

Application Note

Measurement of polyoxyethylene(50)alkyl ether (alkyl group:C16-18)

| | | |
|--------------------|---|--|
| Industry | : | Chemical |
| Instrument | : | Automatic potentiometric titrator |
| Measurement method | : | Potentiometric titration/Ion association titration |
| Standards | : | - |

1. Scope

The polyoxyethylene addition type nonionic surfactant having an ethylene oxide chain-(CH₂CH₂O)_n- incorporates barium ions to form a cationic complex. The nonionic surfactant can be measured by titrating this cationic complex with sodium tetraphenylborate. Since the reaction molar ratio of cationic complex of nonionic surfactant and tetraphenylborate ion depends on ethylene oxide chain length, it is not constant. Approximate reaction molar ratio is 1mol of tetraphenylborate ion per 5 to 6mol of ethylene oxide chain. Therefore, a factor of titrant is generally calculated based on pure product or nonionic surfactant of known concentration.

In this application, we introduce example of determining the factor of the titrant by titrating the polyoxyethylene addition type nonionic surfactant of known concentration. The sample is polyoxyethylene (50) alkyl ether (alkyl group: C16-18), and its preparation concentration is 2.2150g/L.

2. Precautions

Measurement values may not be stable at the start of use. In this case, condition the state of the electrode by ducting the measurement two or three times.

This electrode is applicable only for titration in aqueous solution system because the sensitive membrane is weak against organic solvents.

3. Post-measurement procedure

Rinse the sensitive membrane with pure water every time the measurement is completed and wipe it off with a paper washer etc.

4. Apparatus

| | | |
|-----------|---|--|
| Main unit | : | Automatic potentiometric titration system (preamplifier:STD) |
| Electrode | : | Nonionic surfactant electrode |
| | : | Double junction type reference electrode (Fill 1mol/L sodium chloride solution as inner solution to the outer cylinder) |

5. Reagents

| | | |
|------------------|---|------------------------------------|
| Titrant | : | 0.01mol/L sodium tetraphenylborate |
| Additive reagent | : | 1mol/L barium chloride |

6. Procedure

- 1) Accurately collect 10 mL of sample in a beaker and add 50 mL of pure water with a measuring cylinder.
- 2) Accurately add 1 mL of 1mol/L barium chloride and titrate with 0.01mol/L sodium tetraphenylborate solution.

7. Calculation

$$\text{Factor of titrant} = C1 \times K1 \times S / (EP1 - BL1)$$

- EP1 : titration volume(mL)
- BL1 : Blank level(0mL)
- C1 : Concentration conversion coefficient(2.2150g/L)
- K1 : Unit conversion coefficient(1)
- S : sample(10mL)

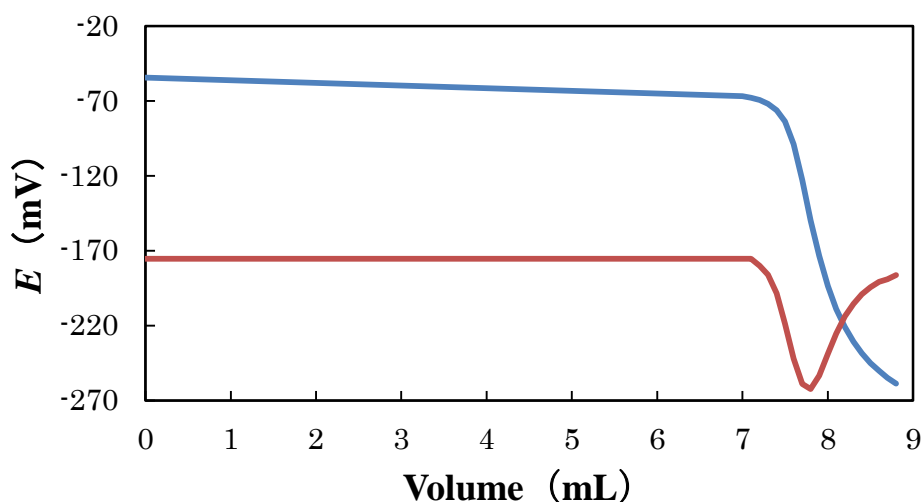
8. Example

-Titration parameter-

| | | | |
|--------------------------|------------|--------------------------|------------|
| <u><Titr.Mode></u> | :Intermit | <u><Ctrl.Para></u> | |
| | | Number of EP | : 1 |
| <u><Titr.Form></u> | :EP Stop | End Sense | : Auto |
| | | Gain | : 2 |
| <u><Titr.Para></u> | | Stirrer Speed | : 4 |
| Burette No. | : 1 | Data sampling | : Set |
| Max. Volume | : 20 (mL) | Data Samp. Pot. | : 999mV |
| Channel/Unit(Ctrl.) | : Ch1, mV | Data Samp. Vol. | : 0.1mV |
| Channel/Unit(Ref.) | : Off | Ctrl. Speed | : Set |
| pH Polarity | : standard | Cut off time | : 10s |
| Titr.Type Check | : Negative | Unit Volume | : 0.1mL |
| Direction | : Auto | Disp. Speed | : 1s/mL |
| Wait Time | : 60 (s) | Other Control | : standard |
| Dose mode | : None | | |

‘(The measurement parameter and the titration curve are an example of our automatic potentiometric titrator. In some titrators, parameter item may be different or another parameter item may be added.)

-Titration curve and results-



Results

| | Titer (mL) | Factor (mg/mL) |
|-----------|------------|----------------|
| 1 | 7.7373 | 2.8628 |
| 2 | 7.7225 | 2.8682 |
| 3 | 7.7876 | 2.8443 |
| 4 | 7.8164 | 2.8338 |
| 5 | 7.8386 | 2.8258 |
| Mean | 7.7805 | 2.8470 |
| S.D. | 0.0499 | 0.0183 |
| R.S.D.(%) | 0.6409 | 0.6411 |

9. Summary

A clear inflection point was observed in the titration curve, and the potential was sufficiently changed at the end point. Since the RSD in 5 measurements is less than 1%, it is considered that good accuracy was obtained. Approximate reaction molar ratio is 1mol of tetraphenylborate ion per 5 to 6mol of ethylene oxide chain. In this result, the stoichiometric ratio was 5.8, which agreed with the results reported previously. It is considered possible to measure polyoxyethylene (50) alkyl ether (alkyl group: C16-18) using this electrode and potentiometric titrator. However, when measuring the actual sample, the measurement result may be affected by coexisting components. For that reason, it may be necessary to consider whether measurement is possible. We can consider the measurement availability of your sample. Please contact us in case of request.

10. References

Kasai Yukio et al. 『Determination of POE Type Nonionic Surface Active Agents by “Sodium Tetraphenylboron Complex-Backtitration Method”』 『Journal of the Chemical Society of Japan. Industrial chemistry』 72(4),pp.912-917.

Milan Sak-Bosnar et al.(2007) 『Nonionic surfactant-selective electrode and its application for determination in real solutions』 , 『Analytica Chimica Acta』 581,pp.355-363