

considerable complication and gives no clear insight into the mechanism of synergistic action. In their study of the synergistic action of tocopherol and ascorbic acid, Golumbic and Mattill (4) showed that the oxidation of the phenolic inhibitor was retarded at the expense of the other. For such a coupled

inhibitors based on their oxidation potentials is being investigated. The role of inorganic acid inhibitors, e.g. phosphoric acid, in such an arrangement will be discussed in a subsequent report.

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TABLE II

The Antioxygenic Action of Gallic Acid and Related Compounds

Compound	(Phenolic) Antioxy- genic Index (Lard) ¹	(Acid) Antioxy- genic Index (Crude C.S.O. ² Esters)	Synergism with Inhibitor ³ (Lard)	Synergism with Inhibitor ⁴ (Crude C.S.O. Esters)
Gallic acid.....	18 ⁵	7-10	+	+
Ethyl gallate.....	4	6	+	+
Triacetyl gallic acid.....	1	3	+	+
Ethyl triacetyl gallate.....	1	1	—	—
Trimethoxy gallic acid.....	1	1	—	—
Pyrogallol.....	> 60 ⁶	32	—	—
Hydroxy hydroquinone.....	> 60 ⁶	18	—	+
Phloroglucinol.....	2	16	+	+

¹ This is the ratio of the induction period (in hours) of the protected fat to the induction period of the substrate fat alone. Unless otherwise indicated the concentration of the inhibitor was 0.02% of the fat.

² The concentrations of gallic acid, ethyl gallate and pyrogallol were 0.01%, of the others 0.02%, in cottonseed oil esters.

³ The inhibitory concentrations ranged from 0.04% to 0.10%.

⁴ The inhibitory concentration was 0.10%.

⁵ The concentration of gallic acid was 0.06%.

⁶ These indices were previously published and are included here for comparison.

reaction to occur a difference in oxidation potential between the two inhibitors is necessary. Such differences also exist between the synergists reported here. Thus the oxidation potentials of gallic acid and of the trihydric phenols (5) are appreciably higher than the apparent oxidation potential of *α*-tocopherol (6). The possibility of a rational classification of fat

Summary

The differences between animal fats and common vegetable oils as regards their protection by antioxidants are briefly reviewed; in general, the former can be stabilized by di- and poly-phenolic inhibitors and by inhibitols, the latter by acid-type inhibitors such as tartaric, phosphoric and other acids; these acids reinforce the action of the inhibitols which occur naturally in vegetable oils or which may be added to animal fats.

A study has been made of the antioxygenic action of the polyphenols on both kinds of fats. The trihydric phenols, gallic acid and ethyl gallate are effective stabilizers in animal and vegetable fats and enhance the antioxygenic activity of inhibitols; they thus demonstrate the properties of both phenolic and acid inhibitors.

The possible mechanism of this synergistic action is briefly discussed.

REFERENCES

- (1) Olcott, H. S., and Mattill, H. A., *J. Am. Chem. Soc.*, **58**, 2204 (1936).
- (2) Olcott, H. S., and Emerson, O. H., *J. Am. Chem. Soc.*, **59**, 1008 (1937).
- (3) Hilditch, T. P., and Paul, S., *J. Soc. Chem. Ind.*, **58**, 21 (1939).
- (4) Golumbic, C., and Mattill, H. A., *J. Am. Chem. Soc.*, **63**, 1279 (1941).
- (5) Fieser, L. F., *J. Am. Chem. Soc.* **52**, 5204 (1930).
- (6) Golumbic, C., and Mattill, H. A., *J. Biol. Chem.*, **134**, 535 (1940).

Report of the Uniform Methods and Planning Committee—1941-1942

Owing to conditions at the present time only very few of the committees reported their work. This is easily understood because all of us have been particularly burdened with various things required of us in our own organization. In the report which follows we will only cover the committees that have submitted reports.

Oil Characteristics Committee:

During the past few years there has been considerable discussion as to the advisability of adopting so-called standards for oils and fats by the American Oil Chemists' Society. Owing to the expression of opinions of various members of the Society when the report was read the Uniform Methods and Planning Committee recommend that the Governing Committee be requested to pass on the policy of adopting standards for oils and fats. Until the Board has voted their approval further consideration of the report will be withheld.

Color Committee:

The Color Committee reported progress and also suggested that it be continued for another year and

that they study the Spencer Colorimeter during that time. The Uniform Methods and Planning Committee have approved this recommendation.

Cellulose Yield Committee:

This committee made the following recommendations:

"1. That the Cellulose Yield procedure be adopted as an official method to be known as 'The American Oil Chemists' Society Cellulose Yield Method.'

"2. That check samples be sent out several times during the next year."

The Uniform Methods and Planning Committee have approved the above recommendations.

