Edible Oils and Fats Used by the U. S. Army

CAPTAIN R. H. MAC DONELL
Chicago Quartermaster Depot, Chicago, Illinois

The Army, in general, uses edible oils and fats in its food preparations, and in preparing food very much like home cooking, but on a considerably larger scale.

However, perhaps it is not fully realized the extent to which the Army has gone in establishing Fresh Fruit and Marketing Centers and the amounts of fruit procured. Fruit and vegetable salads in the Army mess are a comparatively recent addition. Those who served in 1917-1918 saw little if any of these. The significance of this is the created demand for salad dressing procured as such, or the oils obtained to make a dressing in the Army kitchen.

Aside from these general uses, there are a few special food items where edible fats, particularly, play an important part. It is the purpose of this paper to convey to you a picture of our problems in the Quartermaster Corps so that all may realize and have a mutual knowledge of these.

The Army is highly interested in the scientific investigations and technical progress in the exceptionally large field of edible fats and oils. The Army's Quartermaster Corps Subsistence Research Laboratory particularly is following the trend of these with a great deal of interest. We have already had occasion to apply results of what has been years of diligent research in this industry.

An early example of our application was in the development of the B unit of the U. S. Army Field Ration C. There are a few points in connection with this ration which explains its purpose and suggests to you the part that food technology advancement has played in its perfection.

The Ration was designed to provide food for troops when they are away from their field kitchens. It has been extensively used during maneuvers and several million rations have been used for this purpose.

The biscuit replaces hardtack used for similar purpose in previous wars.

It is procured, stored, and shipped to applicable areas by the Army Quartermaster Corps. This storage period is highly important because the weather conditions will necessarily vary from the hot and humid climate of Panama to the sub-zero climate of Alaska. It is generally estimated that this temperature range is from 20 below zero to 135° F.

The period of storage may be several months and in many instances over a year. These are obviously some fairly severe conditions to contend with, considering the nature of foodstuffs in this can.

You may be certain that accelerated aging tests under the above-mentioned temperatures, particularly the higher ones, have been made, not only in the Army's Quartermaster Corps Subsistence Research Laboratory but also in industrial and educational laboratories which aided in the development and perfection of the ration.

Of particular interest is the possible utilization of the developments, the comparatively high degree of perfection and the present stability of hydrogenated shortenings compared to a decade ago.

We specify that a hydrogenated shortening must withstand a free-active oxygen test for 100 hours. The laboratory procedure for determining this, and the one we are guided by, is one published in the journal, OIL AND SOAP, of this association; the June, 1933, issue, Volume 10, No. 6, pages 105-109; "An Accelerated Stabilized Test Using the Peroxide Value as an Index," by King, Roschen, and Irwin.

This is in a large part responsible for the keeping qualities of our B Unit biscuit and is really a tribute to research accomplished in the edible fats and oils laboratories in particular and the industry in general.

The Army Quartermaster Corps is about to go into production on another ration. In many ways it is more complex than the Field Ration C. Besides the necessity of withstanding all of the conditions outlined above, it will be carried by the soldier under all manner of situations imaginable. It may be stocked in lifeboats as a food reserve when the occasion arises. The Air Corps has it under consideration for storing in planes as food for personnel should the plane become stranded in inaccessible areas.

The uses are speculative at the present time but the research to cope with these is very real.

I refer to our so-called Special Ration: A Parachute-Mobile Troop's and Doughboy's ration, which is now officially designated as U. S. Army Field Ration K.

It has been necessary to condense as much food in as small a space as possible. It was designated to be highly nutritious, palatable, and with variation of items.

There are three meals in the day's ration, each different. As we now propose to make this—

The breakfast unit contains:
- Biscuit
  - (a) Defense Biscuit
  - (b) Graham
- Malted Milk—Dextrose
- Canned Veal Loaf
- 2 Packages Soluble Coffee
- 3 Cubes Sugar
- 1 Stick Gum.

The dinner unit contains:
- Biscuit
  - (a) Defense Biscuit
  - (b) Graham
- Dextrose
- Canned Luncheon Meat
- Bouillon Tube
- 1 Stick Gum.

The supper unit contains:
- Biscuit
  - (a) Defense Biscuit
  - (b) Graham
- Canned Cervelat Sausage
- "D" Ration
- 1 Package Lemon Powder, Synthetic
- 3 Cubes Sugar
- 1 Stick Gum.

