Category | *AUTOMATIC TITRATOR COM Series*

Petroleum Products

Total Base Number (TBN)

by Potentiometric titration method (non-aqueous)

Referenced methods ASTM D4739, JIS K2501

Key words; Petroleum products, lubricants, base number, non-aqueous acid/base titration

Outline

The total base number (TBN) for lubricants is one of the important indices for evaluating the quality of lubricants. The TBN is expressed as the milligram (mg) value of potassium hydroxide (KOH) equivalent for the hydrochloric acid or perchloric acid required for neutralizing the total basic components contained in 1g of sample. The components for total base value are organic bases, inorganic bases, amino compounds, weak acid salts (soaps), basic salts of polybasic substances, heavy metal salts, and additives such as antioxidants and cleansers. The methods for measuring the TBN are mainly classified into two: hydrochloric acid titration method and perchloric acid titration method. This section introduces an example in which the total base number of diesel engine oil (used) was measured by hydrochloric acid method.

Precaution

In this method, the sample volume corresponding to total acid value is weighed precisely to be added and dissolved in a mixture of toluene and propan-2-ol. Electrodes are then immersed for titration with 2-propanol-type potassium hydroxide titrant. For samples, which have well-defined inflection points, end points are taken only at well-defined inflections. When no definite inflections are obtained, the pH indicated by non-aqueous basic buffer is considered as the end point for samples with unclear inflection points.

Reagents

Titrant : 0.1mol/L hydrochloric acid solution (in 2-propanol)

Titration solvent :

Toluene	500mL
2-propanol	495mL
DI Water	5mL

} 1L…125mL per measurement

Buffer : Commercial buffer stock solution A
Add 10mL to 100mL titration solvent and mix.

Instruments & Electrodes

Recommended automatic titrator **COM-1700S / COM-1600S / COM-300A**

- **GE-101B** Glass electrode
- **RE-201** Reference electrode

} standard accessories

(Replace the electrolyte with saturated LiCl in ethanol)

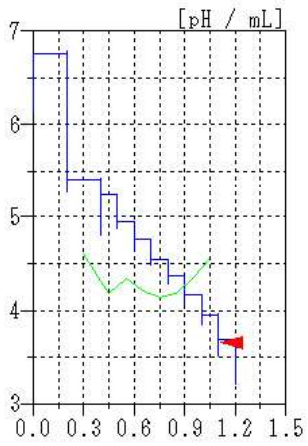
- **TE-403** Thermistor electrode (option, P/N D252415-A)

Condition parameters (example)

Master File 1 **Condition 1** (for BLANK)				**Master File 2** **Condition 2** (for TBN measurement)			
Method	Set			Method	Oil 1		
Buret No.	1	Mode No.	19	Burette No.	1	Mode No.	5
Amp. No.	1	Pre Int	0 sec	Amp No.	1	Del mL 1	0.20 mL
Meas Unit	pH	Del K	0	Meas Unit	pH	Int Time 1	60 sec
S-Timer	120 sec	Del Sens	0 mV	S-Timer	120 sec	Tran Timer	120 sec
CP mL	0 mL	Int Time	60 sec	CP pH	5.00 pH	Del mL 2	0.10 mL
Direction	Down	Int Sens	0 mV	Direction	Down	Int Time 2	120 sec
DP mL	0 mL	Brt Speed	2	DP pH	4.5 pH	Int Time	0 sec
End pH	3.66 pH	Pulse	40	End pH	3.66 pH	Int Sens	0 mV
Over mL	0 mL			Over mL	0.1 mL		
Max volume	1mL			Max Volume	20 mL		
Unit	mL			Unit	mg/g		
Size	0 g			Size	--- g		
Blank	0 mL			Blank	BLANK result value		
Factor	Titre of the titrant			Factor	Titre of the titrant		
Molarity	0.1 mol/L			Molarity	0.1 mol/L		
K	0			K	56.1 (as KOH)		
L	0			L	0		
Formula	D			Formula	(D-B)*K*F*M/S		
					to be set automatically.		

※The meter reading of non-aqueous buffer solution shall be entered as the set pH point.

Measurement result example



Initial pH	6.75 pH
End pH	3.66 pH
mL	1.112 mL
⊿E/⊿mL	1 ⊿E/⊿mL
Sample size	1.00450 mL
	6.2111 mg/g

In this measurement, the end point is defined corresponding to the meter reading of the non-aqueous buffer solution. Generally, the measurement of TBN by the potentiometric titration method tends to proceed very slow due to the delayed response of electrode. To make up for this delay, the method “Oil 1” controls the buret by two different phases; the titrant addition at constant speed by parameters of Del mL 1 and Int Time 1 in the beginning of the titration, and then the titrant addition speed slows down near the end point by parameters of Del mL 2 and Int Time 2.

Information plus

1. Maintenance of electrode performance

While this titration used a glass electrode and a reference electrode for titration, the response of the glass electrode may deteriorate or the electromotive force may deteriorate when titration is repeated for a long period. Thus it can be restored by immersing in water periodically. In addition, the inner KCl solution may precipitate on the liquid junction block of the reference electrode and cause a potential difference fluctuation. It is important to immerse the glass electrode in water periodically to restore the performance.

2. Buret maintenance

Since alcoholic KOH is used as the titrant for total acid value measurement, crystals form within the buret cylinder or the sliding block between the buret cylinder and plunger. It is important that they are rinsed with water regularly. If the buret is not to be used for a long period, remove the titrant and wash well before putting into storage.

3. The effect of temperature change on the titer of the titrant

Organic solvent is used in the titrant of this measurement, and caution is required due to the change in volume with respect to temperature change (approximately 0.11% change at 1ºC). This is larger compared to normal titrants with aqueous solution. It is important that measurement is taken at a temperature that is as constant as possible.

For more information, please feel free to contact:

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