Application Bulletin

Of interest to:	General analytical laboratories; Food	A 1, 7

Automatic determination of the formol number in fruit and vegetable juices

Summary

The formol number represents a further parameter for the characterization of fruit and vegetable juices. As this is merely an index (the formol number does not deal with the molecular size, nor with the quantity of amino acids), the conditions of the titration can be adapted to practical needs. This concerns mainly the pH value of the endpoint of the SET titration (pH = 8.5, pH = 9.0, pH = 9.2, etc.).

Instruments and accessories

- 702 SET/MET Titrino, 716 DMS Titrino, 719 SET Titrino, 736 GP Titrino, 751 GPD Titrino or 785 DMP Titrino or
  726 or 796 Titroprocessor with 700 Dosino or 685 Dosimat
- 765 or 776 auxiliary Dosimat for adding the formaldehyde solution
- 2.728.0040 Magnetic Stirrer
- 6.3014.223 Exchange Units
- 6.0255.100 combined LL double-junction pH glass electrode with 6.2104.020 electrode cable

Reagents

- Titrant: c(NaOH) = 0.1 mol/L
- Formaldehyde solution: w(HCHO) = 35%, adjusted to pH = 8.5 with NaOH

Analysis

Pipet 25.0 mL sample solution into a glass beaker and titrate in a first SET titration to pH = 8.5 with c(NaOH) = 0.1 mol/L. By means of the activate pulse the second SET titration is then automatically started under the following conditions:

Addition of 15 mL formaldehyde solution (auxiliary Dosimat), 60 s waiting time, titration to pH = 8.5 with c(NaOH) = 0.1 mol/L.

Calculation

The formol number is equivalent to the consumption of c(NaOH) = 0.1 mol/L per 100 mL sample solution.

Formol number = EP1 * C01

EP1 = titrant consumption for the second SET titration in mL

C01 = 4 (for a sample volume of 25 mL)

Figures

```
 'pa
719 S Titrino          0P1/110   719.0020
date  1999-05-11    time  09:34       26
SET  pH             Formal1
parameters
>SET1
  EP at pH               8.50
  dynamics               0.5
  max.rate              10.0 ml/min
  min.rate                10 µl/min
  stop crit:           drift
  stop drift              20 µl/min
>SET2
  EP at pH               OFF
>titration parameters
  titr.direction:        auto
  pause 1                   0 s
  start V:               OFF
  pause 2                   0 s
  extr.time                 0 s
  meas.input:               1
  temperature            25.0 °C
>stop conditions
  stop V:                abs.
  stop V                99.99 ml
  filling rate           max. ml/min
>statistics
  status:                OFF
>preselections
  conditioning:          OFF
  req.ident:             OFF
  req.smpl size:         OFF
  activate pulse:        OFF
         ============
```

Fig. 1: *Parameter settings on the 719 SET Titrino for the first SET titration.*

```
 'pa
719 S Titrino          0P1/110   719.0020
date  1999-05-11    time  09:34       26
SET  pH             Formal2
parameters
>SET1
  EP at pH               8.50
  dynamics               0.5
  max.rate              10.0 ml/min
  min.rate                10 µl/min
  stop crit:           drift
  stop drift              20 µl/min
>SET2
  EP at pH               OFF
>titration parameters
  titr.direction:           +
  pause 1                  60 s
  start V:               OFF
  pause 2                   0 s
  extr.time                 0 s
  meas.input:               1
  temperature            25.0 °C
>stop conditions
  stop V:                abs.
  stop V                99.99 ml
  filling rate           max. ml/min
>statistics
  status:                OFF
>preselections
  conditioning:          OFF
  req.ident:             OFF
  req.smpl size:         OFF
  activate pulse:        OFF
         ============
```

Fig. 2: *Parameter settings for the second SET titration.*

```
 'cr
719 S Titrino          0P1/110   719.0020
date  1999-05-11    time  08:26       17
meas.input:          1     CAL   ********
cal.date      1999-05-11
                      pH     U/mV
buffer  1          7.00       15
buffer  2          4.00      185
cal.temp           22.5 °C
slope(rel)        0.968       pH(as)  7.26
          ============
```

```
 'fm
719 S Titrino          0P1/110   719.0020
date  1999-05-11    time  09:47       28
SET  pH             Formal2
>calculations
FZ=EP1*C01;3;
C01=                     4
         ============
```

```
 'fr
719 S Titrino          0P1/110   719.0020
date  1999-05-11    time  09:41       27
pHc(init)        3.85     SET pH   Formal1
EP1            31.420 ml              8.51
          ============
```

```
 'fr
719 S Titrino          0P1/110   719.0020
date  1999-05-11    time  09:46       28
pHc(init)        7.04     SET pH   Formal2
EP1             4.842 ml              8.50
FZ             19.368
          ============
```

Fig. 3: *Result report for the determination of the formol number in orange juice.*

Literature

- Schweizerisches Lebensmittelbuch, Kapitel 28
  Frucht- und Gemüsesäfte, Fruchtnektare, Fruchtsirupe, Konzentrate und Pulver
  Abschnitt 9.4 Bestimmung der Formolzahl (1990).