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CHEMICAL PROCESSES AND PRODUCTS
THEREOF

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The present invention is directed to a novel process for catalytic dehydrogenating and hydrogenating. The invention relates to a novel process of hardening soaps and more particularly it relates to the treatment of anhydrous soaps of unsaturated acids at elevated temperatures with selenium and/or related materials.

To a major extent, the previous attempts to prepare hardened fatty acid derivatives from relatively soft, unsaturated fatty acids or their compounds have been directed to two general methods of treating fatty oils or fatty acids. In one of these methods, elaidinization, the maximum hardness obtainable is limited by the melting point of the equilibrium mixture of the stereoisomers. In addition, the acids and oils may be subject to discoloration and decomposition at the elevated temperatures for the extended periods usually employed for optimum treatment unless certain precautions are observed in their handling. Also, volatile odoriferous by-products sometimes remain in the oil or acid. Hydrolysis of the fats, volatilization of the fatty acids, and corrosion of the apparatus by the fatty acids are other undesirable problems generally encountered in this treatment. Hydrogenation, the second procedure, is also employed to harden the fatty acids or oils but special expensive equipment and hazardous procedures are involved. Furthermore, in soap making, it is very important to produce a hard, firm soap which may be framed and cut. Although there are numerous inexpensive oils of low titer available in large quantities, the acids of which could be utilized for soap making if they could be converted directly into a hard soap by a simple inexpensive process, the two aforementioned methods for treating the oils and acids have not been described in the prior art as being directly applicable to the hardening of the soaps thereof. One common method of obtaining hard soaps using oils yielding low titer fatty acids is to mix oils having high titer fatty acids with the oils yielding low titer fatty acids but there are definite economic limits on the proportions which may be so employed. Therefore, any method of directly converting soft soaps of these low titer acids into hard soaps would be exceedingly valuable and desirable and preferable to any pretreatment process of elaidinization or hydrogenation of the oils or fatty acids prior to soap making.

It has now been discovered that relatively soft unsaturated fatty acid soaps may be hardened economically in a relatively short time by treatment with a small amount of an inorganic non-metallic elemental catalyst of the group VI, preferably selenium, in an inert atmosphere and at an elevated temperature above the melting point of the anhydrous soap and at which reaction takes place, preferably in the substantial absence of liquid water and while blowing with a stream of inert gas such as steam, nitrogen, carbon monoxide and/or carbon dioxide.

The preferred treatment is carried out above the melting point of the anhydrous soap, which is generally between 200° and 350° C. and preferably is above 275° C. or 300° C. In this temperature range, the substantially anhydrous soap is in a freely fluid form, such that steam which may be passed through it thoroughly agitates it, insuring uniformity of temperature throughout the mass and preventing any portions of the mass from being overheated and subjected to decomposition. The strong current of steam which may be used serves not only to agitate the liquid mass, but also to assist in the vaporization of unsaponifiable materials which are distilled off, and to blanket the mass and exclude air to prevent oxidation at the high temperatures used. After removal of the catalyst by suitable means, such as oxidation, the product so obtained is chemically altered, is free from objectionable odor and is substantially free from unsaponifiable material; it forms a harder soap when grained; and the acids which may be liberated have a higher melting point and desirable physical characteristics and appearance. The acids usually may be fractionated into hardened fatty acid fractions and modified acid products usually having at least one aromatic nucleus.

By the convenient process of this invention, it is possible economically to convert large quantities of soft soaps into firm, hard soaps with only a small amount of catalyst and no additional expensive, dangerous or contaminating reactants. It is the applicants' view that in the reaction a portion of the material is converted into a compound (apparently having an alicyclic group) which presumably can be dehydrogenated by the action of the selenium, and that concomitantly another portion of the unsaturated fatty acid soap is hydrogenated through the catalytic action

of the selenium. Thus the selenium or other chosen catalyst plays the role of transferring hydrogen from one type of compound to another and is continuously regenerated in so doing. This explains the production of saturated fatty acid soaps from corresponding unsaturated fatty acid soaps. Also, under the conditions of the reaction, elaidinization can take place tending to produce equilibrium mixtures of the soaps of the stereomeric residual unsaturated fatty acids.

