

HIRANUMA APPLICATION DATA	Automatic Titrator	Data No.	O7	Feb. 03, 2022
Factor standardization	Standardization of iodine titrant			

1. Abstract

Iodine (I₂) is an oxidant and its redox pair is an iodide ion(I⁻). In the iodometric titration method, an excessive amount of iodide ion(I⁻) is reacted with the oxidizing agent in the sample. The produced iodine(I₂) is titrated with sodium thiosulfate and the oxidant is indirectly quantified. This method is widely used to quantify oxidants. On the other hand, in the iodimetric titration method, the reducing agent in the sample is directly titrated with an iodine(I₂) titrant: example of its use is the quantification of sulfites.

Since iodine(I₂) is volatile, it is necessary to check the factor of the iodine standard solution before use as a titrant. JIS K8001 and the Japanese Pharmacopoeia describe that the sodium thiosulfate standard solution should be used for factor standardization of the iodine(I₂) standard solution. 2 mol of sodium thiosulfate reacts quantitatively with 1 mol of iodine(I₂) by equation (1) and shows an inflection point on the titration curve.



- 1) Japanese Pharmacopoeia Eighteenth Edition
- 2) Japanese Industrial Standard JIS K8001 General rules for test methods of reagents

2. Configuration of instruments and reagents

(1) Configuration of instruments

Main unit	: Automatic Titrator	COM Series
	Optional buret	1 unit
Electrodes	: Platinum electrode	PT-301
	Reference electrode	RE-201Z

* It can also be applied to combinations of other platinum electrodes such as PR-701BZ.

(2) Reagents

Standard material : 0.1 mol/L (0.1 N) sodium thiosulfate standard solution (f = 1.000, Buret No. 1),
Used as a titrant

Sample to be standardized
: 0.05 mol/L (0.1 N) iodine(I₂) standard solution (Buret No.2), Used as a sample

3. Measurement procedure

- (1) Add 50 mL of DI water and a stirrer bar to a 100 mL beaker.
- (2) Immerse the electrodes and start the measurement. 10 mL of 0.05 mol/L iodine(I₂) standard solution is added to the beaker by the buret dispensing.
- (3) Titration is subsequently performed with 0.1 mol/L sodium thiosulfate standard solution. The inflection point on the titration curve is detected as the end point.

4. Measurement conditions and results

Examples of titration conditions

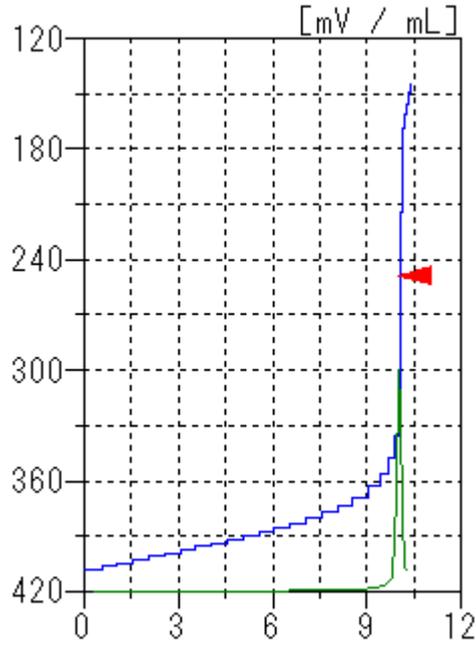
Factor standardization measurement of 0.05 mol/L iodine(I₂) standard solution

M. File	1+2		
Cndt No.	1		
Method	Disp		
Buret No.	2		
S-Timer	5 sec		
Disp Vol.	10 mL		
Cndt No.	2		
Method	Auto	ConstantNo.	2
Buret No.	1	Size	10 mL
Amp No.	2	Blank	0 mL
D. Unit	mV	Molarity	0.1 mol/L
S-Timer	5 sec	Factor	1.000 *1
C.P. mL	0 mL	K	0
T Timer	0 sec	L	0
D.P. mL	0 mL		
End Sens	1000	Unit	Fact
Over mL	0.3 mL	Formula	(D-B)/S*F
Max.Vol.	20 mL	Digits	4
		Mode No.	4
		Pre Int	0 sec
		Del K	9
		Del Sens	0 mV
		Int Time	3 sec
		Int Sens	3 mV
		Brt Speed	2
		Pulse	40

*1: Factor of 0.1 mol/L sodium thiosulfate standard solution

Measurement results

Measurement No.	Sample size (mL)	Titrant volume (mL)	Factor	Statistic calculation	
1	10	10.031	1.0031	Avg.	1.003
2	10	10.036	1.0036	SD	0.0003
3	10	10.035	1.0035	RSD	0.03 %



Measurement of factor of iodine standard solution

Examples of titration curves

5. Note

(1) About the factor calculation formula of the iodine(I₂) standard solution

In measurement of the factor standardization, there are many case examples of titrating a standard material using the titrant to be standardized. In the procedure of JIS K8001 and Japanese Pharmacopoeia for iodine(I₂) standard solution, the titrant and the sample are reversed. The sodium thiosulfate standard solution is used as the titrant, and the iodine(I₂) standard solution to be standardized is used as the sample for titration.

In this case, the factor calculation formula is set as [(D-B)/S*F]. This formula is not initially installed in the titrator and must be set using the formula editing function.

The calculation formula is derived based on the following relational formula (2). The left side (subscript s) is the titrant of sodium thiosulfate standard solution and has already been standardized preliminary, and the right side (subscript t) is the sample of iodine(I₂) standard solution to be standardized.

$$n_s \times M_s \times F_s \times (D - B) = n_t \times M_t \times F_t \times S \quad \cdot \cdot \cdot (2)$$

Sodium thiosulfate	Iodine(I ₂)
n _s : Valence (1)	n _t : Valence (2)
M _s : Molar concentration (0.1)	M _t : Molar concentration (0.05)
F _s : Factor (Known)	F _t : Factor (Unknown)
D-B : Titrant volume (mL)	S : Sample size (mL)

Keywords : Factor standardization, Redox titration, Iodine, Sodium thiosulfate

*Some measurement would not be possible depending on optional configuration of system.