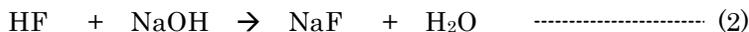
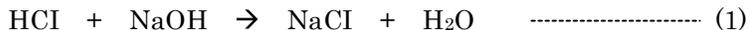


AQUACOUNTER Application Sheet	COM series	DATA No. J3	1st edition
Inorganic Acid		Fractionation quantification of hydrochloric acid and hydrofluoric acid	

1. Measurement outline

The mixture solution of hydrochloric acid and hydrofluoric acid has strong oxidizing power as well as dissolving power in addition to its effect as a strong acid, and is used as the surface treatment solution for metals, glass products and semiconductors.

This section introduces an example of measuring the mixture solution of hydrochloric acid and hydrofluoric acid by conductometric titration with sodium hydroxide.



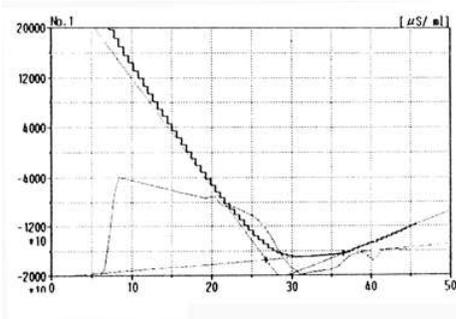
2. Reagents and Electrodes

(1) Reagents	Titrant	0.5mol/L sodium hydroxide titrant
(2) Electrodes	Twin platinum electrode TPT-351 coated with platinum black	

3. Measurement conditions example (for COM-1600E w/ conductivity titration unit)

Master File No.1					
Condition file: 1 + 2					
Parameters for Condition file 1 (For hydrochloric acid)		Parameters for Condition file 2 (For hydrofluoric acid)		Mode No.21	
Method	V2 Cross	Method	V2 Cross	Pre Int	0 sec
Amp No.	2	Amp No.	2	Del K	0
Buret No.	1	Buret No.	1	Del Sens	0 mV
Meas Unit	μs	Meas Unit	μs	Int Time	1 sec
S-Timer	0 sec	S-Timer	0 sec	Int Sens	0 mV
CP	0 mL	CP	0 mL	Brst Speed	2
DP	15 mL	DP	0 mL	Pulse	480
End Sens	500	End Sens	300		
Over mL	0 mL	Over mL	0 mL		
Max. Vol.	50 mL	Max. Vol.	20 mL		
Mode No.	21	Mode No.	21		
Unit	%	Unit	%		
Formula	(D-B)×K×F×M/(S×10)	Formula	(D-B)×K×F×M/(S×10)		
Blank	0	Blank	0		
Molarity	0.5	Molarity	0.5		
Factor	Titer of titrant	Factor	Titer of titrant		
K	36.46	K	20.0063		

4. Measurement example



Measurement results on hydrochloric acid

Sample No.	Sample volume (mL)	Titration value (mL)	Concentration (%)
1	10	26.785	4.91
2	10	27.880	5.11
3	10	27.299	5.00
Avg.			5.01 %
Std. Dev.			0.10 %
C.V.			2.0 %

Measurement results on hydrofluoric acid

Sample No.	Sample volume (mL)	Titration value (mL)	Concentration (%)
1	10	9.674	0.97
2	10	9.561	0.96
3	10	10.174	1.02
Avg.			0.99 %
Std. Dev.			0.03 %
C.V.			3.03 %

5. Outline

- (1) About fractionation titration on hydrochloric acid and hydrofluoric acid

Since both hydrochloric acid and hydrofluoric acid are strong acids, fractionation titration of these two is difficult using potentiometric titration. Another method for fractionation titration other than the successive titration by conductometric titration introduced in this section is the method by potentiometric titration as follows:

In this method, the total acid of hydrochloric acid and hydrofluoric acid is measured first. Then hydrochloric acid is measured by precipitation titration with silver nitrate. The concentration of hydrofluoric acid is calculated by subtracting the hydrochloric acid concentration from the total acid concentration. The disadvantage of this method is that the sample needs to be collected twice, and that 2 or more types of titrant are required.

- (2) About control of the titrant

A high-concentration sodium hydroxide titrant is used as the titrant for this measurement. Since sodium hydroxide tends to absorb carbon dioxide gas in air (Formula 3), it is important that the carbon dioxide gas absorbent (soda lime) in the reagent bottle be replaced regularly. Titrant that has absorbed carbon dioxide gas contains sodium carbonate and delivers a titration curve that shows inflection points at around pH 4 and pH9.5 (Formulae 4 and 5).



(3) About fractionation titration using non-aqueous solvent

Fractionation titration of hydrochloric acid and hydrofluoric acid was tried by neutralization titration using methanol as the titration solvent. Though clear titration curve indicating 2 inflection points was obtained, its results did not show quantitativity and was not practical.

Key words

Fractionation titration of hydrochloric acid and hydrofluoric acid, conductometric titration

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