Although the present invention is particularly suitable for the catalytic dehydrogenating of a modified or cyclized unsaturated fatty acid soap accompanied by the hydrogenation of another portion of unsaturated fatty acid soap which acts as an acceptor or hydrogen, it is also within the scope of this invention to dehydrogenate catalytically in the presence of a molten soap or other organic materials which are alicyclic or generate alicyclic structures with selenium or the like in the presence of a proportion of a hydrogen acceptor which has more affinity for hydrogen than dehydrogenated alicyclic material or the selenium catalyst. The selenium or the like is catalytic in its effect, since it not only operates in traces or small amounts, e. g. 1 to 5%, but it also remains in the mixture after the entire treatment and may be recovered as such.

Fatty acid material and alkali may be used and the soap formed in situ, or the fatty material may be used in saponified form. One way to carry out the treatment is to maintain a body of some of the soap material at the relatively high temperature of 200° to 350° C., at which it is thinly fluid, and to add the rest of the material at a rate not substantially greater than the rate at which it may be heated to the temperature necessary for fluidity, and to operate the process with continuous or successive additions of crude material and withdrawals of treated material. For example, fatty oil and alkali or fatty acid soap, with water, may be raised to an elevated temperature under pressure and then be flashed into the chamber containing the anhydrous soap under treatment. It is important that no excess caustic alkali be present. For this reason it is usually desirable to employ sodium carbonate and/or other carbonates alone or mixed with other alkali in order that any excess alkali may not be present as caustic alkali.

If lower reaction temperatures, in the neighborhood of 250° to 275° C., are used for the treatment, a longer time of treatment is generally required substantially to complete the reaction and to permit the substantially complete separation of the unsaponifiable organic constituents. The time required for these results will vary with the nature of the unsaturated fatty acid soap, the temperature of the treatment, the pressure maintained within the vessel, and the amount of steam used. Both the minimum temperature and time of reaction will vary with the particular fatty material treated, and the amount and type of catalyst employed. In general, the rapidity of reaction and separation of unsaponifiable material is greater at higher temperatures, at higher vacua, and with injection of greater quantities of steam. For example, the hardening of the products and other improvements are more rapid and greater at higher temperatures, e. g. 300° to 325° C., than at lower temperatures, e. g. 225° to 250° C. In general, temperatures of 275° to 325° C. are preferred. In some cases, however, temperatures in excess of

350° C. may be required with the less reactive unsaturated acids.

Various alkaline materials may be used for the saponification, including caustic alkalies (caustic soda or potash), lime, carbonated alkalies (soda ash or potassium carbonate), limestone, marble dust, magnesium carbonate, dolomite, etc., or mixtures thereof. Soda ash is preferred because it is inexpensive, effective, does not destroy the catalyst, and produces a directly usable sodium soap. It may be necessary to change the temperatures used if alkaline materials other than caustic soda and/or soda ash are used, because of the differences in the melting points of the soaps formed with metals other than sodium. In any event, the temperature must be sufficiently high to insure the necessary fluidity. The hot anhydrous soap may be cooled on rolls to form a flake or may be sprayed with or without water in a suitable tower in the substantial absence of free oxygen to yield a grain or bead. The hot anhydrous soap may be added to water or soap solution in order to obtain a neat soap.

The fatty acids may be lightened in color by distillation before and/or after the treatment. When a crude, dark, undistilled product is treated, it may be desirable, after the high temperature catalytic treatment of the anhydrous soap, to remove or destroy the catalyst, to split the soap and distill the acids to improve their color. If a light colored raw material is used, such distillation after treatment is not generally necessary, and the anhydrous soaps produced may simply be hydrated and used as such or in admixture with other soaps, or otherwise treated.

