

1 Supplementary information

2 Reference measurement of pork freshness

3 TVB-N content in pork was measured by a steam distillation method, according to [Chinese](#)
4 [standard GB/T 5009.44](#)¹. Immediately after sensors data acquisition, the fat was removed from the
5 surface of the sample then each sample was ground using a meat grinder of 4 mm holes. 10 g of the
6 ground pork was taken into a beaker, blended with 100 mL distilled water and impregnated still for
7 30 mins, beaker was shaken in every 10 min. Next, the solution was centrifuged at 3000 rpm for 10
8 min and the homogenate was filtered through the filter paper. The entire process was in sterile
9 condition. The tapered bottle contained 10 mL of 20 g/L boric acid and five drops of mixed indicator
10 i.e. a mixture sub-methylene blue (1 g/L) and methylred-ethanol (2 g/L). The condenser pipe must be
11 immersed in the absorbing liquid; the distillate was absorbed by it. A total of 5 mL filtrate was
12 placed into the reaction chamber of the distiller to which 5 mL of 10 g/ L magnesia (MgO) was
13 added. Steam distillation was performed using Kjeldahl distillation unit (Shanghai jianqiang glass
14 Co., China) for 5 min then titrated with 0.1 mol/L HCl. TVB-N content was calculated as follow:

$$15 \quad X = \frac{(v_1 - v_2) \times c \times A}{m \times 5 / 100} \times 100$$

16 where X is the TVB-N of the samples (mg/100 g), v_1 is the consumption amount of hydrochloric acid
17 by the titrated boric acid absorbing liquid (mL), v_2 is the consumption amount of hydrochloric acid
18 by the titrated blank absorbing liquid (mL), c is the concentration of the hydrochloric acid (mol/L),
19 and A is the mass of the nitrogen amount with 1 mL hydrochloric acid standard titration solution (1
20 mol/L) (mg). In this equation, $A = 14$, and m is the mass of the measured sample (mg)

21 Fabrication of colorimetric sensor array

22 The design of the colorimetric sensor array was based on two essential requirements: (1) each
23 center must contain a chemical responsive dye to strongly interact with analytes (2) the interaction
24 center must be strongly coupled to an intense chromophore. The accepted dye classes must meet the
25 following requirements: (1) Lewis acid/base dyes (i.e., metal ion containing dyes), (2) Brønsted
26 acidic or basic dyes (i.e., pH indicators) and (3) dyes with large permanent dipoles (i.e., zwitterionic
27 solvatochromic dyes). Porphyrins and their metal complexes are a natural choice for recognition of
28 analytes with Lewis acid/base capabilities. Metalloporphyrins are nearly ideal for the detection of
29 metal-ligating vapors because of their open coordination sites for axial ligation, their large spectral
30 shifts upon ligand binding and their intense coloration. Common pH indicator dyes change color in
31 response to changes in the proton (Brønsted) acidity or basicity of their environment ^{2,3}.

32 Eventually 9 metalloporphyrins materials and 3 pH indicators were accepted in this work. All 9
33 metalloporphyrins materials were purchased from Sigma-Aldrich Chemical Co. (Shanghai, China),
34 all 3 pH indicators were purchased from Sinopharm Chemical Reagent Co., Ltd. (Shanghai, China).

35 All 3 pH indicators: (1) Bromothymol Blue, (2) Bromocresol Green, (3) Neutral Red. All 9
36 metalloporphyrins materials including:

37 (1) 5,10,15,20-Tetraphenyl-21H,23H-porphin,

38 (2) 5,10,15,20-Tetraphenyl-21H,23H-porphine manganese(III) chloride,

39 (3) 2,3,7,8,12,13,17,18-Octaethyl-21H,23H-porphine manganese(III) chloride,

40 (4) 5,10,15,20-Tetrakis(4-methoxyphenyl)-21H,23H-porphine iron(III) chloride,

41 (5) 5,10,15,20-Tetraphenyl-21H,23H-porphine iron(III) chloride,

42 (6) 5,10,15,20-Tetraphenyl-21H,23H-porphine copper(II),

43 (7) 5,10,15,20-Tetrakis(pentafluorophenyl)-21H,23H-porphyrin iron(III) chloride,

44 (8) 5,10,15,20-Tetrakis(4-methoxyphenyl)-21H,23H-porphine cobalt(II),

45 (9) 5,10,15,20-Tetraphenyl-21H,23H-porphine zinc, synthetic, low chlorine.

46 The steps of making colorimetric sensor were arranged as follows:(1) Each chemically responsive
47 dye (20mg) was dissolved in 10mL of chloroform solution. The mixture was preprocessed for 2h by
48 ultrasound at room temperature, and eventually obtained 12 kinds of pigments solution.(2) Each
49 pigment solution was spotted on C2 reverse phase silica gel plates (Merck KGaA, Frankfurter,
50 Germany) using 0.1L microcapillary tubes. (3) Once printed, the arrays were stored in a nitrogen-
51 flushed glove bag before the further usage in this experiment. Eventually, we can get a colorimetric
52 sensor array consisting of 12 chemically responsive dyes by the above method.

53 **References**

- 54 1. G. T. 5009.44.,China National Standard: Method for analysis of hygienic standard of meat and meat
55 products. 2003.
- 56 2. Z. Ya, K. He, Z. m. Lu, B. Yi, C. j. Hou, S. Shan, D. q. Huo and X. g. Luo, *Flavour and Fragrance*
57 *Journal*, 2012, 27, 165-170.
- 58 3. B. A. Suslick, L. Feng and K. S. Suslick, *Analytical chemistry*, 2010, 82, 2067-2073.