

Application Note

Determination of iron (III) ion content using a multiple sample changer

Industry	Chemicals
Instrument	Multiple sample changer, Automatic potentiometric titrator
Measurement method	Photometric titration / Chelatometric titration
Standards	

1. Scope

The multiple sample changer can be connected to an automatic potentiometric titrator system to create an automatic measurement system. This system contributes to efficiency and labor savings in analytical operations. This Application Note introduces an example of measuring the quantification of Iron (III) ion in Iron nitrate ($\text{Fe}(\text{NO}_3)_3$) solution by back titration, conducted using sequence control. In this test, EDTA was added to the Iron nitrate sample, and then the excess EDTA was titrated with bismuth nitrate solution.

2. Apparatus

Equipment	Automatic potentiometric titrator (Photometric preamplifier PTA)
Electrode	Photometric sensor (Bandpass filter wavelength 530 nm) Combined glass electrode (Inner liquid 3.3 mol/L potassium chloride solution)
Options	Multiple sample changer

3. Reagents

Titrant	0.01 mol/L Bismuth nitrate solution
Reagents	Ion exchanged water
Additional reagent	0.013 mol/L EDTA (Disodium ethylenediaminetetraacetate) Ammonia solution (1+10)
Indicator	1 % Xylenol orange solution

4. Procedure

- 1) Dispense 10 mL of the sample accurately into a beaker.
- 2) Add 10 mL of ion exchanged water
- 3) Add 20 mL of 0.013 mol/L EDTA solution using a whole-pipette.
- 4) While gently stirring the mixture, add enough ammonia solution (1+10) to adjust the pH to between 2.0 and 2.2.
- 5) Add ion exchanged water to make the total volume approximately 70 mL and stir gently for 5 minutes.
- 6) Add 0.3 mL of 1 % xylenol orange solution and set the beaker in the multiple sample changer.
- 7) Titrate with 0.01 mol/L Bismuth nitrate solution.
- 8) Separately, a blank test is performed to correct titration volume during sample measurement.

5. Calculation

$$\text{Iron (III) ion (mg/L)} = (\text{BL1} - \text{EP1}) \times \text{TF} \times \text{C1} \times \text{K1/S}$$

BL1	Titration amount (mL) of Blank test	= 26.0154 (mL)
EP1	Titration amount of sample (mL)	
TF	Factor of titrant	= 1.000
C1	Concentration conversion coefficient	= 0.55845 *
K1	Unit conversion factor	= 1000
S	Quantity of sample (mL)	

* Iron(III) equivalent in 1mL of 0.013 mol/L EDTA solution (mg)

6. Example

—Titration parameter—

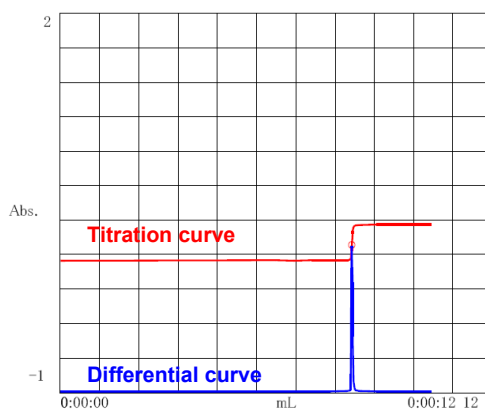
<Titr. Mode>	Auto Int.
<Titr. Form>	Level Stop

<Titr. Para.>	
Burette No.	1
Max. Volume	15 (mL)
Channel/Unit(Ctrl.)	Ch3, Abs
Channel/Unit(ref.)	Off
pH Polarity	Standard
Type of Titration	Not check
EP Direction	Auto
Wait Time	30 (s)
Dose Mode	Volume Stop
Stop volume	6.0 (mL)
Dispense Speed	10.0 (s/mL)

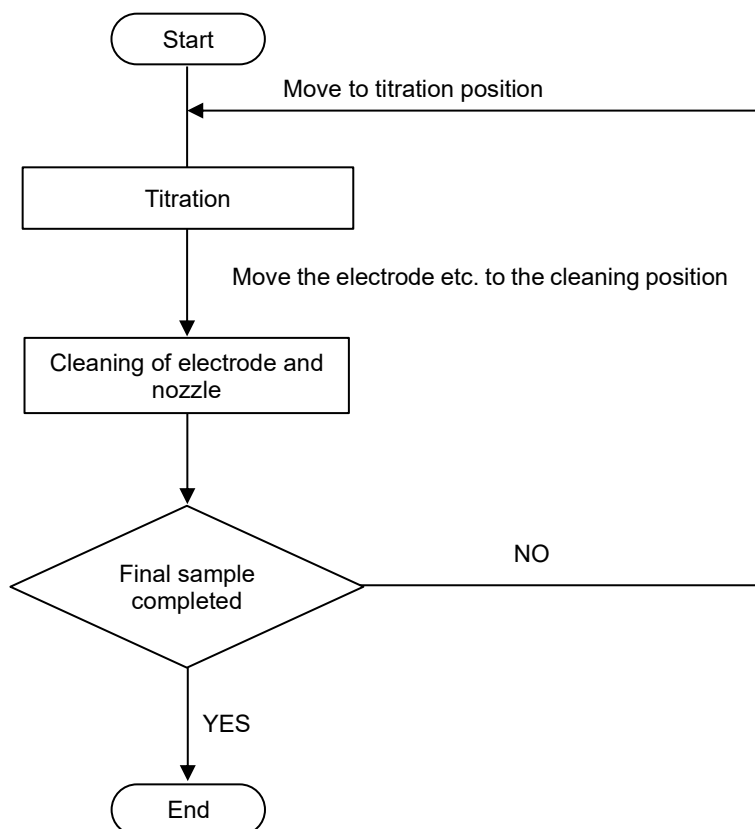
<Ctrl. Para.>	
Number of EP	1
End Sense	Set
End Sense (Potential)	80.0 (dE)
End Sense (Differential)	1810 (dE/dmL)
Gain	2
Data Sampling	Auto
Ctrl. Speed Mode	Set
Ctrl. Speed	0.5
Other Control	Standard
Stirrer Speed	4

(Listed above are example settings. Availability of settings may vary by instrument model.)

—Titration curve—



—Sequence—



— Measurement results —

Table Measurement result

Sequence	Sample (mL)	Titration amount (mL)	Fe(III) (mg/L)
1	10.0	8.1298	998.82
2	10.0	8.1392	998.30
3	10.0	8.0729	1002.00
4	10.0	8.1303	998.79
5	10.0	8.0943	1000.80
6	10.0	8.0865	1001.24
7	10.0	8.0952	1000.75
8	10.0	8.0903	1001.03
9	10.0	8.1074	1000.07
10	10.0	8.1168	999.55
Mean			1000.14
SD			1.23
RSD(%)			0.12