Before the treatment, it is advantageous to treat the fatty acid soaps with a substantially immiscible hot aqueous caustic alkaline salt solution so as to separate the glycerine, mercaptans, phenolic and lignin-like substances from the soaps of the acids. It is also desirable to blow the hot soap mixture with steam or other inert gas to volatilize the unsaponifiable, lower boiling, odoriferous materials, before or after but preferably during the alkaline brine extraction.

After settling, the soaps may then be separated from the brine by any suitable method, thinned with water again, and washed with a fresh caustic alkaline brine of sodium sulphate, sodium chloride, sodium carbonate, and/or the like. After the treatment of the soap with the alkaline brine and with steam, the soap and the acids thereof are light colored and improved in odor, and substantially free from phenol and lignin materials. This previous removal of complex phenols and lignin material from the fatty acid soaps prevents the finished soap from being discolored by decomposition products of these materials which might be formed during the subsequent catalytic high temperature treatment.

Example I

300 grams of U. S. P. oleic acid (I. V. 90) were reacted with 40.3 grams of caustic soda and 4.3 grams of sodium carbonate in a vapor-separating chamber while blowing with steam at about 300° C. When the saponification was complete, 3 grams of selenium were added and the steam treatment continued for about one hour at 350° C. About 28 grams of organic water-insoluble distillate were obtained. The soap was cooled, hydrated and dissolved by pouring into water. The solution was acidified with dilute sulphuric

acid. The organic acids were recovered by petroleum ether extraction. The organic acids were fractionally distilled in a Claisen flask at 3 mm. pressure to obtain the following three major fractions:

		Boiling point at 3 mm.	Per cent	Iodine value
1	Lower boiling material.....	° C. 155-174	3	26
2	Monomer.....	175-198	83	35
3	Complex.....	Above 199	13	40

The second or monomeric fraction was fractionally crystallized from acetone. Repeated fractionation gave:

	Per cent	Iodine value
Liquid fraction.....	47	58
Intermediate fraction.....	20	45
Solid fraction.....	33	7

The solid fractions of saturated fatty acids were fractionally distilled at 3 mm. to yield the following fractions:

	Boiling point	Per cent	M. P.	I. V.	Neutralization equivalent
	° C.		° C.		
1	171-172	10	58-60	7	266
2	172-175	15	67-69	6	278
3	175-175.5	75	68.5-71	5	282

The major proportion of the material, namely, fraction 3, was identified as stearic acid. No stearic acid could be isolated by equivalent fractionation of the starting material; further investigation showed that no palmitic acid was formed during the reaction.

Example II

100 grams of U. S. P. oleic acid were steam treated with 20 grams of soda ash at about 300° C. in an inert atmosphere for about thirty minutes. After the acid appeared completely saponified, 1 gram of black amorphous selenium was added to the reaction mixture and the heating was continued for about forty minutes. The temperature was maintained at 255° to 300° C. after the addition of selenium.

Titer of oleic acid, not treated.....	°C. 6.3
Titer of the treated acid.....	22.2

Example III

The steam treatment of Example II was carried out using 100 grams of U. S. P. oleic acid, 13.5 grams NaOH (95% of theoretical requirement) and 1.5 grams of soda ash (7.5% of theoretical requirement). Approximately five minutes after all of the alkali-oleic acid charge had been fed, 1 gram of selenium was added. The temperature was maintained at 250° to 322° C. for approximately forty-five minutes after the addition of the selenium. Excess caustic soda is undesirable since it tends to reduce the activity of the catalyst. The following comparative titers were observed.

Titer of oleic acid, not treated.....	°C. 5.2
Titer of acid, treated.....	38.0

Example IV

100 grams of U. S. P. oleic acid were steam treated with 19.5 grams of soda ash. Ten minutes after all of the oleic acid-soda ash charge had been fed, 1 gram of sulphur was added. The temperature was maintained at 280° to 329° C. for seventy-five minutes after the sulphur had been added.

