Application Note

Ion exchange capacity of cation exchange resin

Industry	Chemicals
Instrument	Automatic potentiometric titrator
Measurement method	Potentiometric titration / Neutralization titration
Standards	

1. Scope

This Application Note describes an example of measuring the ion exchange capacity of a strongly acidic hydrogen ion type cation exchange resin. A strongly acidic hydrogen ion type cation exchange resin contains the sulfo group (-SO_3H), and as indicated below, exchanges sodium ions, calcium ions, and other cations in the solvent with hydrogen ions.

$$R\text{-}SO_3H + Na^+ \rightarrow R\text{-}SO_3Na + H^+$$
$$2R\text{-}SO_3H + Ca^{2+} \rightarrow (R\text{-}SO3)_2Ca + 2H^+$$

In terms of measuring the ion exchange capacity, in light of the properties mentioned above, an applicable method is to add a sodium chloride solution to the cation exchange resin, and then titrate the hydrogen ions released with a sodium hydroxide solution. The exchange capacity is calculated as (mmol/g).

2. Post-measurement procedure

To suppress efflux and enrichment of the electrolyte when storing the electrodes, seal the electrolyte filling port in the combined glass electrode with a rubber stopper.
The performance of the combined glass electrode quickly deteriorates if it is stored while dry. The following storage methods are recommended.

- Short term storage (less than one month): Store it submerged in pure water.
- Long term storage (at least one month): Store it submerged in a 1:1 volume ratio mixture of a pH 4 standard liquid and a 3.3 mol/L aqueous potassium chloride solution.

3. Apparatus

Main unit	Automatic potentiometric titrator (standard preamplifier STD)
Electrode	Combined glass electrode (Electrolyte 3.3 mol/L aqueous potassium chloride solution) Temperature compensated electrode

4. Reagents

Titration liquid	0.1 mol/L sodium hydroxide solution
Additive reagent	1 mol/L sodium chloride solution

5. Procedure

1) Introduce 0.5 g of the cation exchange resin into a beaker and weigh it.
2) Add 10 mL of a 1 mol/L aqueous sodium chloride solution and stir for 1 minute.
3) Add pure water to dilute the solution up to approximately 100 mL, and titrate with a 0.1 mol/L aqueous sodium hydroxide solution.

6. Calculation

Exchange capacity (mmol/g) = (EP1 - BL1) × TF × C1 × K1/S

EP1	Titration volume required to the first endpoint (mL)
BL1	Titration volume required for a blank test (0 mL)
TF	Titration solution factor (1.0003)
C1	Concentration conversion coefficient (0.0001 mol/mL)
K1	Unit conversion coefficient (1000)
S	Amount of sample introduced (g)

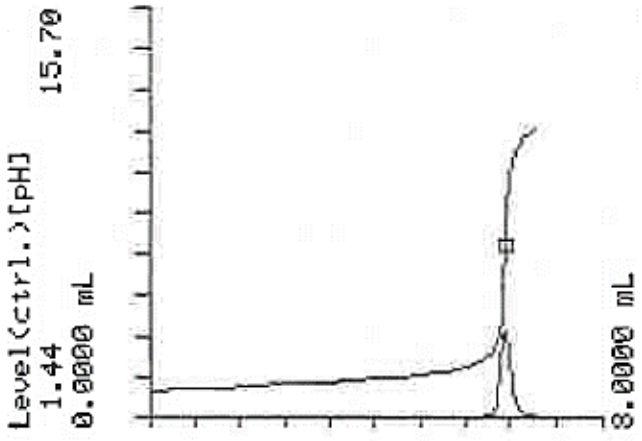
7. Example

— Parameter —

<Titr. Mode>	Auto Int.	**<Ctrl. Para.>**	
<Titr. Form>	Level Stop	Number of EP	1
		End Sense	Auto
<Titr. Para.>		Gain	1
Max Volume	20 (mL)	Data Sampling	Auto
Channel/Unit(Ctrl.)	Ch1, mV	Ctrl. Speed	Standard
Wait Time	0 (s)	Other Control	Standard
Dose Mode	None	Stirrer Speed	4

（The above condition is an example. The setting condition depends on the model.）

— Example of Titration curve —



— Measurement results —

Table 1 Measurement result of exchange capacity of cation exchange resin

	Sample (g)	Titration (mL)	Ion exchange capacity (mmol/g)
1	0.4940	6.2339	1.2623
2	0.4859	6.1134	1.2585
3	0.4911	6.2120	1.2653
Mean			1.2620
SD			0.0034
RSD (%)			0.27