

Organic acid

Determination of formic acid**1. Abstract**

Formic acid is monobasic carbonic acid, which belongs to lower saturated fatty acid group. Formic acid has a little different properties from other saturated fatty acids; it has significantly strong acidity (12 times stronger than acetic acid) and reducing character, degrades to water and carbon dioxide gas by the oxidation. It can also reduce ammoniacal silver nitrate.

The neutralization titration method with sodium hydroxide standard solution for the determination of formic acid is prescribed in “JIS K8264. This report introduces an example of the potentiometric titration with glass electrode instead of indicator method using phenolphthalein prescribed in JIS.

**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
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3. Measurement procedure

- (1) Take 20 mL of DI water into a 100 mL beaker.
- (2) Add about 1 g of sample to the beaker and weigh accurately with 0.1 mg digit.
- (3) Add about 50 mL of DI water and stirring bar to the beaker and stir to homogenize it.
- (4) Immerse electrodes and start titration with 1 mol/L sodium hydroxide standard solution.

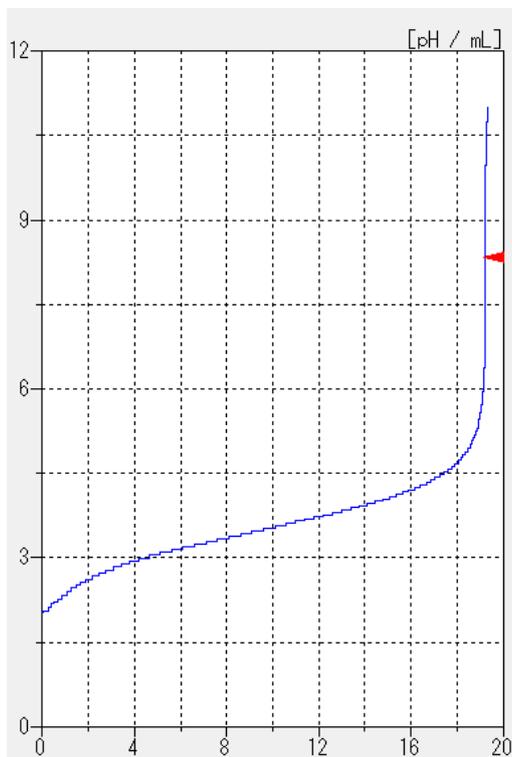
4. Measurement conditions and results

Example of titration condition

Cndt No.	1	ConstantNo.	1	Mode No.	8
Method	Auto	Size	1.005 g	Pre Int	0 sec
Buret No.	1	Blank	0 mL	Del K	5
Amp No.	1	Molarity	1.000 mol/L	Del Sens	0 mV
D. Unit	pH	Factor	1.005	Int Time	5 sec
S-Timer	5 sec	K	46.03	Int Sens	3 mV
C.P. mL	0 mL	L	0	Brt Speed	2
T Timer	0 sec	Unit	%	Pulse	40
D.P. mL	0 mL	Formula	(D-B)*K*F*M/(S*10)		
End Sens	500	Decimal Places	3		
Over mL	0.1 mL	Auto In Pram.	Non		
Max.Vol.	20 mL				

* Enter the molecular weight of formic acid (46.03) to parameter "K".

Measurement results



Number of Measurement	Size (g)	Titrant Volume (mL)	Concentration (%)
1	1.0050	19.178	88.276
2	1.0025	19.075	88.021
3	1.0034	19.175	88.403
Statistic calculation		Avg.	88.23 %
		SD	0.195 %
		RSD	0.221 %

Example of titration curve

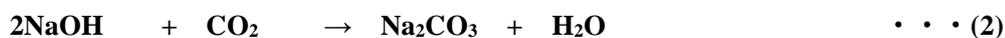
5. Note

(1) Collection of sample

The sample is collected directly to the beaker and weighed accurately. The accuracy of sample collection influences the measurement accuracy. Please note that the sample should be carefully taken and accurately weighed.

(2) 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 (2)). The standard solution of sodium hydroxide that has absorbed carbon dioxide contains sodium carbonate, and the inflection point on titration curve may be unclear due to buffer capacity of sodium hydrogen carbonate generated in the reaction with an acidic sample (formula (3)).



Keywords: Formic acid, Sodium hydroxide, Neutralization, JIS K8264