

Sheet No.

GT-310-FO-002

Food & Beverage

Salt Content Analysis of Soy Sauce

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Outline

Standards of “soluble solids excluding salt” is specified by the Japanese Agricultural Standards (JAS) for each grade of soy sauce. In this application sheet, salt content, which is necessary for the calculation of “soluble solids excluding salt” was measured by potentiometric titration. Good measurement results were obtained with a relative standard deviation (RSD) of less than 1%.

Titration Type : Precipitation Titration
Reference : JAS1703:2021 Japanese Agricultural Standards for Soy Sauce
Soluble solids excluding salt (Potentiometric titration)

Apparatus

Automatic titrator : GT-310
Electrodes : REFERENCE ELECTRODE, L=105 (D-J) (GTRE10B),
SILVER ELECTRODE, L=105 (GTAG1B)
Reference electrode solution : Inner : 1 mol / L - potassium chloride in water
: Outer : 1 mol / L - potassium nitrate in water

Reagents

[Titrant] ■ 0.1 mol / L – silver nitrate solution*
* 0.05 mol / L can be used.
[Reagents] ■ 1% Polyoxyethylene (20) Sorbitan Monolaurate Solution: Take 1 - 2 g of polyoxyethylene (20) Sorbitan Monolaurate into a beaker, add 100 mL of water and mix.*
*Appropriate solution for potentiometric titration including anionic surfactant can be used instead.
■ Nitric acid (1+1): Mix same amount of pure water and nitric acid.

Analytical Procedure

[Preparation of sample solution]

Pour 5 mL of sample into a volumetric flask using a volume pipette and add water until the whole volume becomes 250mL.

[Blank measurement]

- (1) Take 10 mL of the pure water into a 100mL beaker with a volume pipette
- (2) Add 50 mL (up to the level where the electrode is immersed) of pure water into the beaker.
- (3) Add 1 mL of nitric acid (1+1) and 1% polyoxyethylene (20) sorbitane monolaurate solution.
- (4) Titrate with 0.1 mol / L silver nitrate solution.

[Sample measurement]

- (1) Take 10 mL of the sample solution into a 100mL beaker with a volume pipette
- (2) Add 50 mL (up to the level the electrode is immersed) of pure water into the beaker.
- (3) Add 1 mL of nitric acid (1+1) and 1% polyoxyethylene (20) sorbitane monolaurate solution.
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[Calculation]

$$\text{Salt content (g / 100 mL)} = ((A1 - B) / X1) \times Q \times f \times FW \times (1 / W) \times 100$$

- A1 : Volume of titrant for sample measurement (mL)
 B : Volume of titrant for blank measurement (= 0.014 mL) *1
 X1 : Unit conversion factor from mL to L (= 1000)
 Q : Mol concentration of titrant (= 0.1 mol / L) *2
 f : Factor of titrant (= 0.9984) *3
 FW : Formula weight of sodium chloride (= 58.44)
 R : Dilution rate when 10 mL of the sample is diluted to 250 mL
 (= 25)
 W : Amount of Sample (mL)
 100 : Conversion factor to the amount per 100 mL

*1 : When B is less than 0.01 mL, the volume shall be 0 mL.

*2 : Input 0.05 when using 0.05 mol / L silver nitrate solutions.

*3 : Standardization was performed with reference to JIS K8001 (see for application sheet silver nitrate solutions).

Other Requirements

- Confirm reagent labels and safety data sheets for safety.
- Wear protective equipment (eye protector, gloves and others.) when handling reagents.
- Replace the inner solution and outer solution of the reference electrode regularly.
- Please polish the silver detection electrode before the measurement. Darkening on the surface may cause poor response.

Measurement Results

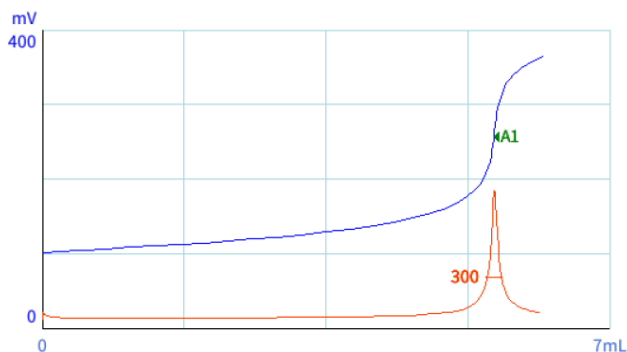
Sample name	Amount of sample (mL)	Titration volume (mL)	Salt content (g / 100 mL)	Average (g / 100 mL)	RSD (%)
Dark soy sauce	5	5.5631	16.19	16.20	0.1
		5.5651	16.19		
		5.5688	16.21		
Light soy sauce	5	6.2706	18.25	18.26	0.0
		6.2723	18.26		
		6.2719	18.26		

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Sample name : Dark soy sauce
 End point : 5.5631 mL 257.22 mV
 Start of titration : 0 mL 101.60 mV
 End of titration : 6.1670 mL 364.23 mV
 Measurement time : 4 min 07 sec

■ Parameters that are not listed below are the default values.

	Blank test	Sample titration
Detector	: mV	: mV
Titration mode	: General titration	: General titration
Drop volume control	: Individual [Fine *1]	: Individual [Normal *1]
Max. drop volume	: 20 μ L	: 300 μ L
Min. drop volume	: 4 μ L	: 10 μ L
Stability criteria	: Individual [Fast *1]	: Individual [Fast *1]
Delta potential	: 2 mV	: 2 mV
Delta time	: 3 s	: 3 s
End point 1	: Inflection point	: Inflection point
E1 potential	: 350 mV	: 350 mV
E1 potential width	: 500 mV	: 500 mV
E1 derivative threshold	: 500 mV/mL	: 300 mV/mL
E1 evaluation points	: 1	: 6 *2
Max. titration volume	: 3 mL	: 20 mL

*1: It can also be used with parameters other than individual.

*2: The default value is used.

*This application sheet is provided as reference, and does not assure the measurement results. Please consider analysis environment, external factors and sample nature for optimal conditions before the measurement.