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PREPARATION OF DETERGENT MIXTURES

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The present invention relates to a new method of producing detergent mixtures of anionic organic sulfates and sulfonates, and more particularly it relates to a method of producing detergent mixtures of sulfated alkylolamides of higher fatty acids and monoalkyl benzene sulfonates.

The term "sulfated alkylolamides of higher fatty acid" as employed hereinafter, shall refer to water-soluble salts of sulfated alkylolamides of straight-chain saturated C_8—C_{18} fatty acids such as are derived from fats and oils of vegetable and animal origin, for instance, coconut oil, palmnut oil, hydrogenated tallow, hydrogenated cottonseed oil, hydrogenated soybean oil, hydrogenated whale oil, and the like materials. These sulfated alkylolamides are prepared by reacting the corresponding fatty acids with primary or secondary C_2–C_7 alkylolamines, and preferably C_2–C_4 alkylolamines, sulfating the resulting alkylolamides and neutralizing the acid sulfates with a suitable base.

The term "monoalkyl benzene sulfonates," as employed hereinafter, shall refer to water-soluble salts of C_9–C_{18} monoalkyl benzene sulfonic acids such as are produced by sulfonating various alkyl benzene stocks, e. g., polypropylene benzenes, described in U. S. Patent No. 2,477,382, to A. H. Lewis; keryl benzenes, described at page 122, of the book "Surface-Active Agents," by Schwartz and Perry (1949); C_8–C_{18} alkyl benzenes in which the alkyl chain is derived from the olefins obtained by the Fischer-Tropsch synthesis; and other suitable alkyl benzene hydrocarbons.

A large number of detergent formulations containing mixtures of different anionic detergent compounds have been proposed in the art. Generally, in these mixtures, one of the detergent components imparts some particular beneficial property, or properties, to the finished detergent formulation, for instance, an easier solubility or a higher wetting power, without adversely affecting the detergent power of the other component and, consequently, renders the formulation suitable for a particular specialized application. Furthermore, quite often one of the detergent components of such a mixture is considerably less expensive than the other detergent component, although the detergency of the mixture is equivalent, or almost equivalent, to the detergency of the second component when employed as the only detergent ingredient in the amount equal in weight to the weight of the mixture.

Sulfated alkylolamides of higher C_8–C_{18} saturated fatty acids are considered by the art to be efficient detergents and lime-soap dispersants. Although these characteristics render sulfated alkylolamides of higher fatty acids attractive to the user, their foams do not possess sufficient persistence. This constitutes somewhat of a drawback, owing to the preference of a large number of small scale users of synthetic anionic detergents for products capable of creating a substantial volume of dense foam similar in consistency to that of soapsuds. In fact, the formation of a copious foam is often accepted by the

user as a criterion of the proper quantity of detergent to be used in preparing a washing solution; and persistence of the foam is thought to be an indication that the washing ability of the detergent is not spent. By the lack of sufficient foam persistence is meant inability of dilute aqueous solutions of the sulfated alkylolamides to form a foam that would endure under the conditions of agitation and in the presence of soiled clothes and fabrics in an agitator-type washing machine.

It has been proposed to remedy this inability to form persistent foam by preparing mixtures of detergent sulfated alkylolamides and detergent monoalkyl benzene sulfonates. These mixtures were to contain a sufficient proportion of sulfated alkylolamides, preferably not less than 15% by weight, based on the entire content of surface-active organic materials in a particular detergent formulation, so as to impart to this formulation the desirable properties of sulfated alkylolamides. Furthermore, these mixtures were to contain detergent monoalkyl benzene sulfonates in an amount adding up to 100% by weight with the content of sulfated alkylolamides, in order to facilitate formation of sufficient quantity (volume) of foam in the solution of a mixture of these two detergents. Although the foam of monoalkyl benzene sulfonates is lacy and of a rather weak texture incapable to withstand continued agitation, the presence of a large volume of this foam assists the foam of the sulfated alkylolamide component in enduring, despite the agitation in the presence of soil, throughout the complete washing cycle of 20 minutes or more in the tub of a washing machine, particularly in the presence of foam-stabilizing additives, such as straight-chain C_{10}–C_{18} saturated aliphatic alcohols, straight-chain C_8—C_{16} alkyl or acyl phenols and straight-chain C_{14}—C_{18} saturated fatty acid amides, described in my patent applications: Serial No. 413,713, filed March 3, 1954; Serial No. 420,183, filed March 31, 1954; and Serial No. 422,240, filed April 9, 1954, respectively. This ability to produce persistent foam is an important property in a detergent formulation, because it is one of the main factors motivating the purchase by the consumer of a synthetic detergent formulation which resembles in its foam behavior that of the conventional, good-quality soap.

