# Relationship of Peroxide Value and Thiobarbituric Acid Value to Development of Undesirable Flavor Characteristics in Fats[1]

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## Abstract

The peroxide value and thiobarbituric acid value were compared with the flavor score for a series of different types of fats, with and without added monoglyceride and with and without different stabilizers. The data indicated that the flavor score cannot be estimated for any given fat from either the peroxide value or the thiobarbituric acid value. Either can be used to follow the development of off flavors in a given product or formulation but the relative level may vary from product to product.


## Introduction

THE PEROXIDE VALUE (PV) and the thiobarbituric acid (TBA) value are frequently employed to follow changes in quality of fats or shortenings during storage and at times they are used to indicate the quality of such products after being held under an unknown storage condition. The quality to be evaluated is usually flavor. While flavor and PV or TBA values correlate well in many experiments reported in literature, the inability of a given PV or TBA value to indicate a given degree of off-flavor has made more exact knowledge of this relationship in fats and shortenings desirable. To obtain information on the relationship between PV or TBA values and the flavor of fats, oils and shortenings, a series of tests was undertaken with different types of fats, with and without added monoglyceride and with and without different antioxidants.

## Experiment and Results

The peroxide value was determined by the Official AOCS Method (1) and the TBA value by a modification made in this laboratory of a procedure published by E. W. Turner et al. (2). The organoleptic evaluation was made by a panel of 6 to 8 judges and scored as given below.

| Score | Flavor |
|---|---|
| 1 | None |
| 2 | Questionable |
| 3 | Barely detectable |
| 4 | Slight |
| 5 | Moderate |
| 6 | Strong |
| 7 | Extra strong |

The reliability of PV and TBA values to indicate flavor quality depends on how well a specific value corresponds to a given flavor or flavor score as determined by a trained panel of judges. The ingredients used in preparing samples and the treatment combinations are indicated below.

| Code | Type | Monoglyceride | 0.01% BHA, 0.01% BHT | Antioxidant: 0.01% BHA, 0.01% propyl gallate | Antioxidant: 0.01% BHA, 0.0025% NDGA | 0.01% BHA |
|---|---|---|---|---|---|---|
| L-1 | Lard | None | | | | |
| L-2 | Lard | None | X | | | |
| L-3 | Lard | None | | X | | |
| L-4 | Lard | None | | | X | |
| L-5 | Lard | None | | | | X |
| L-6 | Lard | 5% | | | | |
| L-7 | Lard | 5% | X | | | |
| L-8 | Lard | 5% | | X | | |
| L-9 | Lard | 5% | | | X | |
| L-10 | Lard | 5% | | | | X |

Samples with the same combination of monoglycerides and antioxidants were prepared using hydrogenated vegetable oil (V 1 to 10) and tallow (T 1 to 10).

The samples were analyzed and scored for flavor when prepared and after selected intervals of storage at 140F and storage at 85F. This paper will deal only with the PV, TBA value and flavor scores. The

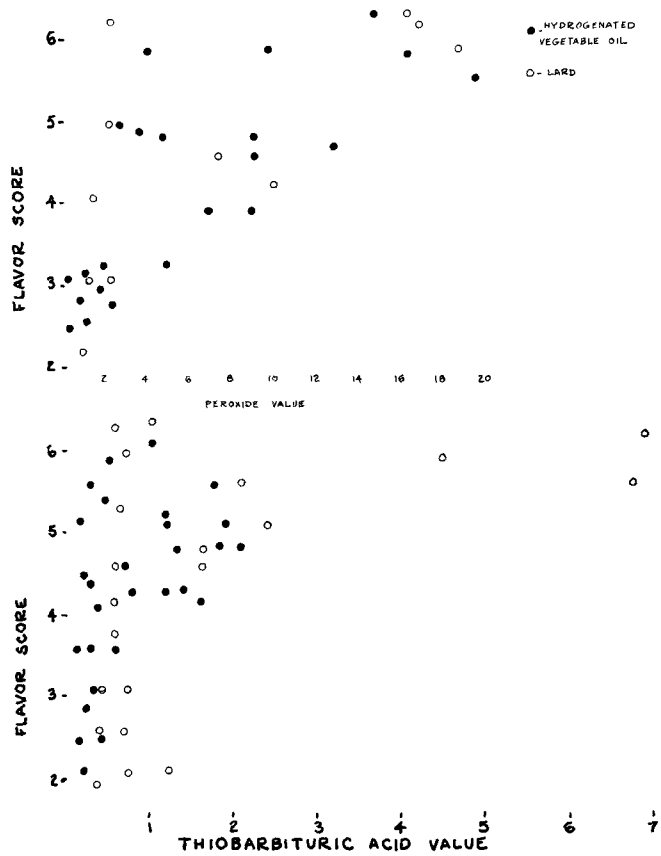


FIG. 1. Relationship between flavor score vs. PV and flavor score vs. TBA without regard to formulation.

