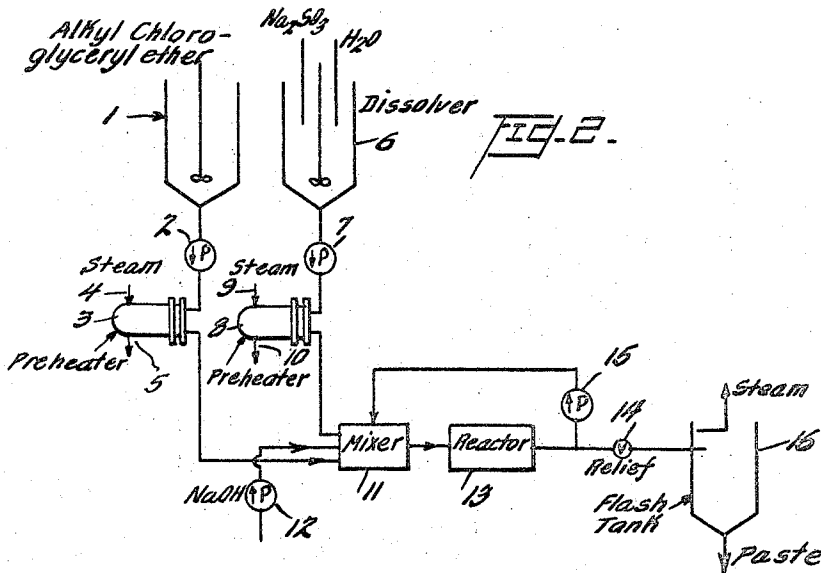
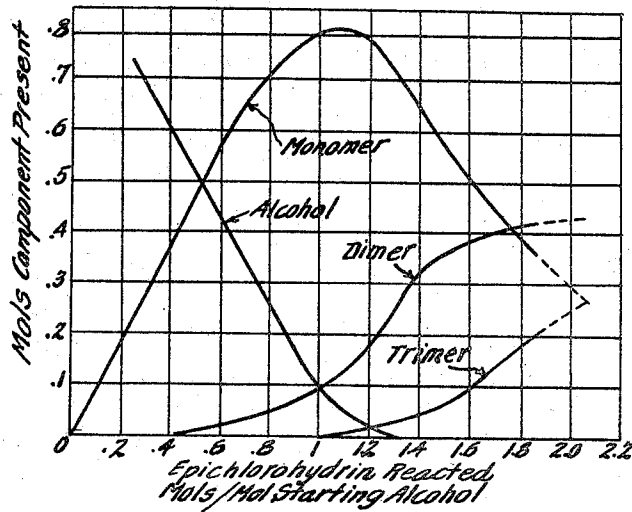


March 6, 1962

D. D. WHYTE ET AL
ALKYL GLYCERYL ETHER SULFONATE MIXTURES AND
PROCESSES FOR PREPARING THE SAME
Filed May 14, 1957

3,024,273

FIG. 1.



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3,024,273

ALKYL GLYCERYL ETHER SULFONATE MIXTURES AND PROCESSES FOR PREPARING THE SAME

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Filed May 14, 1957, Ser. No. 659,038
9 Claims. (Cl. 260—513)

This application is a continuation-in-part of application Serial Number 437,246, filed June 16, 1954, now abandoned.

The present invention relates to detergent compositions. More particularly, this invention relates to sulfonic acid salts of higher molecular alkyl ethers of glycerol and to a process for producing the same.

It is known that sulfonic acid salts of alkyl monoglyceryl ethers may be prepared by reacting epichlorohydrin with higher molecular alcohols in the presence of a catalyst, such as stannic chloride, to form the alkyl chloromonoglyceryl ethers and then subsequently converting the chloromonoglyceryl ethers to the sulfonic acid salts through Streckerization, i.e., reaction with sodium sulfite. Such a process is described in U.S. Letters Patent 2,094,489 to Richard Hueter, granted September 28, 1937.