Here is what we might call a Ration with calories per cubic inch. But there will be three still higher requirements:

First, we are planning to use two types of biscuit.

Second, we have a higher percentage of hydrogenated oil in the formula.

Third, we are specifying a 140-hour free active oxygen test shortening.

It is highly essential that these biscuits be fresh and palatable when our soldiers eat them.

The malted milk dextrose tablets contain an appreciable amount of butter fat which contributes to the nutritional value. However, vitamins are a matter for consideration, investigation, and research with us, and this fat, commensurate with conditions of manufacturing, apparently offers a very good vehicle for any oil soluble vitamins we may choose to use, and vitamin A in particular.

The same holds true for our D Ration bar.

The meat units in this ration contain an appreciable amount of fat. Quite often we overlook the studies and researches that have to be made so that such items are processed and canned. These are solid meats especially designed for this purpose, collaborated in by the meat packing industry. Moisture is relatively low, hence our fat and protein is proportionately raised. It requires some ingenuity to hold these fats so that we will not have a liquid spill-out when it is opened, particularly during warm temperatures. At that particular time the soldier will have enough troubles of his own without adding any.

We also have a particularly difficult problem on our hands with reference to the packaging of this Special Ration. It may be that we shall have to use tin or coated black metal, especially for some uses. However, the Army desires to save tin for other defense needs as much as possible, and we are investigating all other possibilities. In fact, fibre board has many advantages. It is a good deal softer for the soldier to fall on and it is lighter in weight. Our soldiers carry enough as it is, so saving in this direction, even though small, is highly desirable.

We want a water-tight and moisture-proof package; one with strength to hold all this food until it is eaten. The impregnation of strong fibre board with a wax or blend of waxes together with a rubber compound is developing into a very good possibility. In addition, we have to be sure that our package is gas-proof, and this feature is under study now.

When in garrison and frequently in the field, the Army cook does a considerable amount of deep fat frying. Obviously the Army wants to use this same fat as many times as possible. It does not necessarily follow that the same items will be fried in this fat either. Furthermore, it is deep fat frying without benefit of filter and intricate thermostatic controls, hence the presence of carbonized particles are prevalent.

Essential factors for a fat to withstand such a use are certainly apparent. It must have a high smoke point, high stability or resistance to breakdown and catalytic action of carbon, and low free fatty acids. In addition, particularly for use at posts near the Equator, we want a product of relatively high melting point and substantial keeping quality. The Army, up to the present time at least, is using a far greater percentage of hydrogenated vegetable fats, with or without small amounts of animal oils blended for this purpose. There is no reason why lard cannot be used, but lard offered under the Federal Specifications will not serve the Army's purpose. I can state, however, that the Quartermaster Corps has tested lards that will meet our requirements and there is a good field for developments in this direction.

TENTATIVE SPECIFICATION FOR UNITED STATES ARMY FIELD RATION C

Unit B—Bread, Coffee, Sugar, Confection, and Extra Key

GENERAL REQUIREMENTS:

The products shall be prepared in accordance with the best commercial practices, under strictly sanitary conditions. All deliveries shall conform, in every respect, to the provisions of the Federal Food, Drug, and Cosmetic Act of June 25, 1938, and the amendments, regulations, and decisions pertaining thereto, all as in effect on the date of the invitation for bids.

The shortening used shall be hydrogenated vegetable shortening with an active free oxygen-keeping test of 100 hours minimum and shall retain satisfactory flavor after heating to a temperature of 400° F.

The sugar shall meet the requirements for Type I, Federal Specification JJJ-S-791, Amendment 4, dated May, 1935.

The invert sugar used shall be best quality commercial invert sugar.

The salt used shall meet the requirements of Federal Specification SS-S-31.

The powdered milk used shall meet the requirements for Type I, Milk; dry, powdered, skimmed, Federal Specification C-M-351a.

The glycerine used shall be U. S. P. Glycerine.

DETAIL REQUIREMENTS:

a. Biscuit. The product shall be prepared according to best commercial practice from ingredients in the following proportions:

Flour, soft wheat	75 pounds
Flour, whole wheat	25 pounds
Shortening	12 pounds
Sucrose	5 pounds
Invert Sugar	5.5 pounds
Milk, dry, powdered, skimmed	8.0 pounds
Malt	3.5 pounds
Salt	1.5 pounds

Soda, tartaric acid and/or other leavening agents, according to best commercial practice.

