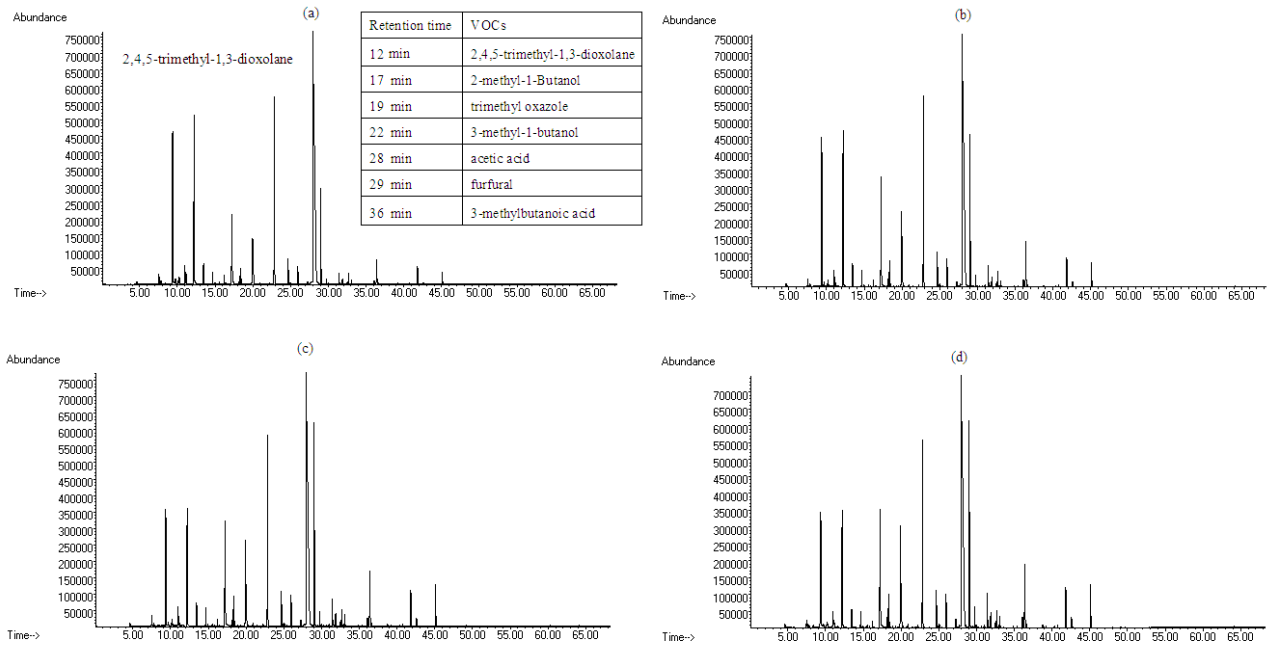
Supplementary information

Here, the following two experiments can be used to verify the response of sensors system with active compounds in vinegar marked different ages, and the results were shown in **Figure 1** and **Table 1** as the supplementary information.

Firstly, an HP6890 gas chromatograph coupled with an HP 5973 mass spectrometer (Agilent Technologies Inc., Santa Clara, CA, USA) equipped with a NIST mass data analysis system was applied for the electron impact (EI) mode GC-MS analysis. And the column was a 60 m × 0.25 mm (i.d.) HP-INNO DB-Wax fused capillary column (Agilent Technologies Inc., Santa Clara, CA, USA) with a film thickness of 0.25 μm. The total ion chromatogram of specific VOCs during each acetic fermentation stage in vinegar samples was shown in Figure 1.



Retention time	VOCs
12 min	2,4,5-trimethyl-1,3-dioxolane
17 min	2-methyl-1-Butanol
19 min	trimethyl oxazole
22 min	3-methyl-1-butanol
28 min	acetic acid
29 min	furfural
36 min	3-methylbutanoic acid

Figure 1: Total ion chromatogram of specific VOCs during each acetic fermentation stage in vinegar samples

Seen from Figure 1, the selected volatile organic components (VOCs) can be used for investigating colorimetric sensors array's response to the specific VOCs during vinegar acetic fermentation; therefore, we could convince that the selected sensors have a high potential in

detecting the active compounds in the vinegar.