The sulfonic acid salts of the alkyl monoglyceryl ether produced in accordance with the process of the above patent were found to have good deterative properties when the alkyl radicals were derived from alcohols obtained from "middle cut" coconut fatty alcohols, i.e., the fatty alcohol fraction, derived from coconut oil, which predominates in alcohols having a chain length of 12 carbon atoms and which are substantially free of alcohols having a chain length of 16 and 18 carbon atoms. The sulfonic acid salts of alkyl monoglyceryl ethers containing such high molecular weight alkyl radicals are characterized by relatively poor deterative performance. This is due primarily to the decreased solubility of the higher alkyl monoglyceryl ether sulfonates.

In the previously known methods for preparing the alkyl monoglyceryl ether sulfonates from a monohydroxy alcohol and an epichlorohydrin, the reaction between the alcohol and epichlorohydrin to form the haloglyceryl ether was normally conducted in the presence of an excess of alcohol. This required the removal of the unreacted alcohol from the haloglyceryl ether before the Streckerization reaction could be satisfactorily carried out and therefore involved an additional distillation operation.

It is an object of this invention to produce alkyl glyceryl ether sulfonates which are characterized by good deterative properties although such products contain appreciable amounts of high molecular weight alkyl groups.

It is a further object of this invention to provide a process for producing alkyl glyceryl ether sulfonates whereby etherification of the alcohols to form haloglyceryl ethers prior to Streckerization can be carried to substantial completion with no further purification of the haloglyceryl ethers being necessary.

A still further object of this invention is to provide a method for preparing detergent compositions containing alkyl glyceryl ether sulfonates which are characterized by improved solubility.

Other objects of the invention will be apparent from the following description and the accompanying drawings in which:

FIGURE 1 is a graphical representation showing the composition of products which are obtained in accordance with the process of the invention in terms of the respective proportions of reactants, i.e., epichlorohydrin and high molecular weight alcohol present; and

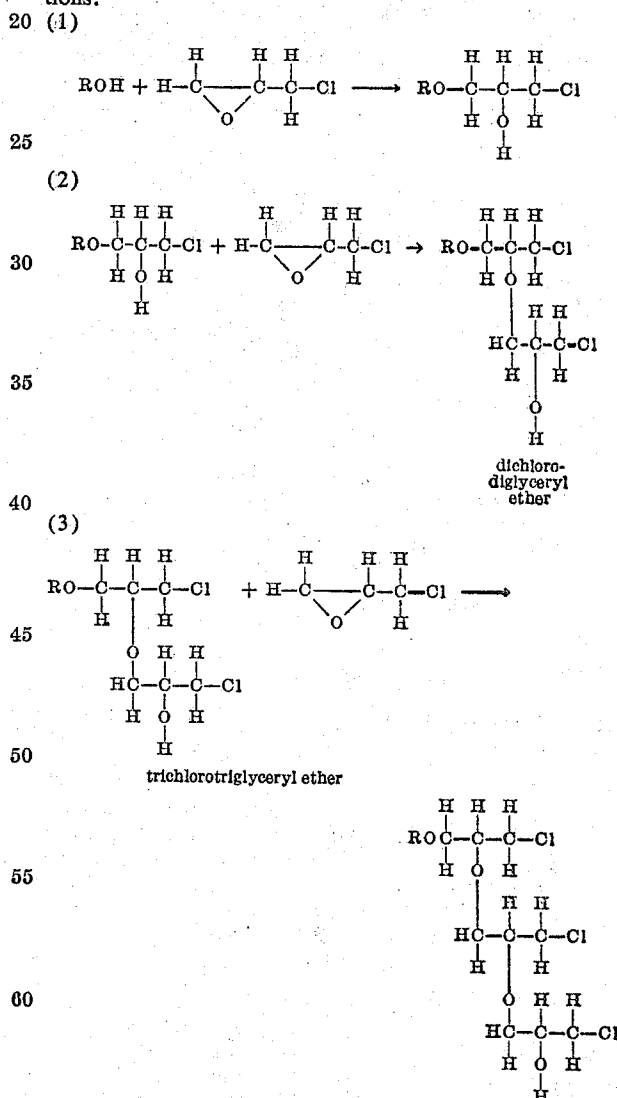
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FIGURE 2 is a schematic diagram representing apparatus suitable for use in practicing this invention.

It has now been found that the foregoing and other objects can be accomplished by reacting high molecular weight fatty alcohols with an amount of epichlorohydrin which is in excess of that required to react with the alcohol to produce the chloromonoglyceryl ether and then sulfonating the resulting chloroglyceryl ethers by means of the Streckerization reaction.