Compared with the straightforward and easily-controlled preparation of monoalkyl benzene sulfonate detergent materials suitable for use in the proposed mixtures of monoalkyl benzene sulfonates and sulfated alkylolamides, the preparation of sulfated alkylolamides of higher fatty acids is not as simple an operation, due to the chemical instability of both the alkylolamides of higher fatty acids and of their acid sulfates. First of all, in the conventional preparation of alkylolamides by reacting a primary and/or a secondary alkylolamine with a higher saturated straight-chain fatty acid, small amounts of amino-esters are ordinarily formed. These esters cannot be sulfated to form sulfuric acid esters nor can they be readily separated from the alkylolamides. Consequently, upon sulfation of the alkylolamide material, they remain in the sulfated alkylolamide product and detract from its surface-active properties. Although formation of these amino-esters can be minimized by employing an excess of the corresponding alkylolamine for the reaction with fatty acids, sulfation of alkylolamides in accordance with the conventional procedures gives rise to additional difficulties. Both the alkylolamides and their acid sulfates tend to decompose and undergo rearrangement in contact with sulfuric acid or other strong sulfating agents, at a temperature of about 40° C. or higher. At lower temperatures the high melting alkylolamides do not sulfate very readily and, in contact with sulfuric acid employed in a stoichiometric excess to insure completeness of the sulfation reaction, they slowly

decompose, undergoing rearrangement to amino-esters and other undesirable by-products. The formation of these by-products is further aggravated by the lack of solubility in sulfuric acid of the alkylolamides of higher saturated fatty acids, particularly of those fatty acids derived from hydrogenated tallow or similar materials. In addition, the sulfated alkylolamides, likewise being insoluble in sulfuric acid, decompose and rearrange after a relatively short period of contact with sulfuric acid, particularly at temperatures above 50° C., the result being a reduction of the yield and impairment of the surface-active properties of the ultimate sulfated alkylolamide product.

The known techniques, employed in the art to palliate the violence of the sulfation reaction at high temperatures (i. e., above the 40–50° C. range) and to reduce occurrence of side-reactions, are of no avail in the sulfation of alkylolamides of higher saturated fatty acids. Application of conventional organic solvents or diluents, e. g., chloroform, methylene chloride, carbon tetrachloride, etc., is of not much help either, since the alkylolamides as well as sulfuric acid are not appreciably soluble in such solvents. As mentioned hereinbefore, sulfation temperatures below the commonly employed temperature range of 40 to 50° C. slow down the reaction and increase the production costs. On the other hand, sulfation temperatures above this range promote the occurrence of side-reactions, increase the amount of undesirable by-products, and markedly lower the yield and the quality of the final product. Lengthening or shortening of the time of reaction is likewise ineffective: If the contact between the alkylolamide and sulfuric acid is too short, the reaction of sulfation is not completed; if the contact time between the alkylolamide and the acid is too long, the amount of undesirable by-products increases, while the quality and the yield of the alkylolamide sulfate product correspondingly suffer.

Satisfactory preparation of sulfated alkylolamides was reported to have been made possible by a very rigid control of the temperature. This method, however, required special refrigeration equipment and a thorough mixing of the reactants, all of which greatly increase the production costs. Even then, the foam performance of the resulting alkylolamide sulfate product in dilute aqueous wash solutions thereof was unsatisfactory, apparently still owing to the presence of aminoesters and/or of other contaminating by-products.

It has been proposed to prepare, first, a sulfuric ester of alkylolamine and to react this ester with a fatty acid chloride, thereby by-passing the sulfation step attended by the formation of undesirable by-products. However, the price of fatty acid chlorides does not render this proposal economically attractive.

