

Application Note

Moisture of engine oil using an evaporator for oils

Industry	Petrochemicals
Instrument	Karl Fischer Moisture Titrator
Measurement method	Volumetric titration / Evaporation method
Standards	JIS K2275-2

1. Scope

Using an evaporator designed for oils for the purpose of moisture content measurement, is ideal not only for oil, but also for grease, tar products, paints and other organic, highly viscous samples. This Application Note introduces an example of how to measure the moisture of engine oil with the use of an oil evaporator.

2. Precautions

Make sure to use an electronic balance accurate enough to measure in 0.1mg increments.

3. Post-measurement procedure

Drain the reagent from the titration cell, then clean it and the twin platinum electrode with methanol. Drain the base oil from the oil evaporator, then clean the vaporization bottle with a solvent such as toluene.

4. Apparatus

Equipment	Karl Fischer moisture titrator for volumetric method
Electrode	Twin platinum electrode

5. Reagents

Solvent	KEMAQUA Solvent MET for General
Titrant	KEMAQUA Titrant TR-3
Others	Base oil, Nitrogen gas

6. Procedure

- Preparation -

- 1) Fill the titration flask with approximately 100 mL of dehydrated solvent.
- 2) Pre-titration is performed to dehydrate the inside of the titration cell.

- Measurement -

- 1) Collect a sample using a syringe and measure the mass.
- 2) Inject the sample into the titration cell of the oil evaporator and measure its moisture content.
- 3) Measure the syringe mass after sample injection.
- 4) The difference in the mass of the syringe before and after injection of the sample is used as the sample collection volume.

7. Calculation

$$\text{Moisture (ppm)} = ((\text{Data} \times \text{TF} - \text{Drift} \times t - \text{Blank}) / (\text{Wt1} - \text{Wt2})) \times 0.1$$

Data	Titration volume (mL)
TF	Factor of titrant (mg/mL)
Drift	Drift level (mg/s)
Blank	Blank level (0mg)
t	Measuring time (s)
Wt1	Sample + syringe (g)
Wt2	Mass of empty syringe (g)

8. Example of measurement

— Titration parameter —

<Titr.Para>

Titration mode	Normal
t(stir)	0s
t(wait)	0s
t(max)	2400s
Max. Volume	10.0mL
Dose mode	None

<Ctrl.Para>

End Time	0s
Final vol.	0.01mL
Tit. speed	3
Detect. mode	1
Drift titr.	On
Start mode	Manual
End level	75mV
Start mode	Auto

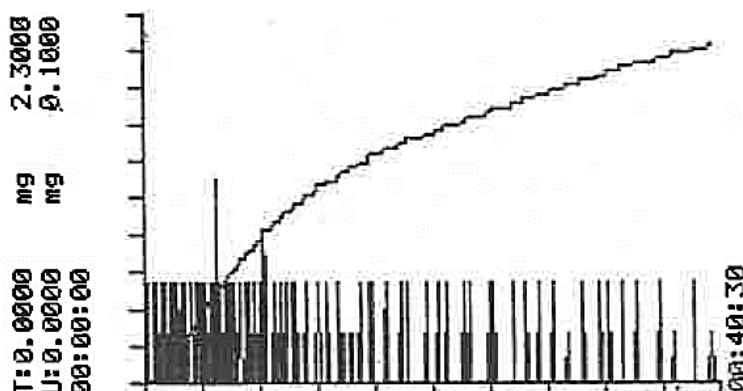
<Evaporator for oil samples Para>

Heating Temp.	105°C
Gas flow rate	200mL/min

Data sampling time	5s
Stirrer speed	4

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

— Example of Titration curve —



— Measurement results —

Table. Results of moisture measurement of engine oil

	Sample (g)	Titration (mL)	Moisture (mg)	Concentration of water content (ppm)
1	1.8123	0.8200	2.2797	1257.9
2	1.8216	0.8700	2.4187	1327.8
3	1.5949	0.7600	2.1129	1324.8
Mean	-	-	-	1303.5
SD	-	-	-	39.5
RSD (%)	-	-	-	3.0

9. References

JIS K2275-2 Crude petroleum and petroleum products - Determination of water - Part 2: Potentiometric Karl Fischer titration method