As a matter of convenience in this application wherever the term "Streckerization" and "sulfonation" appear hereinafter, they will be considered to be synonymous.

The use of an excess of epichlorohydrin results in the production of chloroglyceryl ethers in which the glyceryl radical is replaced in part with polyglyceryl radicals, e.g. with two or three condensed glyceryl radicals. The formation of such polyglyceryl ethers may be said to progress stepwise in accordance with the following equations:

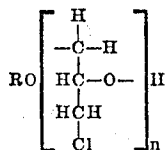


The higher polymers, such as the tetrachlorotetraglyceryl ethers, may also be formed, the amount depending upon the amount of excess epichlorohydrin which is used. In any event, the reaction product will comprise a mixture of the monomer with various proportions of the polymers.

The mixture of chloroglyceryl ethers which is formed

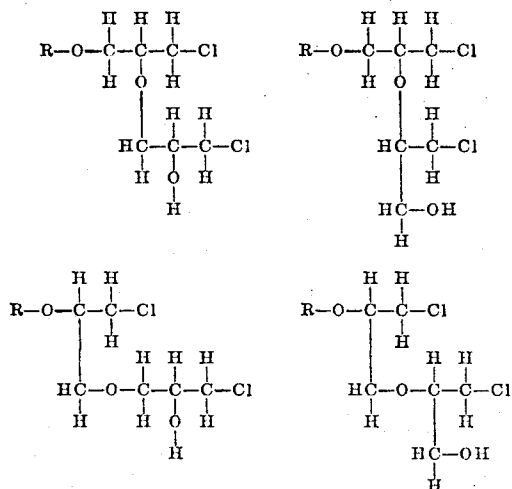
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in the process of this invention can be represented by the following general formula:



wherein R is an alkyl containing from about 8 to 22 carbon atoms and n is an integer from 1 to 4, said mixture comprising at least 10% of such ethers wherein n is 2. For convenience the chloroglyceryl ethers where n is 1, 2, 3 or 4 will hereinafter be referred to respectively, as the monomer, dimer, trimer and tetramer.

The aforesaid mixture of chloroglyceryl ethers will also undoubtedly contain positional isomers of the various ethers in minor quantity, and it is to be understood that herein and in the appended claims any reference to the glyceryl ethers, whether in sulfonated or unsulfonated form, is to be construed as including within its scope the positional isomers of the said glyceryl ethers. For example, the epoxy oxygen of the chlorohydrin may break so that the ether linkage between the alcohol and glyceryl radical may attach to either the terminal or middle carbon of the glyceryl radical. Also, the attachment of the second glyceryl radical to the first may be through an ether linkage to the terminal or middle carbon atom. By way of illustration, four of the isomeric diglyceryl ethers may be illustrated by the following structural formulations:



In preparing the alkyl chloroglyceryl ethers in accordance with the process of this invention at least 1.05 mols of epichlorohydrin is used for every one mol of alcohol which is to be reacted, i.e., at least 5% excess epichlorohydrin over the molar equivalent of alcohol is used. Reference to FIGURE 1 will serve to indicate that with about 5% molar excess epichlorohydrin about 10% of the dimer is formed and about 7.5% (.075 mol) alcohol remains unreacted. It has been found that this amount of dimer, after subsequent sulfonation, is sufficient to impart to the products of this invention the advantages associated with the presence of the dimer. In addition, it has been found that the amount of unreacted alcohol after subsequent sulfonation does not significantly modify the advantageous properties of the alkyl glyceryl ether sulfonates. Hence, no additional distillation step to remove the unreacted alcohol is necessary before the sulfonation reaction is carried out.

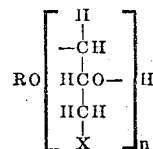
It can be seen from FIGURE 1 that the amount of unreacted alcohol increases rapidly with decreasing amounts of epichlorohydrin below the 5% molar excess value set forth above. Consequently, with such lesser amounts of epichlorohydrin, the unreacted alcohol must be removed from the chloroglyceryl ether product before

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the Streckerization is carried out and the process then offers no economic advantage. In addition, there is danger that the presence of a large excess of alcohol will, upon sulfonation, significantly modify the properties of the alkyl glyceryl ether sulfonate products.