Titer of oleic acid, untreated.....	°C. 5.2
Titer of the treated acid.....	16.0

Examples V-VIII

About 300 gram portions of U. S. P. oleic acid were saponified while steam treating at varying temperatures with 95% of the theoretical of sodium hydroxide and 7.5% of the theoretical of sodium carbonate according to the procedure for heat treating given in Example I. The properties of the acids from each of the treatments as compared to the original material is as follows:

	Temperature	Per cent Se	Per cent recovered	Per cent organic distillate	Titer	Acid value	Iodine value
	°C.				°C.		
V	Untreated				8.6	19.7	90.8
VI	350	1	96	5	12.8	20.3	75.6
VII	285	1	87	8	26.2	20.2	76.6
VIII	300	1	87	10	32.9	20.3	70.5
	325	1	89	9	47.5	20.3	44.1
	350	1	83	11	45.3	20.5	40.3

Example IX

200 grams of lignin liquor distilled (tall oil) were steam treated with 36 grams of soda ash. Approximately 10 minutes after all of the tall oil-soda ash charge had been fed, 1 gram of selenium was added. The temperature was maintained at 290° to 353° C. for approximately 1 hour after the selenium had been added.

Titer of lignin liquor, untreated.....	°C. 5.8
Titer of treated acids.....	19.8

Example X

200 grams of menhaden oil were steam treated with 40 grams of sodium carbonate. Approximately 30 minutes after the oil and soda ash charge had been completely fed, 1 gram of selenium was added. The temperature was maintained at 337° to 343° C. for 1 hour after the selenium had been added.

Titer of menhaden fatty acids.....	°C. 30.6
Titer of treated acids.....	33.0

Example XI

200 grams of soya bean oil were steam treated with 39.5 grams of soda ash. Thirty minutes after all of the oil-sodium carbonate charge had been fed and the volatile unsaponifiable organic materials had been removed, 2 grams of selenium were added. The temperature was maintained at 338° to 352° C. for 1 hour after the selenium had been added.

Titer of soya bean oil fatty acids.....	°C. 21.6
Titer of treated acids.....	45.7

Example XII

200 grams of distilled tall oil were steam treated with 36 grams of soda ash. Approximately 10 minutes after the tall oil-sodium carbonate

charge had been fed, 2 grams of selenium were added. The temperature was maintained at 320° to 327° C. for 75 minutes after the selenium had been added.

Titer of tall oil acids-----	5.8
Titer of treated acids-----	23.5

Example XIII

100 grams of U. S. P. oleic acid (titer 5.2° C.) were steam treated with 18.5 grams of sodium carbonate. Ten minutes after all of the oleic acid-soda ash charge had been fed, ½ gram of selenium was added. The temperature was maintained at 317° to 329° C. for 75 minutes after the selenium had been added. The titer of the treated acid was 37.7° C.

Example XIV

50 grams of pure oleic acid (free from linoleic acid), having a titer of 12° C., an iodine value (Wijs) of 87.2, were steam treated with 10 grams of soda ash at about 300° C. in an inert atmosphere. After the acid was completely saponified, 1% of selenium was added to the reaction mixture and the heating continued for about 40 minutes. The soap was cooled out of contact with the air, and was split to obtain crude acids having a titer of 29° C., and an iodine value (Wijs) of 75.5. Upon purification the acids were found to have a titer of 32.2° C. and an iodine value (Wijs) of 78.1. These values indicate that the high temperature selenium-treatment of the salt of the pure oleic acid causes conversion of a substantial proportion thereof into the salt of the stereoisomeric elaidic acid. The yield of purified and hardened acid was about 95%.

