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# UNITED STATES PATENT OFFICE

NORMAN A. HANSEN AND DONALEE L. TABERN, OF LAKE BLUFF, ILLINOIS, ASSIGNORS TO ABBOTT LABORATORIES, OF NORTH CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS

## LIQUID HALOGENATED ESTERS OF FATTY ACIDS

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It is well known that certain halogenated vegetable and animal oils may be prepared by adding the halogen, for example, bromine or iodine, to glycerides of an unsaturated fatty acid, which compose many animal and vegetable oils and fats. So-called "drying" oils, preferably "semi-drying" oils, are ordinarily employed for this purpose. These halogenated oils are opaque to X-rays, making possible their use in spaces or cavities of the body to permit the sizes and contours of those spaces or cavities to be visualized.

Many of these halogenated oils, however, are of high viscosity, which is detrimental for certain therapeutic purposes; furthermore, many of them have the halogen atoms too loosely bound, so that they decompose too rapidly and produce irritating and deleterious products.

It has now been found that these drawbacks may be avoided by first preparing the alkyl esters of the fatty acids which may be obtained by the saponification of naturally occurring fats or oils, and then halogenating these alkyl esters. The liquids so obtained have the important advantages of stability, freedom from irritating properties, low toxicity and low viscosity. Additional halogen may be introduced by making unsaturated esters, such as allyl esters, of the fatty acids; when halogen is added to these, it combines with the double bonds of the unsaturated alcohol radical, such as the allyl group, as well as with the unsaturated fatty acid radicals themselves.

It has been found to be preferable to use bromine or iodine as the halogens, as they are more opaque to X-rays, and these derivatives are readily produced.

Varying amounts of a halogen, up to saturation, may be introduced into the alkyl or alkylene esters of the unsaturated fatty acids. The amount of halogen controls certain properties of the final halogenated esters, such as density, viscosity, opacity to X-rays, etc.

The methods of preparation may be widely varied. The reactions with halogen may be carried on either with or without a solvent, and with or without a catalyst; the halogen may be added directly, or it may be liberated from compounds of the halogens, introduced into the reaction mixture, such as hydrobromic acid with hypobromous acid, or hydrobromic acid with some other oxidizing agent; or a hydrogen halide, such as hydrogen bromide or hydrogen iodide, may be added to the unsaturated oil.

The following will illustrate methods by which the halogenated esters may be prepared:

*Example 1*

One hundred grams of the ethyl esters of the mixed fatty acids obtained from lard oil is added to fifteen grams of monohydrated sodium carbonate. Keeping the temperature at about 20° C., fifty grams of bromine is dropped in, with stirring. Filter, using a filtering agent if desired. The brominized oil so obtained has a yellowish to amber color, and is neutral in reaction.

*Example 2*

The ethyl esters obtained from cottonseed oil may be halogenated in a manner similar to the above, using 60 to 65 grams of bromine.

*Example 3*

One hundred grams of the ethyl esters of the mixed fatty acids obtained from lard oil is warmed with a solution of 60 grams mercuric chloride in 200 cc. alcohol. To the warm solution is added, with stirring, 70 to 75 grams of iodine.

The iodized oil is taken up in chloroform, washed with water, and the chloroform layer separated. After washing with potassium iodide solution, and drying, the chloroform is removed by distillation. The iodized oil is then treated with a decolorizing carbon or kieselguhr, and filtered. The product so obtained is yellow to amber colored, neutral in reaction, of low viscisity, and stable.

*Example 4*

The ethyl esters of the fatty acids obtained from cottonseed oil may be iodized as in Example 3, except that in this case somewhat more iodine (about 80 grams) may be

employed, if it is desired to obtain a compound with a higher iodine content.

Some physical constants of the halogenated esters described above, together with other halogenated esters which have been prepared by analogous methods, are given herewith:

| Mixed acids from— | Ester | Halogen content | Density |
|---|---|---|---|
| Lard oil | Ethyl | 30% bromine | 1.15 |
| Lard oil | Ethyl | 13% bromine | 1.0 |
| Lard oil | Allyl | 40% bromine | 1.27 |
| Lard oil | Ethyl | 32% iodine | 1.07 |
| Cottonseed oil | Ethyl | 38% bromine | 1.25 |
| Lard oil | N-butyl | 30% bromine | 1.1 |
| Cottonseed oil | Ethyl | 35.5% iodine | 1.12 |
| Castor oil | Ethyl | 30% bromine | 1.22 |
| Soy bean oil | Methyl | 40% bromine | 1.25 |
| Olive oil | Ethyl | 40% bromine | 1.16 |

The following figures represent the viscosities of certain of these products:

| Oil from which esters are prepared | Viscosity of brominized esters (water=1) |
|---|---|
| Lard | Ethyl ester, 4.7 (30% Br.) |
| Lard | Allyl ester, 8.6 (40% Br.) |
| Olive | Ethyl ester, 8.2 (32% Br.) |
| Olive | Butyl ester, 6.8 (28% Br.) |
| Cottonseed | Ethyl ester, 7.5 (38% Br.) |
| Poppy | Ethyl ester, 23.6 (43% Br.) |
| Rapeseed | Ethyl ester, 12.5 (37% Br.) |
| Sesame | Ethyl ester, 12.1 (40% Br.) |

The scope of the invention should be determined by reference to the appended claims, said claims being construed as broadly as possible consistent with the state of the art.

The word oil as found in the claims is used in its generic sense as including also fats.

We claim as our invention:

1. A new liquid medicinal substantially opaque to X-rays, comprising halogenated ethyl esters of the mixed fatty acids derived from cottonseed oil.

2. A new liquid medicinal substantially opaque to X-rays, comprising halogenated ethyl esters of the mixed fatty acids derived from cottonseed oil.

3. A new liquid medicinal comprising a halogenated alkyl ester of an unsaturated fatty acid having a viscosity sufficiently low to enable said medicinal to readily enter the smaller cavities of the human body.

4. A new liquid medicinal substantially opaque to X-rays comprising a halogenated alkyl ester of an unsaturated fatty acid of an oil obtained from the class comprising vegetable and animal oils and fats, said medicinal having a viscosity sufficiently low to enable it readily to enter the smaller cavities of the human body.

Aug. 10th, 1928.

NORMAN A. HANSEN.
DONALEE L. TABERN.

# CERTIFICATE OF CORRECTION.

Patent No. 1,840,034. Granted January 5, 1932, to

NORMAN A. HANSEN ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, line 40, claim 1, for "cottonseed" read lard; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 23rd day of February, A. D. 1932.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.