With increasing amounts of excess epichlorohydrin, i.e. amounts greater than 5% molar excess over the molar equivalent of alcohol used, increasing amounts of dimer and trimer are formed. The amounts of these components in the products of this invention may be readily adjusted by regulating the excess of epichlorohydrin used to obtain alkyl glyceryl ether sulfonates having desired properties. Then too, if desired, the mixed alkyl chloroglyceryl ethers can be subjected to a distillation procedure whereby fractions consisting essentially of the monomer, dimer and trimer components of the aforesaid mixture can be separated. These separated fractions can then subsequently be sulfonated as hereinafter described.

The products of this invention which result from the Streckerization of the aforementioned mixture of alkyl chloroglyceryl ethers consist essentially of a mixture of sulfonated aliphatic glyceryl ether compounds of the general formula:



where R is an alkyl radical containing from about 8 to 22 carbon atoms, n is an integer from 1 to 4, and X is selected from the group consisting of chlorine, hydroxyl and water-soluble sulfonic acid salt radicals, at least one X in the product being a sulfonic acid salt radical, the cation of the said sulfonic acid salts being selected from the group consisting of sodium, potassium, ammonium, calcium, magnesium, and alkylol-substituted ammonium in which alkylol contains a whole number of carbon atoms from 2 to 3, said mixture containing at least about 10% of such ethers where n is 2.

Although the Streckerization reaction can be readily carried out utilizing either sodium or potassium sulfite, sulfonation with other sulfites can be accomplished only with difficulty. Consequently, if it is desired to have salts other than the sodium or potassium salts of the alkyl glyceryl ether sulfonates, such as the calcium, magnesium, ammonium or alkylol-substituted ammonium salts, the sodium salt, for example, can be passed over an ion exchange resin to replace the sodium ion with a hydrogen ion and the resulting acid can then be neutralized with calcium or magnesium hydroxide, ammonia or alkylol-substituted ammonia e.g., the mono-, di- or triethanol or propanol amines.

In carrying out the sulfonation reaction with sodium or potassium sulfite as the sulfonating agent, not all of the reactive groups of the chloroglyceryl ethers are converted to sulfonate radicals. For example, although upon sulfonating the dimer, the dimer disulfonate is primarily formed, some of the chlorine radicals of the chloroglyceryl ether remain unreacted and other chlorine radicals are hydrolyzed to hydroxyl radicals. As a consequence, the sulfonated dimer product comprises, for example, a mixture of diglyceryl monohydroxy disulfonate, diglyceryl dihydroxy monosulfonate, diglyceryl monochloro monohydroxy monosulfonate and a minor amount of diglyceryl trihydroxy ethers. The analysis of typical dimer sulfonates indicates that about 50% of the dimers are monohydroxy disulfonates, about 35% are dihydroxy monosulfonates and about 15% are monochloro monohydroxy monosulfonates.

The presence of the dimer and trimer sulfonates in the products of our invention offer several advantages. For example, the di- and tri-glyceryl ether sulfonates of the

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high molecular weight alcohols, i.e., those containing 16-18 carbon atoms in the alkyl chain, are characterized by a solubility in cool water, i.e., water at normal dishpan temperature—about 105° F., which is comparable to the solubility of the lower molecular weight (12-14 carbon alkyl chain) alkyl monoglyceryl ether sodium sulfonates under the conditions. Moreover, the polyglyceryl derivatives of such high molecular weight alcohols are characterized by good deterative properties either alone or when combined in substantial proportions with the sulfonic acid salts of the monoglyceryl ethers of the relatively lower molecular weight "middle cut" coconut fatty alcohols. The improved solubility of the polymeric forms of the high molecular weight alkyl glyceryl ether sulfonates as compared with the monomeric form of these sulfonates offers a decided economic advantage. For example, hydrogenated tallow can now readily be used as the source of the alkyl groups of the alkyl glyceryl ether sulfonates whereas, heretofore, the alkyl groups had necessarily to be obtained from the relatively more expensive coconut oil if a product having good deterative performance at low temperature conditions was desired.

