

Seasoning

Salinity of Worcestershire Sauce

Precipitation titration by
Automatic Potentiometric Titrator

Standard

Japanese Agricultural
Standard

1. Abstract

Measurement of salinity of Worcestershire sauce is specified in JAS (see below reference). For this purpose, silver nitrate titration using silver electrode is popularly practiced based on below quoted Japanese Agricultural Standard.

The diluted sample liquid is titrated with 0.1mol/L silver nitrate up to the endpoint, which is the maximum inflexion point on titration curve.

Salinity is calculated from titration volume of silver nitrate solution.

2. Reference

- 1) JAS specification for measurement of Worcestershire sauce (Bulletin No. 1074 noticed by Ministry of Agriculture, Forestry and Fisheries, July 22, 1997)

3. Cautions in measurement

- 1) Use 1mol/L potassium nitrate for junction liquid of combination silver electrode in order to refrain from measurement error due to diffused chlorine. Or use mercury sulfate reference electrode.
- 2) Polish the tip of silver electrode with abrasive paper before use.
- 3) If the sample does not show acidity, add nitric acid and measure in acid medium.

4. Post-measurement care

After measurement is finished, polish the tip of electrode with abrasive paper as noted above in 3. Cautions in measurement.

5. Test equipment

Main unit: Automatic potentiometric titrator (Preamplifier: STD-)

Electrode: Combination silver electrode

Mercury sulfate electrode

6. Reagent

Titrant : 0.1mol/L Silver nitrate solution (f=0.9806)

Additive : Pure water, Nitric acid

7. Measurement procedure

—Pretreatment—

- 1) Add pure water to 5g sample liquid and make 250mL in total.
- 2) Filter the liquid.

—Measurement—

- 1) Deliver 10.0mL test liquid to a 200mL beaker.
- 2) Add pure water to make it 100mL.
- 3) Add a few drops of nitric acid.
- 4) Titrated with 0.1mol/L Silver nitrate solution to obtain salinity.

8. Formula

$$\text{NaCl (w/w\%)} = (\text{EP1} - \text{BL1}) \times \text{TF} \times \text{C1} \times \text{K1} / (\text{SIZE} \times \text{R})$$

EP1 : Titration volume (mL)

BL1 : Blank level (0.00mL)

TF : Factor of titrant (0.9806)

C1 : Concentration conversion coefficient (5.844mg/mL)
(Sodium chloride in mg equivalent to 1mL of 0.1mol/L AgNO₃)

K1 : Unit conversion coefficient (0.1)

SIZE : Sample size (g)

R : Constant (0.04)
(dilution ratio: 10mL/250mL)

9. Example of measurement

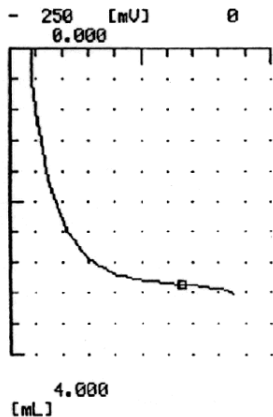
— Ambient condition —

Room temperature : 23 °C	Humidity : 38 %	Weather : Fair
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-Titration parameter-

Model : AT-510 Method No. : 14 Titr.mode : Auto Titration Titr.form : EP Stop	
[Titration parameter]	[Result parameter]
Form : EP Stop APB No. : 1 Unit No. : 1 Detector No. : 2 Unit : mV Max. Volume : 20.0mL Wait Time : 0s Direction : Auto	<Calculation> Calc.Type : Sample Conc.1 : Set CO1=(EP1-BL1)*TF*C1* K1/ (SIZE*R) Unit : % EP No. : 1 Temp.Comp. : Off
[Control parameter]	<Constant>
End Point No. : 1 End sense : Auto End Point Area : Off Separation : Off Over Titr.Vol. : 0mL Gain : 1 Data samp.Pot. : 4.0mV Data samp.Vol. : 0.5mL Control Speed : Medium	C1(mg/mL) : 5.844 K1 : 0.1 R : 0.04 [Titr. constant] Factor : 0.9806 [Blank list] Blank1 : 0.00

-Titration curve-

*** Result *** Sample No. : 18-01 Date : 1999/06/17 15:47 Sample ID :
Method No. : 14 <Auto Titr.> Method Name :
Titr. Time : 00:02:24 Size : <u>5.0462g</u> Conc-1 : <u>8.778%</u> End point-1 Volume : <u>3.0919mL</u> Potential : -86.2mV


(The above printout data were obtained from titration by AT-510)

«Titration parameter»

Form: of titration / APB No. the burette used in titration / Unit No.: [APB Unit File number](#)

Detector No.: the detector used in titration/ Max Volume: of titration

Wait Time: before titration starts/ Direction.: of titration

«Control parameter»

End Point No.: number of EPs / End sense: of EP detection / End Point Area: EP detection area

Separation: of potential / Over Titr.Vol. over-titrated volume / Gain: sensitivity of detection signal

Data samp.Pot.: potential change of sampling signal / Data samp.Vol. : titration volume of sampling signal

Control Speed: control mode of titration speed

«Calculation parameter»

Calc.Type: of formula / Conc.1 formula 1 / Unit: of results /EP No. of calculation

Temp.Comp.: temperature compensation / C1(mg/mL): concentration conversion coefficient

K1: unit conversion coefficient / R:; constant /TF: factor of titration liquid / Blank1: blank level

—Measurement results—

n	Sample (g)	Titration (mL)	NaCl (%)
1	5.0462	3.0919	<u>8.778</u>
2	5.0462	3.0896	<u>8.772</u>
3	5.0462	3.0917	<u>8.778</u>

Batch calculated salinity	
Mean	8.7758 %
SD	0.0037 %
RSD	0.0422 %

* The data were obtained from 3 tests of the same sample.

* Red underline shows the data from page 3/4.

10. Summary

Worcestershire sauce or Worcester sauce is the popular liquid seasoning, which is made of vegetable and fruit juice or puree fermented after salt, sugar, vinegar and spices are added. In Japan, sauce is called synonymously for Worcester sauce.

Measurement of salinity of Worcester sauce is very important in quality control and evaluation of taste.

Sample measurement shows a good repeatability with 0.04% relative standard coefficient.

Precise and reliable measurement is assured by automatic potentiometry.

Sodium chloride in Worcester sauce can be perfectly analyzed by any of the following titration systems manufactured by Kyoto Electronics (KEM).

【AT-610】



Awarded Product of Supreme Technology from Kyoto City

- Easy key entry by touch panel of large color LCD (8-inch wide)
- Simultaneous titration in parallel
- Both potentiometric and Karl Fischer moisture titration (coulometric·volumetric) can be performed at a time.

【AT-510】



- Compact and cost performance model
- PC card expands data memory for convenience and versatility.

【AT-500N-1】



- Low cost and high performance
- Easy view with back light LCD
- GLP/GMP conformed model

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