Glycerine, not to exceed 5.5 per cent in lieu of part of the invert sugar.

The finished product shall contain not more than 8 per cent moisture.

The flour used shall be unbleached soft wheat flour, not lower than a "straight" grade.

The whole wheat flour used shall be entire wheat flour that meets the requirements of Federal Specification N-F-461.

The malt used shall meet the requirements of Federal Specification N-M-96.

The tartaric acid used shall be U. S. P. Tartaric Acid.

The soda used shall meet the requirements of Federal Specification EE-S-571.

The individual biscuits shall be circular in shape, shall weigh approximately 15 grams each and shall be approximately four-tenths (.40) inch thick. The

diameter shall be such that the biscuit will fit snugly into a commercial 300 x 308 sanitary can.

The biscuits shall be uniformly well baked; shall be of uniform size and thickness, with clean-cut edges, and shall be free from excessive dusting flour. They shall be open, evenly grained, reasonably tender and crisp, but reasonably free from "checking" or "cripples" after packaging. Shall have a characteristic appetizing flavor and shall remain free from rancidity for not less than twelve months when packaged as prescribed herein.

b. Soluble Coffee and/or Soluble Coffee Product.

The soluble coffee and/or soluble coffee product shall be the dry, powdered water soluble solids of roasted and ground coffee or the water soluble solids of roasted and ground coffee with added carbohydrates. Shall be prepared in such manner that there will be no material change to the flavor, aroma, or stimulating properties of the resulting cup of the coffee.

(1) Soluble coffee or soluble coffee product shall be readily soluble in water. The moisture content of the finished product shall be such that it will remain free from caking or hardening while in a hermetically sealed package. Twenty-five hundredths (.25) ounce of the soluble coffee, or not to exceed five-tenths (.50) ounce of soluble coffee product, shall produce sixteen ounces of good strong brew with good soft or mild cup quality, including body and flavor, and free from Rio or other objectionable flavor.

(2) The soluble coffee shall be the dry, powdered water soluble solids of roasted and ground coffee.

(3) The soluble coffee product shall be the dry, powdered water soluble solids of roasted and ground coffee and added carbohydrates, which carbohydrates may be employed only for the purpose of sealing the flavor and aroma in the product. The soluble coffee product shall contain not less than twenty-five hundredths (.25) ounce of pure water soluble solids of roasted and ground coffee.

(4) The soluble coffee and/or soluble coffee product shall be packed in a plain round, seamless slip-cover tinned or black plate box approximately two inches in diameter and approximately five-eighths (5/8) inch in height. If the box is made of black plate it shall be coated with either aluminum bronze pigmented enamel or plain lacquer, both inside and outside. The aluminum bronze enamel or lacquer used must be of a type and composition which is permanently applied and which will not impart off odors or flavors to either the contained coffee or coffee product, or to the biscuits. The box shall be necked in. The inside surface of the cover shall be seated flush on the top edge of the body. Both cover and box shall be expanded.

This box shall be sealed with a tape which shall have pressure sensitive adhesive sealing quality. The tape used shall not impart off odors or flavors to either the coffee or the biscuits. The tape shall be applied to the outside of the coffee container and shall afford a seal which will remain tight for twelve months. The material of which the tape is made shall afford moisture-proofness, through its entire thickness. It shall be capable of withstanding a twenty-four hour exposure to a relative humidity of 90 per cent at 80° F. after which it shall withstand submergence in water for four hours without loosening from the can. This tape shall be sufficiently pliable to conform to irregular contours through its ability to stretch and remain sealed in stretched position as well as be capable of withstanding expansion and contraction of coffee containers due to change in temperature.

c. Sugar Tablets. The tablets of sugar shall meet the requirements for Type I, Class 3—2a(3), Federal Specification JJJ-S-791, Amendment 4, dated May, 1935.

The tablets of sugar shall be individually wrapped in standard commercial wrappings and shall have a count of not less than eighty nor more than ninety-six to the pound, when wrapped. The tablets shall be approximately 3/8 inch thick, 5/8 inch wide, and 1¼ inches long.

d. Confection. The confection shall be squares of a hard candy type manufactured by any recognized procedure. The candy shall be made of 60 per cent sucrose and 40 per cent corn syrup with coloring and flavoring materials added with the exception of butterscotch, which shall contain by weight 1½ per cent of butter.