The present invention also makes available many other alcohols as convenient source materials for the alkyl groups of the alkyl glyceryl ether sulfonate products. Thus, the fatty alcohols derived from unhydrogenated tallow can be utilized. These will, of course, result in the inclusion of alkenyl glyceryl ether sulfonates in the products of the invention. Consequently, wherever herein the term "alkyl" appears it is to be understood to include within its scope the alkenyls as well as the true alkyls.

Palm oil, hydrogenated marine oil, the latter containing some fatty acids having 20 and 22 carbon atoms in the alkyl chain, and oxo alcohols, made by reacting carbon monoxide and hydrogen with olefins, also represent available fatty alcohol sources which can be used in this invention.

It is to be understood that because of solubility considerations, with the higher molecular weight alkyl glyceryl ether sulfonate products of this invention i.e., those glyceryl ether sulfonates containing alkyl chains having from about 16 to 22 carbon atoms, it is advantageous to have a higher proportion of dimer, trimer and tetramer present than if the said products contained lower molecular weight alkyl groups, i.e., those alkyl groups containing from about 8 to 14 carbon atoms.

Advantages are also experienced from a conversion of portions of lower molecular weight alcohols, i.e., those having 12-14 carbon atoms in the alkyl chain, to the alkyl polyglyceryl, and especially the alkyl diglyceryl, ether sulfonates. These low molecular weight sulfonated polyglyceryl ethers have been found to be as effective in their deterative properties as the sulfonated monoglyceryl ethers. For this reason there is no particular advantage in the preparation and isolation of only the monoglyceryl form of the said ether sulfonates. Consequently, the monoetherification of such lower molecular weight alcohols can be carried out to substantial completion by using an excess of epichlorohydrin, which excess also promotes the formation of the dimer and trimer ethers, and no further purification of the resulting product ethers will be required.

It has been further found that the dimer ether sulfonate in the products of the invention acts in the capacity of a solubilizing agent and promotes solution of the monomer ether sulfonate present in the product.

When the alkyl glyceryl ether sulfonates of the invention are prepared utilizing the "middle cut" coconut alcohols it is preferred that the amount of excess epichlorohydrin be adjusted so as to produce a chloroglyceryl ether product which, upon sulfonation, will be characterized by a dimer content of about 10% to about 30%. Adjustment of the excess epichlorohydrin to produce a product having a dimer content within the aforemen-

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tioned limits will insure the presence in the chloroglyceryl ether intermediate of a minimum of unreacted alcohol and trimer and tetramer fractions.

The presence of large amounts of trimer and tetramer sulfonates in the alkyl glyceryl ether sulfonates prepared from "middle cut" coconut alcohols is to be avoided because of the reduced deterative activity of such trimer- and tetramer-containing compounds in detergent applications.

In the following examples, in which all parts are expressed by weight, and which are meant to be illustrative only, the various terms are defined as follows:

"C₁₂ Alcohol."—Denotes the alcohol derived from fractionally distilling the alcohols made by the reduction of coconut oil, the separated alcohol comprising about 97% alcohol containing 12 carbon atoms in the alkyl chain and having a molecular weight of about 186.

"Middle Cut CN Alcohol."—Denotes the alcohol derived from fractionally distilling the alcohols made by the reduction of coconut oil, the separated fraction having the following approximate composition:

2%	-----	¹ C ₁₀
66%	-----	C ₁₂
23%	-----	C ₁₄
9%	-----	C ₁₆

¹ The subscript denotes the number of carbon atoms in the alkyl chain.

Example 1.—400 parts of "C₁₂ alcohol" were reacted with 219 parts of epichlorohydrin for about one half hour at 90° C. in the presence of 9.2 parts of stannic chloride as a catalyst. The amount of epichlorohydrin was 10% in excess of the molar equivalent of alcohol.

The product ethers were water washed and a yield of 623.2 parts was recovered. The fractions separated during the subsequent distillation of the recovered ethers at 5 mm. of mercury absolute pressure are set forth below.

Alcohol cut	-----	29.3 parts—4.7%.
Monomer ether	-----	435.8 parts—70.0%.
High boiling cut (predominantly dimer ether)	-----	71.3 parts—11.4%.
Polymers and losses	-----	86.8 parts—13.9%.