Soap in Refined Oil Committee:

This Committee has been doing some work on a method during the past year, but feel that the results obtained to-date are not definite enough to make any recommendations as to the adoption of a method. The Uniform Methods and Planning Committee approve their report and recommend that the committee be continued for another year.

Refining Committee:

The Refining Committee, as usual, have done a great deal of work and special appreciation is given to the help obtained from the Regional Soybean Laboratory and Dr. Wheeler. Their recommendations are as follows:

- "1. Consideration should be given to standardizing the centrifuge method with regard to stirring, cup dimensions, and centrifuging force and time. The amount of caustic to be used might be given consideration, using a definite excess over theory, instead of a definite number of times theory, as proposed.
- "2. Further coöperative tests should be made on solvent extracted soybean oil, using both the centrifuge method and the tentative A.O.C.S. method on enough samples to evaluate the former method. If the method should prove satisfactory on solvent-extracted oils, it should be tested on expeller and hydraulic oils.
- "3. Continued close coöperation by the Regional Laboratory is essential to the solution of the soybean refining problem. It is hoped that this group will again be in a position to carry the burden of the experimental work in the next year's program."

The Uniform Methods and Planning Committee approve these recommendations for the consideration of next year's committee.

Soybean Analysis Committee:

- "1. Referee Procedure: Heating a 2-gram sample in an A.O.C.S. moisture dish at 105°C. for 6 hours in a vacuum oven of the externally-heated chamber type in which pressure of less than 25 mm. Hg. is maintained."

The Uniform Methods and Planning Committee felt that the adoption of this recommendation would require the purchase of a very expensive oven and feel that under present conditions this would not be desirable.

- "2. Routine Procedure: Heating a 2-gram sample in an A.O.A.C. moisture dish in an air oven at 130°C. for 2 hours."

The Uniform Methods and Planning Committee approve this method as tentative with the recommendation that our committee collaborate with the Association of Official Agricultural Chemists to obtain uniformity in methods.

- "3. Alternate Procedure: Using any temperature, time, and pressure combination that will give the same values as the referee procedure."

The Uniform Methods and Planning Committee felt that this recommendation was too all-inclusive and, therefore, do not recommend its adoption.

Bleaching Methods Committee:

This committee made the following recommendations:

"In view of the now well-established occurrence of the 'heat darkening' effect when our present bleach test is applied to soybean oil, as shown by this Committee's work and the work of others, this Committee recommends the adoption of a method employing a slightly modified procedure, designed to eliminate this 'heat darkening' from the results. This procedure is to be designated for use exclusively on soybean oil, so that the present official method as it now stands will remain unchanged.

"The Committee, therefore, recommends that the section in our methods covering the bleach test be rewritten as follows:

Refined Oils—Bleaching

- (a) Apparatus. Scales, weights, refining cups and stirring machine are to be similar to those specified under Refining, but with T-shaped paddles one-half inch wide instead of one inch wide.
Gas burners or electric heaters to heat the oil in the cups.
Official fullers earth: This is obtained from the Secretary of the American Oil Chemists' Society. A fresh supply must be used each year beginning August 1.

- (b) Determination:
Cottonseed and Other Oils, Except Soybean. Weigh 300 grams of refined oil into a refining cup; heat to 120°C., and add 6 per cent of official fullers earth. Stir mechanically at 250 R.P.M. (plus or minus 10) for five minutes, not allowing temperature to fall below 105°C. Soybean Oil. Weigh 300 grams of refined oil into a refining cup; using mechanical agitation at approximately 250 R.P.M., add 6 per cent of official fullers earth and heat immediately to 120°C., taking not more than five minutes. Then stir mechanically at 250 R.P.M. (plus or minus 10) for five minutes, not allowing temperature to fall below 105°C.

Filter Through Filter Paper. After sufficient oil has passed the filter to insure clearness, collect a sample for color reading. Cool and read color immediately as prescribed under Color.

"The Committee's recommendation is that the procedure constituting the paragraph headed 'Soybean Oils' be adopted as a tentative method of the Society."

This Committee was appointed rather late in the year and are to be commended on the immense amount of work that they did in the short time available. The Uniform Methods and Planning Committee approve the method as written to be adopted as a tentative method and recommend a continuation of the committee.

Method for Determining Residual Lint on Cottonseed

The Uniform Methods and Planning Committee felt that this method should be referred to a committee for study before adopting it tentatively. It represents considerable work on the part of the authors and should be published in OIL AND SOAP, either as written or preferably as part of a paper. In this way it would be available to all who had to make use of it. The fact that it is a method of the Agricultural Marketing Service also makes it available to various laboratories.

All of the above recommendations upon motion by the chairman of the Uniform Methods and Planning Committee were adopted by the Society.

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