[1] Presented at the AOCS Meeting in Minneapolis, 1963.

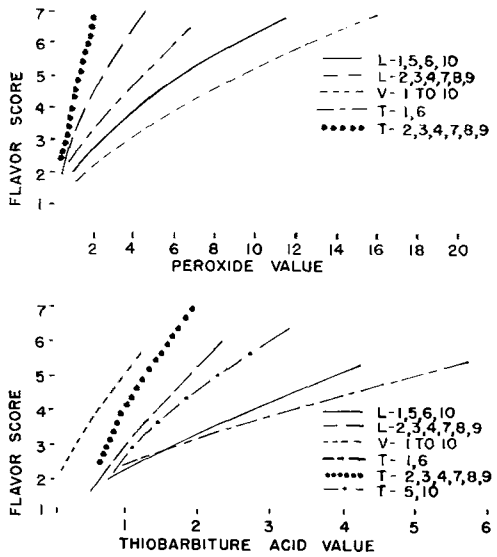


FIG. 2. Approx relationship between flavor score vs. PV and flavor score vs. TBA value after grouping formulations that had similar characteristics.

changes with time will be taken up in another paper.

A typical plot of flavor score vs. PV and TBA value is given in Figure 1. The plot is made without regard to whether the values were obtained from samples of lard and hydrogenated vegetable oil before and after selected intervals of storage at 140 and 85F. The distribution of the points shows clearly that a PV or a TBA value cannot be relied upon to indicate the flavor quality of a fat or shortening of unknown history.

Since the PV and TBA value have been used to follow the development of off flavor, the data was examined to see whether the samples could be placed in groups with respect to the relationship between PV and flavor, and TBA value and flavor. Figure 2 shows the approx relationships drawn by inspection from data for samples that showed similar characteristics.

It is evident that the change in PV or TBA value with change in flavor is different for different types of products and formulations and that a good correlation may be obtained for a series of tests on a given formulation. This limits the value of these tests except possibly for research, as the relationship between PV or TBA value and change in flavor would have to be established for a given formulation from a series of tests before PV or TBA value could be used as an index of flavor characteristics.

## Conclusion

The data indicate that the PV or TBA value of a sample cannot be used as an index of flavor quality unless it is part of a series on which previous data is available.

REFERENCES

1. Official and Tentative Methods of the American Oil Chemists' Society, Cd 8-53.
2. E. W. Turner, W. D. Paynter, E. J. Montie, M. W. Bessert, G. M. Struck and F. C. Olson, Food Technol. *8*, 326 (1954).

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# The Kinetics of Autoxidation of Methyl Linoleate. The Effect of Added Antioxidants and a New Method for the Evaluation of Antioxidants

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## Abstract

A new method is described for the evaluation of antioxidants. Oxygen uptake by autoxidizing methyl linoleate both with and without antioxidants is measured in the Warburg apparatus and reaction orders, reaction rate constants, and length of induction periods determined. Tenox's BHT and BHA and Griffith's G-16 are evaluated and compared.

## Introduction

MOST ANTIOXIDANTS are evaluated by their ability to increase the stability of fats. That no standard limits have been set for defining fat stability is appreciated by noting various definitions which have been used. Lundberg (4) defines induction period as that time during which no off-flavors can be detected. In the oxidation of tocopherol in the ethyl esters of hydrogenated cottonseed oil, Golumbic (3) also determined the end of the induction period organoleptically. Filer et al. (2) in their work on cottonseed oil with added antioxidants measured the induction period as the number of hr aeration necessary to raise the peroxide value of the sample to 120 meq sodium thiosulfate/kg fat. Riemenschneider et al. (5), working on the effect of deodorizing and antioxidants on the stability of lard, stated the end of the induction period to be that amt of time needed for 0.5 cc sample to absorb 300 cc oxygen. Stirton et al. (7), in measuring the effect of antioxidants on the oxygen absorption of methyl esters, used an oxygen absorption of 1 g/kg as the end of the induction period. Smith and Stolz (6), in their studies on the effects of copper and antioxidants on linoleic acid autoxidation, defined the incubation period as the time taken to reach 200 $\mu m^3$ oxygen uptake. Stability in the past, then, has been judged solely on the basis of prolonging the induction period. Stirton, et al. (7) further in their oxygen ab-

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