A second alkyl chloroglyceryl ether preparation was made in accordance with the above conditions by reacting 400 parts of "C₁₂ alcohol" with 179 parts of epichlorohydrin in the presence of 5.8 parts of stannic chloride catalyst. The epichlorohydrin was 87.5% of the molar equivalent of the alcohol. The product ethers were water washed and a yield of 555.4 parts was recovered. Fractional distillation of the recovered ethers at 5 mm. of mercury, absolute pressure gave the following results.

Alcohol cut	-----	94.7 parts—17.1%.
Monomer ether	-----	381.3 parts—68.6%.
Residue	-----	63.1 parts—11.4%.
Losses	-----	16.3 parts—2.9%.

A comparison of the fractions obtained from the distillation of the chloroglyceryl ether where an excess of epichlorohydrin was used with the fractions obtained from the distillation where no excess of epichlorohydrin was used indicates that the product constituents are considerably different. Where excess epichlorohydrin was used the polymers, including the high-boiling cut which is predominately dimer ether, and losses comprise 25.3% of the ethers subjected to fractional distillation as compared to a total of 14.3% of residue (polymers) and losses where no excess epichlorohydrin was employed. The formation of an increased amount of chloroglyceryl ether polymers where an excess of epichlorohydrin is used is clearly indicated.

The data also indicate a marked decrease in the amount of the alcohol fraction when an excess of epichlorohydrin was used. This evidences a more complete utilization of

the alcohol reactant with the attendant advantages hereinbefore pointed out.

Example 2.—250 parts of dichlorodiglyceryl ether of dodecyl alcohol, 267 parts of potassium sulfite of 96% purity and 346 parts of water were placed in an autoclave, were allowed to react for one hour at 375° F., and were subsequently cooled. It was determined that 97.7% of the dichlorodiglyceryl ether was converted to a potassium salt of the sulfonate derivative. The product was highly soluble and its solutions were mild in their action toward fabrics and the skin and possessed good deterative characteristics.

Example 3.—10.35 parts of a mixture of alkyl chloroglyceryl ethers, 7.25 parts of sodium sulfite having a 95% purity, and 28.4 parts of water were reacted for one half hour at 375° F. in an autoclave. The mixture of chloroglyceryl ethers was obtained from reacting middle cut coconut alcohol with an amount of epichlorohydrin 100% in excess of the molar equivalent of the alcohol and comprised approximately 30% monomer, 44% dimer, and 26% trimer ethers. The reaction products were subsequently cooled and it was determined that 94.5% of the ethers were converted to a sodium salt of the sulfonate derivative. The product was highly soluble and its solutions were mild in their action toward fabrics and the skin and possessed good deterative characteristics.

It is to be understood that in the foregoing example the mixture of chloroglyceryl ethers obtained from reacting the alcohols resulting from the reduction of hydrogenated or unhydrogenated tallow, for example, with an amount of epichlorohydrin at least 5% in excess of the molar equivalent of the alcohol, can be substituted for the coconut alkyl chloroglyceryl ethers of the example with comparable results.

Example 4.—13.5 parts of the mixture of alkyl chloroglyceryl ethers, 9.25 parts of sodium sulfite of 95% purity, 0.5 part of sodium hydroxide and 22.5 parts of water were reacted in an autoclave at 400° F. for one half hour. The mixture of chloroglyceryl ethers was obtained from reacting middle cut coconut alcohol with an amount of epichlorohydrin 40% in excess of the molar equivalent of the alcohol and comprised approximately 65% monomer, 32% dimer and 3% trimer ethers. The resultant product was cooled and it was determined that 93.4% of the chloroglyceryl ethers were converted to a sodium salt of the sulfonate derivative. The product was highly soluble and its solutions were mild in their action toward fabrics and the skin and possessed good deterative characteristics.

Example 5.—A detergent formulation comprising 7.9% sodium alkyl glyceryl ether sulfonate, 9.6% sodium tallow alkyl sulfate, 6.0% silicate solids, 50% sodium tripolyphosphate and 8% water, the remainder of the composition comprising essentially sodium sulfate, was prepared and found to be eminently suitable for general household detergent use.

The alkyl glyceryl ether sulfonate constituent of this detergent formulation was prepared in accordance with the process of the invention. A 15% excess of epichlorohydrin was utilized to prepare a mixture of alkyl chloroglyceryl ethers from middle cut coconut alcohols, and this mixture was then sulfonated to produce the alkyl glyceryl ether sulfonate constituent.