The flavors shall be an equal assortment of Butterscotch, Lime, Orange, and Lemon flavors jumbled before packing.

The candy shall be not less than 64 nor more than 80 count per pound, and shall be packed not less than one (1) ounce per can. The individually wrapped pieces shall permit packing in a space three (3) inches in diameter and 5/8 inches in height.

The pieces of candy shall be individually wrapped in a regenerated cellulose film approximately .001 inch thick, which film shall not adhere to the candy, and in all other respects provide protection equivalent to the film designated "300 M.T.-33 cellophane" by the E. I. du Pont de Nemours & Co.

When so wrapped the candy shall remain solid and free from stickiness and adherence to the wrapper, when subjected to a temperature of 120° F., and shall remain in good condition for one year.

The colors used shall be U. S. Certified Food Colors.

Flavoring agents other than butter shall be natural or artificial in accordance with good commercial practice.

Butter used shall be not less than 90 score butter, U. S. Department of Agriculture grade.

Citric acid used shall be U. S. P. grade.

Corn Syrup used shall be commercial confectioners' type of syrup of 43° Baume.

The finished product shall not contain by weight more than one per cent of citric acid, nor shall it have a moisture content in excess of one per cent.

e. Extra key. In addition to the key securely attached to the can, there shall be included in the can a steel-wire can key made of No. 12 gauge wire having not less than a ¼-inch slot when tinned and an over-all length of approximately 1⅜ inches. The overall size of the loop shall be approximately 7/16 x 15/16 inches. The distance from the lower side of the loop to the center of the slot shall not be less than ¾ inches. The key shall be dipped in hot tin or treated in such a manner that there will be no untinned surfaces or ends.

Each can shall contain five (5) of the biscuits, one (1) container of the soluble coffee, three (3) of the sugar tablets, not less than one ounce of individually wrapped confection, and one (1) extra key.

Each can shall have lithographed on the body of the can, the name and description of the product, the name and location of the contractor, the date of packing, and net weight, as follows:

U. S. ARMY FIELD RATION C
B-UNIT
2.50 oz. biscuit
1.00 oz. confection
.50 oz. sugar
.25 oz. soluble coffee or
(.50 oz. soluble coffee product).
Blank & Co., Chicago, Ill.
Packed (Month and Year).

The date of packing may be embossed in the cap of the can in lieu of being lithographed on the body of the can.

Each can shall have a key securely attached thereto by solder or spotwelding and each can shall be scored with a key-opening band so scored as to insure that the can may be opened readily with a key.

Packaging shall be in accordance with instructions issued with invitations for bids.

PACKING AND PACKAGING.

The biscuits, individually wrapped confection, soluble coffee, sugar, and extra tinned key shall be packed in key-opening cans, size 300 x 308.

TENTATIVE SPECIFICATION FOR UNITED STATES ARMY FIELD RATION K

Biscuit Component

A. APPLICABLE SPECIFICATIONS.

Federal Specifications applicable to this specification are indicated herein.

B. TYPES AND GRADES.

B-1. Biscuit Component shall be of two types, as follows:

Type I. Defense Biscuit
Type II. Compressed Graham Biscuit.

B-2. Biscuit Component shall be of the grades specified herein.

C. MATERIAL AND WORKMANSHIP.

C-1. All material or ingredients shall have been prepared, manufactured, or produced in a strictly sanitary manner.

C-2. Workmanship shall conform to standards established by and commensurate with Army requirements in accordance with best commercial practice.

D. GENERAL REQUIREMENTS.

D-1. The products shall be prepared in accordance with the best commercial practices, under strictly sanitary conditions. All deliveries shall conform in every respect to the provisions of the Federal Food, Drug and Cosmetic Act of June 25, 1938, and the amendments, regulations, and subsequent decisions pertaining thereto, all as in effect on the date of invitation to bid.

D-2. The whole wheat flour used shall be the entire wheat flour that meets the requirement of Federal Specification NF-461.

D-3. Milk, dry, skimmed, shall conform to Type I, Federal Specification C-M-351b.

D-4. Shortening shall be hydrogenated vegetable shortening with an active free-oxygen-keeping test of 140 hours minimum and shall retain satisfactory flavor after heating to a temperature of 400° F.

D-5. Molasses shall conform to Federal Specification JJJ-M-576.

D-6. Sugar shall conform to Federal Specification JJJ-S-791, as amended May, 1935, for Sugar, Beet or Cane, Type I.

D-7. Salt shall conform to Federal Specification SS-S-31 as amended January, 1941, for Salt, Table.

E. DETAIL REQUIREMENTS.

E-1. Type I, Defense Biscuit, shall be prepared according to best commercial practice from ingredients in the following proportions:

Whole Wheat Flour	73 pounds
Wheat Flour	103 pounds
Soybean Flour	100 pounds
Fine Cut Oat Meal	70 pounds
Gelatin	32 pounds
Whole Eggs	112 pounds
Dried Skim Milk	70 pounds
Sugar	24 pounds
Molasses	12 pounds
Shortening	114 pounds
Ammonium Bicarbonate	3 pounds
Salt	3¾ pounds
Cinnamon	9 ounces

Moisture content of finished product shall not exceed 6.5%.

E-1 (a). The flour used shall be unbleached wheat flour not lower than a straight grade.

E-1 (b). Soybean flour shall be processed from a select grade of properly dehulled soybeans. It shall be properly cooked and debittered and shall have a neutral, bland flavor. It shall contain no more than one per cent fat, no more than six per cent ash, and no less than 50 per cent protein. It shall be of sufficient fineness so that 97 per cent will pass through a U. S. Bureau of Standard screen No. 100. It shall be prepared in a sanitary manner, according to best commercial practice.

E-1 (c). Fine cut oat meal shall be made from hulled oats and shall contain not more than 12 per cent of moisture, not more than 1.8 per cent of crude fiber, not less than 2.24 per cent of nitrogen, and not more than 2.2 per cent of ash. Shall be of a good and uniform granular texture, cut from oat groats made from No. 1 white oats, shall be clean, sound, properly hulled, and of the latest crop. Shall be processed without added flavoring. Ninety-five per cent of the granular meal shall pass through a U. S. Standard No. 8 screen and not more than 10 per cent shall pass through a U. S. Standard No. 40 screen. Shall be free from rancid, musty, bitter or other undesirable flavors and shall be of a uniformly bright color.

E-1 (d). Gelatin shall conform to Federal Specifications C-G-191a as amended May 10, 1940, for Gelatin, Plain (Type I).

E-1 (e). Eggs shall be whole eggs conforming to Federal Specification C-E-271 and shall be of the grades "United States Standards (retail grade)" or "United States Extras (retail grade)". Frozen eggs may be used, and they shall be prepared from eggs meeting this specification.

E-1 (f). Ammonium Bicarbonate shall be U. S. P.

E-1 (g). Cinnamon ground shall conform to Type II. Federal Specification EE-S-631a.

E-1 (h). Product shall be uniformly well baked, of reasonably uniform size and thickness, with reasonably clean-cut edges, shall be free from excessive dusting flour and shall have a characteristic appetizing flavor. Biscuits shall be rectangular in shape with dimensions approximately and not exceeding $3\frac{3}{16}$" long, $1\frac{3}{16}$" wide, and $\frac{3}{8}$" thick.

E-1 (i). Four each of the biscuits shall be assembled face to back and tightly wrapped as a unit in amber or bleached greaseproof, waxed glassine. In lieu of waxed glassine, 300 M. S. A. T. cellophane or its equivalent may be used. Wrapper or label shall contain name of product, net weight and the name and address of manufacturer. Net weight of this assembly shall be not less than two ounces.

E-2. Type II, Compressed Graham Biscuit, shall be prepared according to best commercial practice from ingredients in the following proportions:

Whole Wheat Flour	200 pounds
Shortening	33 pounds
Invert Sugar	10 pounds
Molasses	20 pounds
Sugar	45 pounds
Honey	5 pounds
Dried Skim Milk	70 pounds
Soda	2 pounds
Salt	2 pounds
Calcium Carbonate	1 pound

Moisture content of finished product shall not exceed 6.5%.

E-2 (a). Invert sugar shall be best commercial quality.

E-2 (b). Honey shall conform to Federal Specification C-H-571.

E-2 (c). Soda shall conform to Federal Specification EE-S-571.

E-2 (d). Calcium carbonate shall be U. S. P.

E-2 (e). Product shall be uniformly well baked, of reasonably uniform size and thickness, with reasonably clean-cut edges, shall be free from excessive dusting flour and shall have a characteristic appetizing flavor. Biscuits shall be rectangular in shape with dimensions approximately and not exceeding $3\frac{3}{16}$" long, $1\frac{3}{16}$" wide, and $\frac{1}{4}$" thick.

E-2 (f). Four each of the biscuits shall be assembled face to back and tightly wrapped as a unit in amber or bleached greaseproof, waxed glassine. In lieu of waxed glassine, 300 M. S. A. T. cellophane or its equivalent may be used. Wrapper or label shall contain name of product, net weight and the name and address of manufacturer. Net weight of this assembly shall be not less than 1.7 ounce.

F. Methods of Sampling, Inspection, and Tests.

F-1. Unless otherwise specified in the invitation to bid, inspection for compliance with this specification shall be made at point of origin during the process of manufacture and packing. Products inspected at origin shall be inspected for condition only at the point of delivery.

F-2. Chemical analyses, if required by the purchaser in the examination or testing of samples and deliveries under this specification, shall be made in accordance with methods of the Association of Official Agricultural Chemists in effect on date of invitation to bid and by approved methods in general use in the trade.

G. Packaging, Packing, and Marking.

G-1. Packaging and packing shall be in conformity with instructions issued with invitations to bid.

Abstracts

Oils and Fats

Edited by
M. M. PISKUR and SARAH HICKS

Symposium on the molecular structure of fats and oils. Introduction to the symposium. C. G. King. *Chem. Rev. 29*, 199-200 (1941). Composition and structural characteristics of glycerides in relation to classification and environment. H. E. Longenecker. *Ibid.* 201-24. Structural peculiarities of acid-fast bacterial lipid. R. J. Anderson. *Ibid.* 225-43. The structure of the phospholipids. E. B. Working and A. C. Andrews. *Ibid.* 245-56. Constituents of fats and oils affecting the development of rancidity. H. S. Olcott and H. A. Mattill. *Ibid.* 257-68. Synthetic fatty acid glycerides of known constitution. B. F. Daubert and C. G. King. *Ibid.* 269-85. Preparation and properties of optically active derivatives of glycerol. H. O. L. Fischer and E. Baer. *Ibid.* 287-316. The separation of natural components of fats and oils by molecular distillation. N. D. Embree. *Ibid.* 317-32. Low-temperature crystallization of the fatty acids and glycerides. J. B. Brown. *Ibid.* 333-54. The polymorphic forms or phases of triglyceride fats. R. H. Ferguson and E. S. Lutton. *Ibid.* 355-84. Surface films of fatty acids, alcohols and esters. W. D. Harkins. *Ibid.* 385-417. Ultraviolet absorption spectra of fatty acids and their application to chemical problems. G. O. Burr and E. S. Miller. *Ibid.* 419-38.

Synthetic food fats. A. E. Williams. *Food Manuf. 16*, 161-3 (1941). Synthetic fats are produced from the hydrogenation of water gas (equal vols. CO and H_2) at 300° with metallic Pt and CrO_3 as catalysts, resulting in 10% CH_4 and 90% higher paraffin hydrocarbons. The latter are oxidized to solid fat acids at 140-160° for 6-8 hrs. in presence of oxides of Fe, Mn or V. Esterification is carried out under vacuum at 200-220° by use of glycerol with a sulfonic acid as catalyst. The synthetic product is not identical with the natural products, but is satisfactory as nutriment. Synthetic lard compares favorably in cost with the wartime price of true lard. Glycerol is hard to obtain in wartime, so in Germany it is synthesized by (1) hydrogenation of water gas, chlorination resulting in trichloropropane which, when treated with caustic alkali, produces glycerol, or (2) fermentation of glucose with yeast and Na_2SO_3, then addn. of lime and $CaCl_2$ and activated C, filtration, distn, of alc., leaving weak glycerol in the still, which is then concd. and refined. Sometimes substitutes for glycerol are used, such as glycol or mannitol. Certain molds and yeasts synthesize fats. *(Chem. Abs.)*

A measure of total unsaturation in the presence of conjugated doublebonds. J. D. Von Mikusch and Charles Frazier. *Ind. Eng. Chem. Anal. Ed. 13*, 782-9 (1941). The I reagents now in use react incompletely with substances containing conjugated double bonds. The methods recommended for detn. of the total unsatn. of conjugated oils and fatty acids are complicated and have not found general use in industrial analysis. Hanus soln. when used in large excess, measures the total unsatn. of dehydrated castor oil,