Example XV

100 grams of fractionally distilled undecenoic acid, having a boiling point of about 126° C. at about 1.5 mm. pressure, an acid value of about 29.9 and an iodine value of about 134, were steam treated with 22 grams of sodium hydroxide and 2.2 grams of sodium carbonate at about 300° C. in an inert atmosphere. Approximately ten minutes after all the fatty acid-alkali mixture had been added and the mixture completely reacted, about 1 gram of selenium was added and the heating continued for about 1 hour. The acids were split from the soap and purified by distillation. The iodine value of the acid product was found to be about 50.

It should be noted that during the reaction between the fatty acid material and the alkaline material at the elevated temperature there is a small amount of unsaponified fatty acid material distilled over. This is recovered and may be re-treated.

The above examples are directed to unsaturated fatty acid soaps but the invention is not so limited as evidenced by the following example.

Example XVI

65 grams of pure oleic acid (free from linoleic acid) having a titer of about 12° C. and an iodine value (Wijs) of about 88, and 10 grams of cyclohexenyl acetic acid (cyclohexylidene acetic acid) [Ann. 353, 287 (1907); Jour. Chem. Soc. 107, 1099 (1915)] were neutralized, while steam blowing, with 20 grams of sodium carbonate at 315° C. About ten minutes after all the acid and alkali material had been added and the saponification completed, 1 gram of selenium was added. The steam treatment was continued for two hours at

325° C. During this treatment the mixture changed from black to red in color. The soap product was cooled out of contact with the air and dissolved in water. The soaps were split to the corresponding acids with dilute sulphuric acid. The aqueous solution was freed of organic acids by extraction with ethyl ether. The organic acid solution in ether was washed with water and dried over calcium chloride. The solvent was distilled off to obtain about 70 grams of solid acids. The acids were fractionally distilled to obtain phenyl acetic acid having a boiling point of 125° to 130° C. at 5 mm., and a melting point of about 69° to 72° C., and a hardened fatty acid fraction having a titer of about 49° C. and an iodine value of about 58. The results indicate that the transfer of the hydrogen from the cyclohexenylidene acetic acid to oleic acid is substantially quantitative.

In all the foregoing cases the materials catalytically dehydrogenated and/or hydrogenated have been in the preferred form of a non-volatile salt. However, it is also possible to employ a soap flux and to use other materials for dehydrogenating such as saturated and partially unsaturated cyclo-aliphatic materials, including the hydrocarbons, alcohols, acids, esters and corresponding halogenated derivatives thereof, as well as materials capable of forming these agents under the reaction conditions in the molten soap. It is also possible to employ other acyclic unsaturated organic materials as hydrogen acceptors, such as the acyclic olefinic and polyolefinic materials, including the hydrocarbons, alcohols, acids, esters and corresponding halogenated derivatives thereof, as well as materials capable of forming these agents under the reaction conditions. Any combination or mixture of the soap and/or non-soap donors or acceptors may be employed as long as a molten soap is present, preferably as a donor and/or acceptor. It will usually be necessary in treating compositions containing non-soap volatilizable reactants to operate under increased pressure in order to hold the donor and/or the acceptor in the reaction zone. The products of the reaction or the corresponding acids of the soaps, as indicated hereinbefore, may be separated, for example by fractional distillation, crystallization and/or solvent extraction.

Removal of residual catalyst from the soap or the like can be achieved by addition of alkali and/or an oxidizing agent to the molten soap, or by continued steam, vacuum distillation. Alternatively, the soap may be hydrated and filtered, treated with oxidizing or reducing agents and/or treated with a caustic alkaline brine solution.

Among the catalysts which may be employed are selenium, sulphur or tellurium and their derivatives or mixtures thereof. Selenium or mixtures thereof, however, are the most effective catalysts.