Besides, HP 6890-5973 Gas chromatography-mass spectrometry instrument supplied by Corning Company (Agilent, American) was used to detect the main active compounds in vinegar samples. Chromatographic separations were carried out on DB-WAX (60 m×0.25 mm×0.25 μm) and DB-5MS (60 m×0.25 mm×0.25 μm) chromatographic columns. The DB-WAX oven temperature program was as follows. The initial temperature was set at 35℃ (5 min), then raised from 40 to 100℃ at 5℃/min, from 100 to 200℃ at 3℃/min, and from 200 to 220℃ at 10℃/min maintained for 15 min. Helium was used as carrier gas at 1.1 mL/min flow. The DB-5MS oven temperature program was as follows. The initial temperature was set at 35℃ (5 min), then raised from 40 to 100℃ at 5℃/min, from 100 to 200℃ at 3℃/min, and from 200 to 250℃ at 10℃/min maintained for 15 min. Helium was used as carrier gas at 1.1 mL/min flow. 10 parallel samples were tested to get the concentration level of main active components containing 6 kinds of acid, 6 kinds of alcohol, and 6 kinds of ester in vinegar solution that were shown in Table 1.

In Table 1, it shows the concentration level of main active compounds that contributed to the aging vinegar in our previous research work. Based on the previous research results, this improved classification method combined of two novel artificial sensing tools was attempted to discriminate the vinegar samples marked different ages in this work.

Table 1: Changes of main active components in vinegar samples marked different ages

	Content ± SD（μg/L）(n=10)					
	0-year	0.5-year	1-year	1.5-year	4-year	6.5-year
Acetic acid	157.35±399.29	141.85±293.95	138.34±446.58	126.62±280.83	205.91±33.20	150.53±46.65
Propionic acid	151.06±49.70	151.61±59.42	151.04±58.29	124.53±24.90	209.15±58.79	172.16±30.23
2-methyl-propionic acid	2172.16±304.38	1743.77±389.17	3319.17±705.30	2043.67±429.37	3163.26±288.49	2244.39±813.81
Butyric acid	103.38±13.42	84.45±24.29	116.64±24.75	105.41±23.12	360.25±61.89	532.27±132.73
3-methyl-butyric acid	8860.50±477.68	8674.64±812.89	11162.92±977.83	8639.80±824.30	10019.53±752.79	6983.44±706.11
Valeric acid	378.34±43.80	470.41±103.83	535.35±126.32	498.07±98.66	492.56±79.56	261.73±23.95
Ethanol	3345.35±1182.35	2374.02±441.98	1330.31±470.06	2944.71±435.88	3762.27±742.98	5611.02±1901.97
2-methyl butanol	1070.50±62.70	582.37±52.07	924.98±205.02	914.30±101.17	879.15±48.87	534.98±48.27
3-methyl butanol	3257.66±211.42	1788.92±88.65	2481.48±532.65	2605.34±167.02	2434.88±270.20	1688.29±65.17
2,3-butanediol	14807.82±3869.32	2194.93±811.34	6898.19±3392.60	2279.47±2461.08	10588.35±4253.14	6539.91±3990.87
2-furan methanol	982.27±146.68	232.00±34.49	403.56±44.79	414.12±49.33	325.07±43.25	58.44±14.08
3-methyl thiol-1-propanol	409.74±55.82	303.55±76.70	207.15±81.89	199.48±60.91	250.48±37.08	193.29±44.26
Methyl acetate	11.489±18.38	188.27±63.65	238.04±70.82	279.02±64.82	240.60±35.01	257.34±59.33
Ethyl acetate	7187.84±466.97	8218.31±1573.81	6585.72±1527.54	11909.65±1794.96	11709±1096.55	17425.19±3709.39
Propionic acid ethyl ester	0±0	0±0	0±0	43.38±5.41	62.62±5.14	77.70±22.89
2 - methyl - ethyl propionate	43.98±18.55	46.41±5.31	40.5±17.18	65.98±19.80	92.21±34.96	137.05±19.04
Ethyl butyrate	0±0	0±0	0±0	0±0	0±0	60.41±22.71
Ethyl caproate	37.89±23.98	46.41±5.31	38.81±23.19	72.84±38.70	84.33±35.36	184.90±30.71