# Standard Methods for the Analysis of Fats, Oils and Related Materials

Japan Oil Chemists' Society

Edition 2003

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# 2.3.1-$_{1996}$ Acid Value

## 1. Definition

The acid value indicates the number of milligrams of potassium hydroxide necessary to neutralize the free fatty acids in 1 g of the sample.

## 2. Scope

Applicable to fats and oils.

## 3. Apparatus

Erlenmeyer flasks- 200-300 mL.

## 4. Reagents

4.1 Neutralized solvent①
4.2 Phenolphthalein indicator solution②
4.3 Alkali blue-6B indicator solution③
4.4. Bromophenol blue indicator solution
4.5 Bromthymol blue indicator solution
4.6 0.1 mol/L Potassium hydroxide standard solution

## 5. Procedure

5.1 Weigh accurately the specified amount of sample④ into an Erlenmeyer flask in accordance with the size of sample for the estimated acid value in Table 1.

5.2 Add 100 mL of the neutralized solvent and shake the flask well until the sample is completely dissolved in the solvent⑤. In the case of solid sample, warm and melt it in the flask with water bath, and add the solvent and dissolve it.

5.3 Titrate the sample with 0.1 mol/L potassium hydroxide standard solution, and determine the end point of neutralization when the sample solution totally has changed the color and the color persisted for 30 s⑥⑦.

Table 1

| Acid value | Amount of sample (g) | Acid value | Amount of sample (g) |
|---|---|---|---|
| Below 1 | 20 | 15-75 | 0.5 |
| 1-4 | 10 | Above 75 | 0.1 |
| 4-15 | 2.5 | | |

5.4 Calculations

$$\text{Acid value} = \frac{5.611 \times A \times F}{B}$$

Where-

A = Volume of 0.1 mol/L potassium hydroxide standard solution (mL)
F= Factor of the 0.1 mol/L potassium hydroxide standard solution
B= Amount of sample (g).

Notes

① Ethyl alcohol can be replaced by isopropyl alcohol.

② Alkali blue-6B indicator or bromthymol blue indicator is preferable for rice bran oil and corn oil that contain ferulic acid esters, and the like. They give even higher acid value than phenolphthalein indicator.

③ Freshly prepared alkali blue indicator solution should be used because the indicator gets deteriorated in a few days.

④ To determine whether the sample contains mineral acids or not, add two times of water in volume to the sample and warm it with stirring in a water bath. Then filtrate the sample with wet filter paper. When the wet filter paper shows orange color at contact with methyl orange indicator, the sample should be rinsed with water. It should be noted that orange color also appears by the same procedure in the case of the sample which contains water soluble fatty acids or naphthenic acids (For details about these analyses, see 2.4.11- 1996).

⑤ For the sample with poor solubility in the solvent, add more diethyl ether to the solvent.

⑥ For dark color samples, use a proper procedure from the following methods.

(a) Use alkali blue-6B or thymolphthalein (JIS K 8006) as an indicator.

(b) Use pH test paper as a non-liquid indicator.

(c) Use a side-armed Erlenmeyer flask and determine endpoint by the color change at the side arm.

(d) Use a standard solution of higher concentration for titration.

(e) Reduce the amount of sample from the indicated amount in Table, and use a large amount of solvent.

(f) Use potentiometric titration method.

⑦ Knowing the free fatty acid content in fats and oils is required sometimes. Acid value is converted by the following formula and Table 2, with the assumption that free fatty acids are oleic acid in most of common fats and oils, lauric acid in coconut oil and palm kernel oil, and palmitic acid in palm oil.

Table 2

| Fatty acid | *f* |
|---|---|
| Lauric acid | 0.356 |
| Palmitic acid | 0.456 |
| Oleic acid | 0.503 |

*f* is a coefficient showing the content of free fatty acid (%) corresponding to the acid value 1.

Free fatty acid (%) = Acid value × *f*