Although it is not intended that this application shall be limited thereto, it has been found that a continuous sulfonation procedure has marked advantages if certain procedures are followed. It is also to be understood that any of the conditions set forth hereinafter in describing a continuous sulfonation procedure are also applicable to batch type sulfonations and that other alkali metal sulfites may be readily substituted for sodium sulfite as the sulfonating agent. The preferred continuous sulfonation procedure will be better understood in reference to the diagrammatic sketch of FIGURE 2 which is merely illustrative of apparatus suitable for use in the process and is

not to be construed as establishing limitations on applicable apparatus.

Alkyl chloroglyceryl ethers prepared in accordance with the process of this invention are held in storage tank 1 and a sodium sulfite solution is held in dissolving and storage tank 6. The concentration of the sodium sulfite solution is not critical but should be such that the undried sulfonation product will contain at least 50% water. Although it is preferred to maintain the sodium sulfite concentration in the range which will result in the formation of an undried sulfonate product containing about 50–60% water, the sulfonation reaction will proceed satisfactorily with a solution of sodium sulfite which will result in the formation of an undried sulfonate product containing as much as 70% water. The limit on the water content of the sulfite solution is determined by the limit of solubility of sodium sulfite in water and by economic factors, such as, the decrease in the formation of active product, i.e. sulfonated glyceryl ethers, because of the hydrolysis of the chloroglyceryl ethers which is promoted by the presence of large amounts of water and by the economics of the subsequent drying operation. It has been found, for example, that with the addition of an alkali metal hydroxide to control the pH during the sulfonation reaction as indicated hereinafter, sodium sulfite solutions having a concentration as high as 17% can be utilized.

It has also been found that when potassium sulfite is utilized as the sulfonating agent, the concentration of the potassium sulfite solution may be such as will result in the formation of an undried sulfonate product containing as little as 40% water—the actual lower limit on water content of the said undried sulfonate product being determined only by the ease with which the said product can be pumped.

The alkyl chloroglyceryl ether is pumped by metering pump 2 through the preheaters 3, equipped with steam inlet 4 and steam condensate outlet 5, and is heated therein to about 360° F.

The sodium sulfite solution is pumped by metering pump 7 through preheater 8, equipped with steam inlet 9 and steam condensate outlet 10, and is heated therein to a temperature of about 360° F. It is usual in the practice of this process to heat both the alkyl chloroglyceryl ether and the sulfite solution to temperatures in the range from about 350° F. to 375° F. to maintain the desired temperature in the reactor.

The alkyl chloroglyceryl ether and sodium sulfite solution passes from preheaters 3 and 8 respectively into mixer 11 to which metering pump 12 supplies an alkali metal hydroxide solution of such strength and in such amounts as will maintain the pH of the mixture at a value in the range from about 8 to 10. Although sulfonation will proceed at any pH in the range from about 7 to 11, it is preferred, in order to obtain maximum completeness of the reaction, that the pH be maintained in the aforementioned 8 to 10 range.

The mixture of reactants is conducted from mixer 11 into reactor 13 wherein sulfonation is allowed to proceed to substantial completeness at a pressure which approximates the vapor pressure of water at the reaction temperature. The sulfonated product then passes through pressure relief valve 14, into flash tank 16. A minor portion of the sulfonated product from the reactor is recycled by pump 15 to the mixer. The recycled sulfonate product is utilized to promote emulsification of the reactants in the mixer so that the sulfonation reaction is readily maintained and normally comprises about 5% by weight of the total amount of material fed into the system. The amount of sulfonated product which is recycled can, of course, be varied and is limited in maximum amount only by economic considerations. It is to be understood that in any event a sufficient amount of the sulfonated product is normally recycled so that the emulsification in the mixer is adequate to the maintenance of the sulfonation reaction.

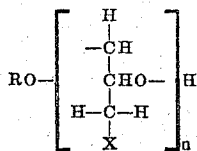
The flow of reactants to the reactor and the size of the reactor itself are normally scaled so that the reactants are in contact in the reactor for about 10 minutes. As little as 4 minutes reaction time will suffice in many cases but sulfonation completeness will be sacrificed to some extent with such short times. The highest possible completeness of sulfonation can be obtained with a total contact time in the reactor of about 20 minutes.