An advantageous way to conduct the catalytic treatment is to flash the soap with or without non-soap reactants and with added catalysts into the top of a packed tower to produce a molten substantially anhydrous soap at a temperature between about 250° and 400° C. The molten soap then passes down through the tower. Superheated steam is introduced into the bottom of the treating chamber and rises countercurrently to the descending molten anhydrous soap. Alternatively, the soap solution with a catalyst added thereto is flowed under pressure through a heat-

ing coil or bank of tubes wherein it is raised to effective temperatures. The soap solution may then be flashed into a lower pressure chamber preferably held at the optimum temperature. If desired, the hot anhydrous soap can further be treated by flowing it through a packed tower as described above.

Although any unsaturated aliphatic carboxylic acid material or alicyclic organic material may be employed, among the specific materials which may be treated by the present process, alone or in admixture, are wool fat, certain grades of garbage grease, whale oil, shark, menhaden and other fish oils, spermaceti, tallow, coconut oil, olive oil, tall oil, cottonseed oil, cottonseed foots, castor oil, linseed oil, stand oil, China-wood oil, oiticica oil, soya bean oil, palm oil, montan wax, carnauba wax, Japan wax, Chinese wax, petroleum naphthenic acids, oxidized petroleum, as well as the various individual unsaturated acids with or without the saturated acids thereof such as oleic acid, linoleic acid, linolenic acid, undecenoic acid, eleostearic acid, ricinoleic acid, palmitoleyl acid, hydronaphthoic acid, cyclohexenoic acid, cyclohexanoic acid, abietic acid and other naphthenic acids, their polymerized derivatives, their halogenated derivatives, and the accompanying caproic acid, lauric acid, stearic acid, palmitic acid, myristic acid, behenic acid, or mixtures of any of these fats, oils, waxes, resins and acids.

The fatty alcohol, sterols, glycerol and other unsaponified materials may be recovered by full or fractional condensation of the vapors from the treatment.

As many widely different embodiments of the invention may be made without departing from the spirit and scope thereof, it is to be understood that the application is not limited to the specific proportions or embodiments thereof except as defined in the following claims.

We claim:

1. The process which comprises simultaneously catalytically dehydrogenating an alicyclic compound and hydrogenating an unsaturated aliphatic compound by treating a molten mixture of an alicyclic compound and an unsaturated aliphatic compound with a small amount of an element of the group consisting of selenium, sulphur and tellurium in the presence of a substantial quantity of molten anhydrous soap, at an elevated temperature between about 200° and 400° C. and under non-oxidizing conditions.

2. The process which comprises simultaneously catalytically dehydrogenating an alicyclic compound and hydrogenating an unsaturated aliphatic compound by treating a molten mixture of an alicyclic compound and an unsaturated aliphatic compound, at least one of which is a salt, with an element of the group consisting of selenium, sulphur and tellurium under non-oxidizing conditions and at a temperature between about 250° and 400° C.

3. The process which comprises catalytically dehydrogenating an alicyclic compound and hydrogenating an unsaturated fatty acid soap by treating a molten mixture of an alicyclic compound and unsaturated fatty acid soap with an element of the group consisting of selenium, sulphur and tellurium at an elevated temperature between about 200° and 400° C. and under non-oxidizing conditions.

4. The process which comprises catalytically dehydrogenating-hydrogenating an unsaturated

fatty acid soap by treating a molten polymerizable soap of unsaturated fatty acids containing mono- and polyunsaturated fatty acids with an element of the group consisting of selenium, sulphur and tellurium at an elevated temperature between about 200° and 400° C. and under non-oxidizing conditions to form a dehydrogenated cyclicized polymer of the unsaturated fatty acid soap and a hydrogenated fatty acid soap.

5. The process which comprises treating, under non-oxidizing conditions, a molten anhydrous unsaturated fatty acid soap with an element of the group consisting of selenium, sulphur and tellurium at a temperature between about 200° and 400° C.

6. The process which comprises treating, under non-oxidizing conditions, a molten unsaturated fatty acid soap with an element of the group consisting of selenium, sulphur and tellurium at a temperature above 250° C. but not higher than 350° C.

