

DETERMINATION OF CARBONYL VALUE OF ESSENTIAL OILS

Principle of method

The carbonyl value of an essential oil is the number of milligrammes of potassium hydroxide that is equivalent to the amount of hydroxylamine required to oximate the carbonyl compounds present in 1 gramme of the oil.

The acid liberated in the reaction between the aldehyde or ketone in the oil and hydroxylamine is titrated with alkali in alcoholic solution.

Reagents

Ethanol, 95% v/v, free from aldehydes and ketones

Hydrochloric acid, 0.5 N

Ethanolic potassium hydroxide, 0.5 N.: 33 g of KOH is dissolved in 1 liter of ethanol, allowed to stand, and decanted or filtered the clear supernatant liquid. Standardized against 0.5 N HCl, using bromophenol blue as indicator and running the alkali into the acid.

Hydroxylammonium chloride solution.: 5 g of hydroxylammonium chloride is dissolved in 95 mL of ethanol, 0.5 mL bromophenol blue indicator solution is added, and the solution is neutralized with 0.5 N ethanolic KOH, so that the solution is green when the liquid is observed as a thin layer and red when the layer is thick. Filter if necessary.

Bromophenol blue indicator solution.: 0.2 g of bromophenol blue is dissolved in 3 mL of 0.1 N ethanolic KOH solution and 10 mL ethanol (warm). Cool and dilute to 100 mL with ethanol.

Determination of carbonyl value for oils of caraway, dill, geranium, peppermint and spearmint

Weight a suitable quantity of the oil* to a conical flask, add 25 mL of hydroxylammonium chloride solution, and mix. Reflux in a water bath at 75-80°C for 5 minutes, cool rapidly, and immediately titrate the liberated acid with 0.5 N ethanolic KOH, taking care not to go beyond the greenish-yellow colour of the indicator; repeat the heating and titrating: Continue this procedure until the reaction complete and no further acid is liberated during the heating period. Besides peppermint oil which necessitates 1 hour, the other oils need 40 minutes heating.

**The following weights are suitable: For carbonyl value below 50, 9-10 g oil; 50 to 100, 5-6 g oil; 100-200, 2.5-3 g oil; 200-300, 1.7-2.0 g oil; 400 to 500, 1.0-1.1 g oil and over 500, 0.8 g oil.*

Carbonyl Value

$$\text{Carbonyl Value } C = (28.05 \times f \times V) / W$$

where, f = a correction factor of 1.0 (depends on the indicator: for dimethyl yellow or methyl orange is 1.008)

V = Volume of 0.5 N ethanolic KOH (mL)

W = the weight of oil (gramme)

Content of Aldehyde or Ketone

The percentage of carbonyl compounds, calculated in terms of a specific aldehyde or ketone may be calculated from the Formula:

$$\text{Percentage by weight of aldehyde or ketone} = (C \times M) / 561$$

Where, C = the determined carbonyl value;

M = the molecular weight of the specific aldehyde or ketone.

Reporting

In recording results, the following format should be used: "*Total aldehydes (or ketones) by the hydroxylammonium chloride method, calculated as citral (or other aldehyde or ketone), % by weight.*".

REFERENCE

N. W. Hanson, Official, Standardised and Recommended Methods of Analysis, 2 nd Ed., The Soc. For Analytical Chemistry, London, 1973, Heffers Printers Ltd. Cambridge, UK