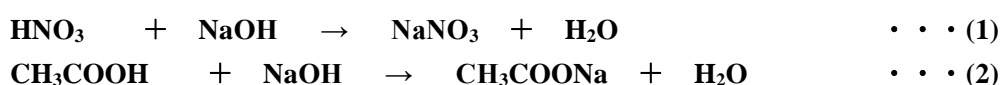


<b>HIRANUMA APPLICATION DATA</b>	Automatic Titrator	Data No.	J6	Apr. 5, 2019
<b>Inorganic acids &amp; Mixed acids</b>	<b>Fractional determination of nitric acid and acetic acid</b>			

## 1. Abstract

The mixed solution of nitric acid (inorganic acid) and acetic acid (organic acid) works as strong acid, and also has the strong oxidizability and solvency. It is used as the surface treatment solution for metals, glass products, and semiconductors.

This report introduces an example of the fractional and successive determination for nitric acid and acetic acid by neutralization titration with sodium hydroxide standard solution.



## 2. Configuration of instruments and reagents

### (1) Configuration of instruments

Main unit	:	Hiranuma Automatic Titrator COM series
Electrodes	:	Glass electrode GE-101B
		Reference electrode RE-201Z

\*Instead of the above electrodes, the following electrodes are usable.

- Glass reference combination electrode GR-501BZ···Fixed sleeve type
- Glass reference combination electrode GR-511BZ···Moveable sleeve type

### (2) Reagent

Titrant	:	1 mol/L Sodium hydroxide standard solution
---------	---	--

## 3. Measurement procedure

- (1) Dispense 1 mL of sample into a 100 mL beaker with a volumetric pipette.
- (2) Add 40 mL of CO<sub>2</sub>-free DI water.
- (3) Immerse electrodes and start titration with 1 mol/L sodium hydroxide standard solution.

## 4. Measurement conditions and results

### Examples of titration conditions

#### (1) Titration condition for nitric acid

Cndt No.	1	ConstantNo.	1	Mode No.	4
Method	Auto	Size	1.000 mL	Pre Int	0 sec
Buret No.	1	Blank	0.000 mL	Del K	9
Amp No.	1	Molarity	1.000 mol/L	Del Sens	0 mV
D. Unit	pH	Factor	1.005	Int Time	3 sec
S-Timer	10 sec	K	63.01	Int Sens	3 mV
C.P. mL	0 mL	L	0.000	Brt Speed	2
T Timer	0 sec	Unit	g/L	Pulse	40
D.P. mL	0 mL	Formula	(D-M)*K*F*M/S		
End Sens	150	Decimal Places	3		
Over mL	0 mL	Auto In Pram.	Non		
Max.Vol.	20 mL				

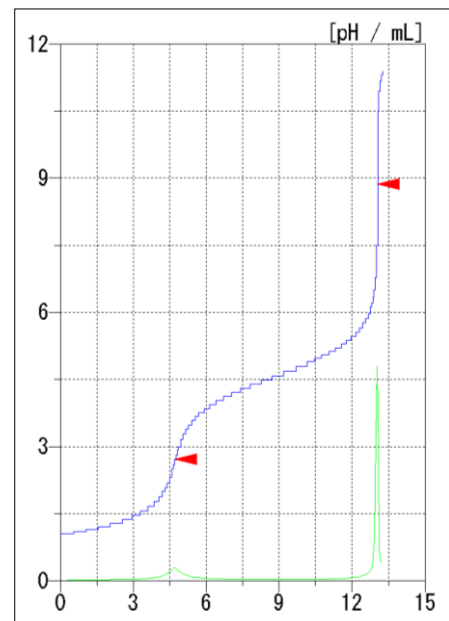
#### (2) Titration condition for acetic acid

Cndt No.	2	ConstantNo.	2	Mode No.	4
Method	Auto	Size	1.000 mL	Pre Int	0 sec
Buret No.	1	Blank	0.000 mL	Del K	9
Amp No.	1	Molarity	1.000 mol/L	Del Sens	0 mV
D. Unit	pH	Factor	1.005	Int Time	3 sec
S-Timer	0 sec	K	60.05	Int Sens	3 mV
C.P. mL	0 mL	L	0.000	Brt Speed	2
T Timer	0 sec	Unit	g/L	Pulse	40
D.P. mL	0 mL	Formula	(D-M)*K*F*M/S		
End Sens	1000	Decimal Places	3		
Over mL	0.2 mL	Auto In Pram.	Non		
Max.Vol.	20 mL				

\*Connect the condition (1) and (2) for successive titration.

### Measurement results

Number of Measurement	Size (mL)	Titrant volume at 1 <sup>st</sup> endpoint (mL)	Nitric acid (g/L)	Titrant volume at 2 <sup>nd</sup> endpoint (mL)	Acetic acid (g/L)
1	1	4.708	289.134	8.314	501.752
2	1	4.709	298.198	8.311	501.571
3	1	4.710	298.261	8.318	501.993
		Avg.	<b>295.2 g/L</b>	Avg.	<b>501.8 g/L</b>
Statistic calculation		SD	5.25 g/L	SD	0.21 g/L
		RSD	1.78 %	RSD	0.04 %

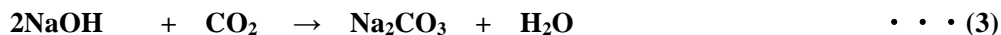


Example of titration curve

## 5. Note

- Control of titrant

The concentrated sodium hydroxide standard solution is used as titrant in this report. The carbon dioxide gas absorber (soda lime) on reagent bottle has to be regularly exchanged because sodium hydroxide readily absorbs carbon dioxide gas in the air (formula (3)). The titrant contains sodium carbonate if it absorbed carbon dioxide gas. When using this titrant, the titration curve would show the inflection points at pH around 4 and 9 (formula (4) and (5)).



Keywords: Nitric acid, Acetic acid, Neutralization titration, Fractional titration, Successive titration