7. The process which comprises treating, under non-oxidizing conditions, a molten unsaturated fatty acid soap with an element of the group consisting of selenium, sulphur and tellurium while passing a current of inert gas therethrough at a temperature above 250° C. but not higher than 350° C.

8. The process which comprises treating, under non-oxidizing condition, a molten soap of a polyolefinic acid with an element of the group consisting of selenium, sulphur and tellurium at a temperature between about 200° and 400° C.

9. The process which comprises treating, under non-oxidizing conditions, a molten soap of a polyolefinic acid with an element of the group consisting of selenium, sulphur and tellurium while passing a current of inert gas therethrough at a temperature above 250° C. but not higher than 350° C.

10. The process which comprises treating, under non-oxidizing conditions, a molten mixture of soaps of unsaturated acids at least one of which is polymerizable with an element of the group consisting of selenium, sulphur and tellurium at a temperature above 250° C. but not higher than 350° C.

11. The process which comprises treating, under non-oxidizing conditions, a molten mixture of soaps of mono-olefinic and polyolefinic acids with an element of the group consisting of selenium, sulphur and tellurium while passing a current of steam therethrough at a temperature above 250° C. but not higher than 350° C.

12. The process which comprises treating, under non-oxidizing conditions, a molten mixture of soaps of oleic and linoleic acids with an element of the group consisting of selenium, sulphur and tellurium while passing a current of steam therethrough at a temperature above 250° C. but not higher than 350° C.

13. The process which comprises treating at a temperature above 250° C. but not higher than 350° C. and under non-oxidizing conditions, a molten anhydrous unsaturated fatty acid soap with selenium.

14. The process which comprises treating, at a temperature above 250° C. but not higher than 350° C. and under non-oxidizing conditions, a molten unsaturated fatty acid soap with selenium while passing a current of inert gas therethrough.

15. The process which comprises treating, at a temperature above 250° C. but not higher than 350° C. and under non-oxidizing conditions, a

molten mixture of soaps of oleic and linoleic acids with selenium.

16. A process of raising the titer of unsaturated aliphatic compounds which comprises treating an unsaturated aliphatic organic compound with an element from the group consisting of selenium, sulphur and tellurium under non-oxidizing conditions at a temperature of about 200° to 400° C. in the presence of a substantial quantity of molten anhydrous soap, and recovering the treated aliphatic organic compound from the reaction mixture.

17. The process of producing hydrogenated fatty acids from organic compounds having unsaturated fatty acid radicals which comprises saponifying the compound, treating the saponified material in the absence of excess caustic alkali with an element from the group consisting of selenium, sulphur and tellurium under non-oxidizing conditions at a temperature of about 200° to 400° C., splitting the treated material, and recovering hydrogenated fatty acids.

18. A soap product containing soap of a

cyclicized polymer of fatty acids derived from the group consisting of plant and animal oils and fats containing unsaturated fatty acid radicals, said soap product prepared by saponifying material from said group and treating the resultant soap in the absence of excess caustic alkali under non-oxidizing conditions at a temperature of about 200° to 400° C. with a small amount of material selected from the group consisting of selenium, sulphur and tellurium for a period of time sufficient substantially to free the soap from objectionable odor and unsaponifiable material and to raise substantially the titre thereof.

19. A soap of a cyclicized polymer of unsaturated fatty acid prepared by the process of claim 4.

20. A soap of an alicyclic polymer of polyolefinic acid prepared by the process of claim 8.

21. A soap of an alicyclic polymer of fatty acid prepared by the process of claim 15.

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CERTIFICATE OF CORRECTION.

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ROBERT BANGS COLGATE, ET AL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 16, for "or hydrogen" read --of hydrogen--; page 4, first column, line 40, for "distiled" read --distilled--; page 5, first column, line 32, for "alcohol" read --alcohols--; 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 2nd day of January, A. D. 1945.

Leslie Frazer

Acting Commissioner of Patents.

(Seal)