

Fat and Oil

Saponification value of Fat and Oil

Acid-base titration (non aqueous) by
Automatic Potentiometric Titrator

Standard

JIS K 0070
ASTM D 5558
ISO 3657

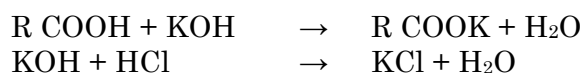
Standard Test Method
for Fat and Oil

1. Abstract

Saponification value is expressed by potassium hydroxide in mg required to saponify one (1) gram of fat. It depends on the kind of fatty acid contained in the fat. Measurement of saponification value is performed according to the below listed official test methods.

Here we test a sample of fatty acid. The sample is first saponified by adding 0.5mol/L potassium hydroxide ethanol, and then the excessive potassium hydroxide is titrated with 0.5mol/L hydrochloric acid until the endpoint is reached.

EP is determined by the maximum inflexion point on titration curve.



2. Reference

- 1) JIS K 0070-1992 Test Method for Acidity, Saponification value, Ester value, Iodine value and Hydroxy value of Chemical products and Unsaponifiables
- 2) ASTM D 5558-95 Standard Test Method for Determination of the Saponification Value of Fats and Oils
- 3) ISO 3657 : 2002 Animal and vegetable fats and oils – Determination of saponification value
- 4) Method (I) 3.3.2-1996 Saponification Value from Standard Test Method for Fat and Oil by Japanese Oil Chemistry Society

3. Cautions in measurement

- 1) When the sample is heated in flask for saponification, gently heat it so that backflow ethanol will not reach the top of cooling pipe fitted to the flask.
- 2) Replace junction liquid of reference electrode with saturated sodium perchlorate acetic acid.

4. Post-measurement care

After the electrode is rinsed with water, keep the tip of electrode dipped in pure water for storage.

5. Test equipment

Main unit: Automatic potentiometric titrator (Standard preamplifier STD-)

Electrode: Standard combination glass electrode

(Change junction liquid to saturated sodium perchlorate acetic acid)

6. Reagent

Reagent : 0.5mol/L Hydrochloric acid (f = 1.006)

Reagent : 0.5mol/L Potassium hydroxide · Ethanol

7. Measurement procedure

—Measurement—

- 1) Deliver 1.5 to 2.0g sample into a 200mL conical flask.
- 2) Add 25.0mL of 0.5mol/L potassium hydroxide Ethanol, and fix a cooling pipe to the flask.
- 3) Gently heat the flask occasionally shaking while adjusting the heat so that backflow ethanol will not reach the top of cooling pipe.
- 4) After heated for 30 minutes, immediately cool it, and titrate with 0.5mol/L HCl before the test liquid is solidified.
- 5) Perform blank test (without sample following step 1 to 4 above) for 3 times to obtain mean value of titration volume of 0.5mol/L hydrochloric acid.

8. Formula

Saponification value (mg / g) = (BL1 - EPl) × TF × Cl × K1 / SIZE

EPl : Titration volume (mL)

BL1 : Blank level (25.029mL)

TF : Reagent (HCl) factor (1.006)

Cl : concentration conversion coefficient (28.05 mg/mL)
(Potassium hydroxide in Eq.: 56.11×0.5)

K1 : Unit conversion coefficient (1)

SIZE : Sample size (g)

9. Example of measurement

— Ambient condition —

Room temperature : 22.5 °C	Humidity : 47 %	Weather : Cloudy
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-Titration parameter-

Model : AT-510 Method No. : 12 Titr.mode : Petroleum Titr. Titr.form : EP Stop	
[Titration parameter]	[Result parameter]
Form : EP Stop APB No. : 1 Unit No. : 1 Detector No. : 1 Unit : mV Max. Volume : 20.0mL Wait Time : 60s Direction : Auto	<Calculation> Calc.Type : Sample Conc.1 : Set CO1= (BL1-EP1)*TF*C1*K1/SIZE Unit : mg/g EP No. : 1 Temp.Comp. : Off
[Control parameter]	<Constant> C1(mg/mL) : 28.05 K1 : 1
End Point No. : 1 End sense : Auto End Point Area : Off Separation : Off Over Titr.Vol. : 0.0mL Gain : 1 Data samp.Pot. : 4.0 mV Data samp.Vol. : 0.05 mL Integral Time : 60s Start Lim.Time : 0s Limit Time : 0s 1st Volume : 0.1 mL 2nd Volume : 0.05 mL Stability : 5 mV/min dE(1st-2nd) : 30mV	<Titr. Constant> Factor : 1.006 Conc. : 0.500
	<Blank> Blank1 : 25.029

