

Seasoning

## Salinity of Soy Sauce

Precipitation titration by  
Automatic Potentiometric Titrator

Standard

Japanese Agricultural  
Standard

### 1. Abstract

Salt-free soluble solid content in soy sauce can be obtained by measuring its salinity. 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 0.02mol/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) Japanese Agricultural Standard – Soy sauce, Notice 1381, September 3, 1996

### 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) In this application, a convenient combination silver electrode is used, but the same result can be obtained using single silver electrode with a reference electrode in combination.

## 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: Option Combination silver electrode

## 6. Reagent

Titrant : 0.02mol/L Silver nitrate solution

Additive : Pure water

## 7. Measurement procedure

—Pretreatment—

- 1) Add pure water to 5.0mL sample liquid and make 250mL in total.
- 2) Filter the liquid.

—Measurement—

- 1) Deliver 5.0mL test liquid to a 200mL beaker.
- 2) Add pure water to make it 100mL.
- 3) Titrated with 0.02mol/L Silver nitrate solution to obtain salinity.

## 8. Formula

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

EP1 : Titration volume ( mL )

BL1 : Blank level ( 0.00mL )

TF : Factor of titrant ( 0.9642 )

C1 : Concentration conversion coefficient ( 1.1688 mg/mL )  
(Sodium chloride in mg equivalent to 1mL of 0.02mol/L AgNO<sub>3</sub>)

K1 : Unit conversion coefficient ( 0.1 )

SIZE : Sample size ( mL )

R : Constant ( 0.02 )  
(Dilution ratio: 5mL/250mL)

## 9. Example of measurement

— Ambient condition —

Room temperature : 23 °C	Humidity : 47 %	Weather : Cloudy
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### -Titration parameter-

Model : AT-510	
Method No. : 16	
Titration mode : Auto Titration	
Titration form : EP Stop	
[Titration parameter]	
Form : EP Stop	[Result parameter]
APB No. : 1	<Calculation>
Unit No. : 1	Calc.Type : Sample
Detector No. : 1	Conc.1 : Set
Unit : mV	CO1=(EP1-BL1)*TF*C1*
Max. Volume : 20.0mL	K1/
Wait Time : 0s	(SIZE*R)
Direction : Auto	Unit : %
	EP No. : 1
	Temp.Comp. : Off
[Control parameter]	
	<Constant>
End Point No. : 1	C1(mg/mL) : 1.1688
End sense : Auto	K1 : 0.1
End Point Area : Off	R : 0.02
Separation : Off	[Titration constant]
Over Titr. Vol. : 0mL	Factor : 0.9642
Gain : 1	[Blank list]
Data samp. Pot. : 4.0mV	Blank1 : 0.00
Data samp. Vol. : 0.5mL	
Control Speed : Slow	

### -Titration curve-

*** Result ***	
Sample No. : 23-01	
Date : 1999/06/21 14:00	
Sample ID :	
Method No. : 16	
<Auto Titr.>	
Method Name :	
Init. Level : 172.1	
Titration Time : 00:10:44	
Size : <u>5.0mL</u>	
Conc-1 : <u>16.11%</u>	
End point-1	
Volume : <u>14.2936mL</u>	
Potential : 307.4mV	

(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 (mL)	Titration (mL)	NaCl (%)
1	5.0	<u>14.2936</u>	<u>16.11</u>
2	5.0	14.2182	16.02
3	5.0	14.1776	15.98

Batch calculated salinity	
Mean	16.036 %
SD	0.066 %
RSD	0.412 %

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

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

## 10.Saummary

Soy sauce, the Japanese popular cooking and table sauce is made from soy bean and wheat. The secret of tasty quality of soy sauce is a bit of saltiness and attractive flavor due to fermentation caused by enzyme and yeast in ageing process.

When “Light” and “Strong” soy sauce are compared with, “Light” looks light in color with less flavor but salinity is higher than “Strong”.

Quality control and evaluation is made by analysis of salinity, which is of extreme importance. Sample measurement shows good repeatability with 0.4% relative standard coefficient.

Precise and reliable measurement is assured by automatic potentiometry.

Sodium chloride in soy 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

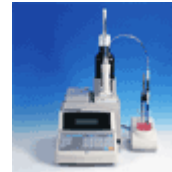
- Easy key entry by touch panel of large color LCD (8-inch wide)
- Simultaneous titration in parallel
- Both potentiometric and Karl Fischer moisture titration (coulometric·volumetric) can be performed at a time.

### 【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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