The sulfonation reaction is exothermic in nature. It is desirable that the reaction temperature be maintained in the temperature range from about 350 to 400° F., although higher temperatures, up to about 415° F., can be tolerated for short periods of time. Such high temperatures should be avoided, however, since undesirable side reactions are promoted and there is a tendency for the product to discolor at such temperatures. The desired temperature can be conveniently maintained by adjusting the temperature of the reactants emerging from heat exchangers 3 and 8 and/or by providing the reactor with suitable temperature adjusting means.

The term "consisting essentially of" as used in the definition of the ingredients present in the composition claimed is intended to exclude the presence of other materials in such amounts as to interfere substantially with the properties and characteristics possessed by the composition set forth but to permit the presence of other materials in such amounts as not substantially to affect said properties and characteristics adversely.

Having thus described the invention, what is claimed is:

1. A composition of matter, particularly adapted for use in detergent applications, consisting essentially of a mixture of sulfonated aliphatic mono- and poly-glyceryl ether compounds of the general formula



wherein R is an alkyl radical containing from about 8 to 22 carbon atoms, n is an integer from 1 to 4, and X is selected from the group consisting of chlorine, hydroxyl and water-soluble sulfonic acid salt radicals, at least one X in each compound of the mixture being a sulfonic acid salt radical, said mixture containing at least about 10% of such sulfonated aliphatic glyceryl ethers where n is 2, the balance of said mixture consisting predominately of a mixture of such sulfonated aliphatic glyceryl ethers where n is 1 and 3.

2. The compositions of claim 1 wherein the cation of the water-soluble sulfonic acid salt radical is selected from the group consisting of sodium, potassium, ammonium, calcium, magnesium, and alkylol-substituted ammonium in which the alkylol contains a whole number of carbon atoms from 2 to 3.

3. The composition of claim 1 wherein the cation of the water soluble sulfonic acid salt radical is sodium.

4. The composition of claim 1 wherein the cation of the water soluble sulfonic acid salt radical is potassium.

5. A process for preparing a mixture of aliphatic glyceryl ether sulfonates which comprises reacting a high molecular weight alkanol containing from about 8 to 22 carbon atoms with an amount of epichlorohydrin at least 5% in excess of the molar equivalent of the said alcohol, and contacting the resulting mixture of alkyl chloroglyceryl ethers with an aqueous solution of an alkali metal sulfite at a temperature within the range from about 350° F. to about 415° F. for from about 4 to about 20 minutes, the sulfonation reaction chamber containing from about 50% to about 70% water.

6. A continuous process for preparing a mixture of aliphatic glyceryl ether sulfonates which comprises separately heating, to a temperature within the range from about 350° F. to about 370° F., an aqueous solution of an alkali metal sulfite and a mixture of aliphatic glyceryl ethers containing at least about 10% of aliphatic dichlorodiglyceryl ethers, passing said heated materials through a commingling zone, then passing the commingled aliphatic glyceryl ether and sulfite solution through a reaction zone in from about 4 to about 20 minutes, the temperature of said reaction zone being maintained in the range from about 350° F. to about 415° F., and recycling a minor portion of the exiting stream being released from the reaction pressure to a lower pressure in a receiving zone.

7. The process of claim 6 wherein the alkali metal sulfite is sodium sulfite.

8. The process of claim 6 wherein the alkali metal sulfite is potassium sulfite.

9. The process of claim 7 wherein the water content of the sulfonation reaction mixture is from about 50% to about 60% water.

References Cited in the file of this patent

UNITED STATES PATENTS

2,010,726	Kirstahler	Aug. 6, 1935
2,094,489	Hueter	Sept. 28, 1937
2,260,753	Marple	Oct. 28, 1941
2,706,207	Schnell et al.	Apr. 12, 1955

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,024,273

March 6, 1962

David D. Whyte et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 24, for "Strechkerization" read -- Streckerization --; column 3, line 10, after "alkyl" insert -- radical --; column 4, line 15, for "hte" read -- the --; column 7, line 7, for "97.7%" read -- 97.9% --; column 10, line 19, for "chamber" read -- mixture --.

Signed and sealed this 10th day of July 1962.

(SEAL)

Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents