The unsimerized methyl esters isolated from a sample of freshly cut alfalfa also showed a large amount of absorption at 3160 Å. The large absorption was therefore not due to the production of partially oxidized or polymerized linolenic acid during the process of dehydration.

Discussion
The contribution of alfalfa lipids to the total dietary fat intake is small as standard animal and poultry feeds usually do not contain more than 10% dehydrated alfalfa leaf meal. However, their contribution may become significant when animals and poultry are pastured on alfalfa, as is usually practiced with hogs and turkeys. Furthermore, Richardson and Abbott (27) found that when dairy cows were fed exclusively on alfalfa a crumbly butter resulted, which seemed similar to the results obtained when dairy cows were restricted to feeds containing too much oil meal.

A large amount of absorption of the unsimerized methyl esters seemed to be due to an unidentified faintly yellow compound. This was not extracted with the nonsaponifiable material. Furthermore it could not be removed from the methyl esters by high vacuum distillation. It is possible that this or a similar compound is partly responsible for the difficulties encountered in the spectrophotometric analysis of natural oils such as linseed oil.

Summary
Freshly dehydrated alfalfa leaf meal was repeatedly extracted with acetone, ethyl alcohol, and Skellysolve B in a percolator at room temperature; 6.5% of crude extract was obtained. This extract was composed of 3.7% phospholipids, 33.2% triglycerides, 17.2% crude wax, 8.3% unsaponifiable, and 37.6% water soluble material.

Spectrophotometric analysis of the mixed methyl esters from the triglyceride fraction indicated the presence of 32.2% linolenic, 16.9% linoleic, 31.0% oleic, and 19.9% saturated acids. The mixed methyl esters from the phospholipid fraction contained 35.2% linolenic, 14.7% linoleic, 36.8% oleic, and 13.3% saturated acids.

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Processing of Cottonseed. IV. Effect of Preparation and Cooking of Meats on the Bleach Color and Storage Properties of Screw-Pressed Oils


Introduction
As the result of a series of mill-scale tests previously reported (1, 2), it was found that hydraulic-pressed oils had lower initial bleach colors than did those of screw-pressed oils produced from the same seed. The lower bleach color of the hydraulic-pressed oils was attributed to the presence of water added to the meats during cooking prior to pressing. It was postulated that the presence of moisture during cooking of the meats caused deep-seated changes in the pigments contained in the water-sensitive pigment gland walls. It was therefore predicted that non-reverting 4 screw-pressed oils of low bleach color could be produced by wet-cooking of the meats prior to expression of the oil.

Conditions during preparation and cooking of the meats prior to expression of the oil which might affect the bleach color of the oils are as follows:
1. Particle size of meats: a) whole, b) ground, c) rolled.
2. Moisture in the meats: a) originally, b) added before and during cooking.
3. Preheating conditions: a) temperature, b) duration of cooking, c) extent of agitation during cooking, d) venting during cooking.

“Non-reverting” oils are oils which do not develop high bleach color during storage at moderate temperatures.
Conditions during expression of the oils from cooked meats which may affect the bleach color of screw-pressed oils are as follows:

1. Moisture in the cooked meats.
2. Temperature of a) cooked meats, b) shafts, c) cages, d) expressed crude oils.
3. Pressure resulting from changes in a) rate of feed, b) setting of the slots in the cages.

During the investigation it has been possible to vary a number of the aforementioned processing conditions and determine effect of these variations on the bleach color and rate of reversion of screw-pressed cottonseed oils.

Experimental

Methods of Analysis. The samples of meals and oils which were collected at the mills were analyzed, and the oils were refined and bleached by American Oil Chemists’ Society official methods. Samples of meals prepared on a laboratory scale were refined and bleached by use of a small scale modification (3) of the American Oil Chemists’ Society official methods.

Absorption spectra of chloroform solutions of the crude and refined oils were measured with a Beckman quartz spectrophotometer. The concentrations of gossypol in the oils and cooked meats were determined by application of the alkaline extraction and the antimony triehloride-spectrophotometric method to chloroform solutions of the oils and to aqueous ethanol extracts of the meals (4).

Laboratory Experiments

A preliminary series of cooking and pressing experiments was carried out on a laboratory scale to determine the optimum amount of water which should be added to the meats before cooking. For this purpose three batches of flakes, 0.007 to 0.008 inches thick, were prepared from a single lot of prime cottonseed. The flakes were stored in closed cans at 38°F. for periods not exceeding 10 days between preparation and processing of each lot of flakes. Determination of the content of moisture and pigments of the flakes indicated that the three batches were essentially uniform.

Experiments were carried out with one-kg. samples of the flakes which were cooked in aluminum pans 13.5 x 8.25 x 2.5 inches covered with aluminum lids. Wetting of the meats was accomplished by spraying water over successive thin layers of the flakes, followed by manual stirring of the moistened flakes. The covered pans containing the flaked meats were placed in a forced draught, electrically heated and thermostatically controlled oven. During the first half-hour of cooking the pan was usually kept covered to simulate conditions in the first stack of a commercial cooker. The lids were then removed to permit moisture to escape. The flakes were thoroughly stirred at 15-minute intervals during cooking.

Oil was expressed from the cooked meats in a preheated (200°F.) Elmes press fitted with a Carver No. 4 head assembly (2.5 in. diam.) and slotted cage. Strips of 0.009 inch thick metal were inserted in the relatively wide slots (0.025 in.) of the cage to prevent extrusion of the meal. Pressure was applied by manual operation of the hydrostatic pump. The pressure was built up in successive stages; each pressure was maintained until oil was no longer forced out; after this the pressure was increased. The maximum pressure obtainable with the press was approximately 2,350 lb./sq. in. on the cake, but in the case of some of the wet-cooked meals, the maximum pressure could not be applied because of extrusion of the meal.

Results. These experiments indicated that oils having the darkest bleach color were obtained from meats cooked without addition of water at high temperatures whereas addition of relatively large amounts of water, followed by cooking at 235-244°F. for 1.5 hours, produced oils having the lightest bleach color. It was also noted that, in the case of meats cooked without any added water or with 5% or less of added water, relatively high pressures were necessary to express the oil. However, most of the oil was expressed at very low pressures from meats which had been cooked after addition of 10-15% of water which is the basis of the foregoing operation employed in the Skipin process (5, 6).

Another series of experiments was made to determine the optimum amount of water which should be added to meats before cooking at 235-244°F. for 1.5 hours. The results which are summarized in Table I show that, under the cooking conditions used,

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<td>Effect of Addition of Water Prior to Cooking Meats 1.5 Hours at 235-244°F.</td>
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<tr>
<td>Water added</td>
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1. All results except those for sample without added water are the average from two experiments.
2. Original moisture content, 9.4%.
3. Original gossypol content, 2.35%.
4. Absorption calculated as 352 times the percentage of gossypol in the oil, where 352 is E₁% at 364-366 m/L of pure gossypol.
5. Cell length 5½ inches.

addition of 10, 15, and 20% of water to the meats prior to cooking reduces the bleach color of the expressed oils; the greatest reduction occurred with the addition of 10% water.

The amount of unchanged gossypol in the cooked meats was found to decrease proportionally to the increase in the amount of water added prior to cooking. However, the amount of gossypol in the crude oils appeared to be relatively constant, and as previously reported (1, 2, 3) there does not appear to be any correlation between the bleach colors of the expressed oils and their contents of gossypol. Based on the position of the absorption maxima and the poor correlation of the specific extinction coefficients of the crude oils at their absorption maxima compared with the values calculated for pure gossypol at its absorption maximum, it can also be concluded, as previously pointed out (1, 2), that the pigments of the crude oils which are responsible for the color in the bleached oils are modified forms of gossypol rather than the original pigment.

Samples of the cooked meats were examined with a microscope under low power to determine changes in the color and condition of the glands and the extraglandular tissue. The cooked meats were also