-Titration curve-

*** Result *** Sample No. : 22-01 Date : 1999/07/15 09:09 Sample ID :
Method No. : 12 <Petroleum Titr> Method Name :
Titr.time : 00:43:31 Size : <u>1.6347g</u> Conc-1 : <u>327.6mg/g</u> End point-1 Volume : <u>6.0526mL</u> Potential : 390.04mV

(The above printout data were obtained from titration by AT-510 unit)

<p>«Titration parameter» Form: of titration / APB No. the burette used in titration / Unit No.: APB Unit File number Detector No.: the detector used in titration/ Unit of potential / Max Volume: of titration Wait Time: before titration starts/ Direction.: of titration</p> <p>«Control parameter» End Point No.: number of EPs / End sense: of EP detection / End Point Area: EP detection area Separation: of potential / Over Titr.Vol. over-titrated volume / Gain: sensitivity of detection signal Data samp.Pot.: potential change of sampling signal / Data samp.Vol. : titration volume of sampling signal Stability: of EP potential / Delay Time: before stability check / Limit Time: of stability check Integral Time: potential reading time for stability / Start Lim.Time: for stability check at start 1st Volume: first EP / 2nd Volume: second EP/ dE(1st-2nd): Potential change</p> <p>«Calculation parameter» Calc.Type: of formula / Conc.1 formula 1 / Unit: of results EP No. of calculation / Temp.Comp.: temperature compensation / C1(mg/mL): concentration conversion coefficient K1: unit conversion coefficient / TF: factor of titration liquid / Blank1: blank level 1</p>
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–Measurement results–

n	Sample (g)	Titration (mL)	Saponification (mg/g)	Saponification value	
				Mean	SD
1	<u>1.6347</u>	<u>6.0526</u>	<u>327.6</u>	327.6 mg/g	0.4620 mg/g
2	1.6347	6.0222	328.1		
3	1.6363	6.0570	327.2		
				RSD	0.1410 %

*The above test results were obtained by 3 tests of the same sample.

* Red underline shows the data from page 3/4.

10. Summary

Saponification value is expressed by potassium hydroxide in mg required to saponify one (1) gram of fat. By measuring saponification value, mean molecular mass can be obtained. Saponification value is inversely related to mean molecular mass.

The measurement results of fatty sample shows favorable repeatability with less than 0.3% relative standard deviation.

Precise and reliable measurement is assured by the automated potentiometry. Saponification value can be perfectly measured by any of the following titration systems manufactured by Kyoto Electronics (KEM).

【AT-610】



Awarded Product of Supreme Technology from Kyoto City

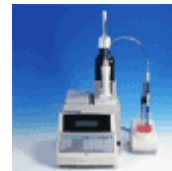
- Easy key entry by touch panel of large color LCD (8-inch wide)
- Simultaneous titration in parallel
- Both potentiometric and Karl Fischer moisture titration (coulometric·volumetric) can be performed at a time.

【AT-510】



- Compact and cost performance model
- PC card expands data memory for convenience and versatility.

【AT-500N-1】



- Low cost and high performance
- Easy view with back light LCD
- GLP/GMP conformed model

KEM KYOTO ELECTRONICS MANUFACTURING CO.,LTD.

Overseas Division: Yamawaki Bldg 9F,4-8-21 Kudan-minami,Chiyoda-ku,
Tokyo 102-0074 JAPAN

Phone: +81-3-3239-7333, Fax: +81-3-3237-0537

Head Office: 56-2 Ninodan-cho,Shinden,Kisshoin,Minami-ku,
Kyoto 601-8317 JAPAN

Phone: +81-75-691-4122, Fax: +81-75-691-9961

URL: <http://www.kyoto-kem.com>