danin	6.40	5.74
	6.34	6.65
	6.29	7.13
		7.23
		7.51
Xuanqing2	3.86	3.87
	3.76	4.05
	3.77	4.13
		3.91
		4.07
Benevolence1	7.03	5.45
	6.96	6.41
	6.98	5.31
		7.42
		7.80
Baiyun Mountain	3.50	3.00
	3.46	5.31
	3.43	5.74
		4.79
		5.12
Benevolence2	7.02	7.23
	6.98	5.37
	7.02	7.81
		7.32
		7.57

Table S3. pH detection results of 4 brands of metronidazole hydrogel

Brand of gel	pH meter detection	SERS microtip detection (0-40 $\mu\text{m}$ )
Liv	4.64	3.68
	4.70	3.32
	4.71	4.11
		5.09
		5.11
Hardcore doctor	7.30	6.07
	7.23	6.03
	7.26	6.39
		7.23
		7.48
Hi Liaoto	5.44	3.93
	5.42	3.92
	5.50	5.56
		5.80
		5.51
Boom	5.48	4.52
	5.47	4.03
	5.45	5.28
		5.61
		5.44

Table S4. pH detection results of 4 brands of terbinafthol hydrochloride hydrogel

Brand of gel	pH meter detection	SERS microtip detection (0-40 $\mu\text{m}$ )
999	5.59	3.15
	5.65	3.62
	5.68	4.81
		4.07
		5.71
Vantone	4.85	5.74
	4.84	5.12
	4.80	5.93
		6.23
		6.88
Wei Danin	4.86	4.00
	4.91	4.50
	4.88	5.32
		5.19
		5.03
Better	5.05	4.49
	5.04	4.31
	5.00	4.64
		5.91
		5.64