DETERMINATION OF AIR CONTENT IN DRY SHORTENINGS

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Abstract

A method of test is described for the determination of dry shortening air content. Liquid mediums are prepared which have identical specific gravity to that of the shortening which is under test. Simple calculation of specific gravity data gives the air content. A distinct advantage to the method lies in the fact that air content can be determined for any shortening sample size.

FOR control purposes in shortening manufacture air content is generally determined in a cylindrical container which has been calibrated for this purpose. The procedure followed is that of weighing the cylinder filled with melted, de-aired shortening and then obtaining the weight for the cylinder carefully filled with shortening. A simple calculation gives the air content.

Obviously, this method is not suited for determination of air content of shortenings for any time other than at the time of plasticizing. The need was evident for a method of test to determine air content of previously plasticized shortenings. Shortening samples after setting up cannot be accurately refilled into a calibrated cylinder. Furthermore, a successful method of determining air must be such that the determination can be made on any size sample.

In the method of test used in Wilson & Co. laboratories, specific gravities of the aerated shortening and de-aired shortening samples are determined by preparing a liquid medium having a specific gravity which is identical to that of the shortening samples. The liquid medium is immediately tested with a Westphal balance. A simple calculation from these data gives the air content.

METHOD

This test permits air content determination of shortening samples of any size. For convenience, a 2 cm. cube (i.e. 8 ml.) (approximate) has been chosen as the test sample size. Thus, numerous test samples may be obtained from even a small shortening sample.

Extreme care must be exercised to prevent shortening structure rupture when removing test samples from the composite shortening sample. If the shortening is not sufficiently firm to permit cutting out of the 2 cm. cubes, then the shortening is to be chilled to facilitate test sample preparation.

Carefully lower three test samples (20-25° C.) into a 100 ml. tall form, electrolytic type beaker containing 50 ml. previously de-aired 95% alcohol at a temperature of 20° C.

Slowly add previously de-aired distilled water at 20° C. from a burette while mixing the liquids by a gentle rotary motion of the beaker. At some specific gravity of the liquid mixture the test samples will neither rise nor fall; then this solution is identical in specific gravity to the shortening. The liquid medium is immediately transferred to a suitable container in which the specific gravity is determined with a Westphal balance.

Should the test samples float in 95% alcohol, previously de-aired absolute methyl alcohol at 20° C., is substituted for the ethyl alcohol. In the case the test sample floats in methyl alcohol, the air content is recorded as being greater than the value calculated for the specific gravity of methyl alcohol (or over 13% by volume).

Speed in testing is essential, especially for those test samples containing coconut oil. The partial solubility of coconut oil in alcohol affects the determination if the time of testing is excessive.

CALCULATION

$$\% \text{ Air (by volume)} = \frac{(0.912 - \text{Sp. Gr. Alcoholic Solution}) \times 100}{0.912}$$

The value 0.912 represents the average specific gravity for de-aired shortening of all types at 20° C. This value was obtained by two methods: first, specific gravity data were obtained for a number of melted shortening samples and the values calculated back to 20° C; second, specific gravity data were obtained for previously chilled pellets of de-aired shortening samples. In the first method part of the fat is in the solid state in the platicized shortening at 20° C. However from a large number of determinations it has been found that, if the value 0.0007 units per °C is used, a value for the specific gravity of the fat in the shortening at 20° C. will be obtained that will be sufficiently accurate for most practical purposes. In the second method, pellets were prepared from shortening heated to 100° C. to dispel air. The possibility that the heated oil possessed residual air content was investigated. After heating the oil to 100° C. it was placed in a vacuum dessicator for a lengthy period of time; with this oil, pellets were prepared. The specific gravities for oil pellets are given in Table No. 1.

TABLE No. 1
Effect of Residual Air Contents in Oils Upon Specific Gravity.

		Lard	Hydrogenated Shortening
Oil Heated to 100°C Pellet Temperature	10°C	0.914	0.912
	20°C	0.909	0.908
Oil Heated to 100°C and Vacuum Applied Pellet Temperature	10°C	0.919	0.917
	20°C	0.914	0.912

Since the value 0.912 is most representative for de-aired shortenings at 20°C, this has been inserted in the above calculation formula.

SUMMARY

The method of test described is rapid and easily operated. The accuracy of the test is well founded since the data are expressed in absolute units. The fact that air content can be determined on any size shortening sample is a distinct advantage.