

Petroleum

## Water Content of Petroleum Products

Volumetric titration (Direct Method) by  
**Karl Fischer Moisture Titrator**

Standard	JIS	K 0113	ASTM	E 203
	JIS	K 0068	ASTM	D1744
	JIS	K 2275-2	ISO	760

### 1. Abstract

Moisture titration using Karl Fischer reagent is popularly practiced water determination worldwide as the most reliable method. The procedure is adopted in many official standards as test method specified in ISO, ASTM, DIN, BS and JIS.

The test conducted this time is an example of volumetric moisture titration for measurement of water content in petroleum products. For the extracting medium, we use solvent CM. Moisture titration by this way can measure the following petroleum products: Crude oil, Heavy oil, Lubricant and Mineral oil.

### 2. Reference

- 1) JIS K 0113-2005: Standard Test Method by Potentiometric, Amperometric, Coulometric and Karl Fischer Titration
- 2) JIS K 0068-2001: Test Method for Water Content in Chemical Products
- 3) JIS K 2275-2-2015 Crude petroleum and petroleum products –Determination of water – Part2: Potentiometric Karl Fischer titration method
- 4) Hydranal manual published by Riedel de Haen
- 5) ISO 760:1978 Determination of Water-Karl Fischer method (General method)
- 6) ASTM E 203-16 Standard Test Method for Water Using Volumetric Karl Fischer Titration
- 7) ASTM D1744-13 Standard Test Method for Determination of Water in Liquid Petroleum Products by Karl Fischer Reagent

### 3. Cautions in measurement

- 1) In order to refrain from the effect of ambient humidity, the test must be conducted in a well air-conditioned room.
- 2) Utmost care must be taken in handling a sample with trace amount of water in it.
- 3) Obtain the factor of Karl Fischer reagent using the solvent in advance.

## 4. Post-measurement care

After the reagent in flask is drained out and the electrode is cleaned, keep the titration flask with solvent in it.

## 5. Test equipment

Main unit : Karl Fischer moisture titration volumetric system

Electrode : Twin platinum electrode for KF titration

## 6. Reagent

Reagent : Hydranal Composit 5 (Riedel de Haen)

Solvent : Extracting medium CM (for oils)(Hayashi Chemicals)

## 7. Measurement procedure

-Pretreatment-

- 1) Prepare approximately 30mL extracting medium in the titration cell.
- 2) Dehydrate the measuring cell by performing pre-titration in advance.

-Measurement-

- 1) Sample 0.1 ~ 2.5g of test oil in a 5mL syringe.
- 2) Weigh the syringe on a balance of which resolution is to the nearest 0.1mg.
- 3) Discharge the sample into titration cell to dissolve in solvent.
- 4) Press Start key of titrator.
- 5) Weigh the syringe of above 3).
- 6) Enter Wt1 with weighed above 2) and Wt2 with 5).
- 7) The endpoint is automatically detected, from which water content can be obtained.

## 8. Formula

$$\text{Moisture (\%)} = ((\text{Data} \times \text{F} - \text{Blank}) / (\text{Wt1} - \text{Wt2})) \times 0.1$$

Data : Titration volume ( mL )

F : Reagent factor ( mg H<sub>2</sub>O / mL )

Blank : Blank level ( mg )

Wt1 : Sample + Syringe weight ( g )

Wt2 : Empty syringe ( g )

## 9.Parameters

### -Titration parameter-

MKV-710M/S,MKA-610	MKA-520	MKS-500
Method No. 1 [Titration] Titr.mode Normal t(stir) 0 s t(wait) 10 s t(max) 0 s t(interval) 0 s Max.volume 10 mL Titr.bur.No. 1 Dose mode Off  [Control] End time 30 s Final vol. 0.01 mL Titr.speed 3 Detect.mode 2 Drift titr. On Start mode Manual End level 75 mV Samp.time 5 s Stir.speed 4	[Titration] Method 1 Titr Mode Normal Titr Buret No. 1 End Time 30 s Final Vol. 0.01 mL Titr.Speed 3 Detector Mode 2 t(stir) 0 s t(wait) 10 s t(max) 0 s Drift Titr On Start Manual Max.Volume 10 mL Dose mode Off Oven Off	[Titration] Method Driect Titr.Speed 3 End Time 30 s Final Vol. 0.01 mL Detector Mode Oil t(stir) 0 s t(max) 0 s Drift Titr. On Max.Volume 10 mL

### -Calculation parameter-

MKV-710M/S,MKA-610	MKA-520	MKS-500
[Calculation] Calc.type Sample Blank No. 1 Calc.No. 2 Unit % Decimal 3 Fraction Round (Half adjust) Drift comp. Off Evaluation Off	[Calculation] Calc. 2 Unit % Weight Variable	[Calculation] g->%

–Measurement results–

Sample name	Sample (g)	Extracting medium	Water content	
			mg	%
Crude oil	1.5023	Solvent CM	5.41	0.36
Heavy oil	1.0805	Solvent CM	27.88	2.58
Lubricant	2.419	Solvent CM	12.92	0.534
Mineral oil	0.0694	Solvent CM	40.43	58.26

## 10.Summary

By refining crude oil, we obtain not only gasoline, light oil, kerosene but other various products including propane, naphtha, jet fuel, heavy oil and asphalt.

The test sample in this application dissolves in solvent CM, which makes moisture titration performed with ease.

Stable measurement of water content is assured by Karl Fischer moisture titration.