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.

$$2Na2S2O3 + I2 \rightarrow Na2S4O6 + 2NaI \cdots(1)$$

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.

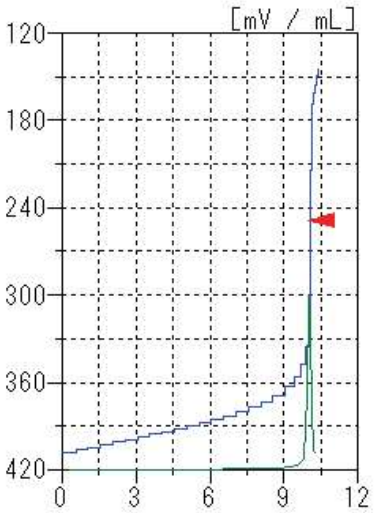
Factor standardization measurement of 0.05 mol/L iodine(I2) standard solution

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

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

Measurement results

Measurement No.	Sample Size(mL)	Titrant volume (mL)	Factor	Statistical 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 %



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.

$ns \times Ms \times Fs \times (D - B) = nt \times Mt \times Ft \times S$ ・・・(2)

Sodium thiosulfate	Iodine(I2)
ns ： Valence (1)	nt ： Valence (2)
Ms ： Molar concentration (0.1)	Mt： Molar concentration (0.05)
Fs ： Factor (Known)	Ft ： 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.

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