I have now discovered that despite the aforementioned difficulties observed in the preparation of sulfated alkylolamides of higher saturated fatty acids, mixtures of these detergent alkylolamide sulfates and monoalkyl benzene sulfonates suitable for the formulation of detergent compositions characterized by improved foam performance, i. e., better quality and persistence of foam under agitation, can be prepared in an efficient manner by first sulfonating an alkyl benzene material to provide a mixture of monoalkyl benzene sulfonic acid and sulfuric acid, and subsequently sulfating an alkylolamide or alkylolamides of higher fatty acids in the sulfonation reaction product mixture. In this manner, formation of by-products during the sulfation of the alkylolamides is substantially reduced, if not totally eliminated, enabling production of efficient detergent mixtures of sulfated alkylolamides and alkyl benzene sulfonates, characterized, in addition, by excellent foam performance in aqueous wash solutions under conditions of agitation and in the presence of soil.

I have found that sulfonated hydrocarbons, i. e., sulfonic acids of the general formula: RSO_3H, wherein R may be any conveniently available hydrocarbon, when present in the reaction of sulfation of alkylolamide by sulfuric acid, solubilize the alkylolamides of higher saturated fatty acids. This unexpected property permits a rapid sulfation of alkylolamides with the minimum of decomposition and minimum production of undesirable non-detergent by-products.

The preferred embodiment of the preparation of mixtures of detergent alkylolamide sulfates and detergent monalkyl benzene sulfonates in accordance with my invention involves sulfonation of suitable alkyl benzene materials with an excess of sulfuric acid varying in strength from about 95% H_2SO_4 up to 30% oleum, the mol ratio of the acid to the alkyl benzene ranging from about 2.5 to about 5.5 mols, and preferably from about 3 to about 4.5 mols. This ratio refers to mols of equivalent 100% H_2SO_4 per one mol of alkyl benzene, regardless of the strength of the acid actually employed. Details of such sulfonation can be found at pages 4 to 10 of the bulletin published by Oronite Chemical Company of San Francisco, California, under the title "Alkane-Product and Processing Information."

During the sulfonation, the strength of the sulfuric acid is reduced, now ranging from 5% oleum to as low as 80% H_2SO_4, depending upon the initial ratio of the acid to the alkyl benzene. Therefore, on completion of the sulfonation treatment, it becomes necessary to adjust the strength of the acid to the desired value from about 90% H_2SO_4 to about 2% oleum, and preferably from about 95% to about 100% H_2SO_4, by introducing additional acid or SO_3, or by diluting the sulfonation product mixture with water. The adjustment of the acid strength in the sulfonation reaction product mixture is governed by the following considerations: (*a*) The amount of alkylolamide to be sulfated; (*b*) the desire of attaining the maximum of conversion, since the weaker the acid, the lower the conversion; (*c*) the color of the sulfated alkylolamide product, which is a function of the sulfation temperature; should this temperature be too high, additional cooling means are required to prevent degradation of the color. On the other hand, should this temperature be too low, the reaction mixture becomes too viscous, the reaction itself is slowed down and conversion correspondingly decreases.

Having adjusted the acid strength in the sulfonation product mixture, the alkylolamide material can be added thereto, and the whole is then digested at a temperature from about 30 to about 60° C., the temperature range from about 40 to about 50° C. being preferred. Ordinarily, whenever one mol of alkyl benzene is sulfonated at mol ratios of the acid to the alkyl benzene within the aforementioned range from about 2.5 to about 5.5, and preferably from about 3 to about 4.5, the amounts of the alkylolamide which may be effectively sulfated, upon adjusting the acid strength of the sulfonation reaction mixture to from about 90% H_2SO_4 to about 2% oleum, will be in the range from 0.25 to 1 mol per each mol of the initial alkyl benzene stock. Of course, the desired weight ratio of the alkylolamide sulfate to the alkyl benzene sulfonate in the ultimate mixed detergent product controls the choice of a proper quantity of the alkylolamide to be added to the sulfonation product mixture, and this choice is, furthermore, dependent on the choice of the right temperature in the aforementioned operating temperature range from about 30 to about 60° C. When a smaller proportion of alkylolamide sulfate is required in the ultimate detergent mixture, the viscosity of the sulfation product mixture will be correspondingly reduced, so that a lower temperature may be employed for the sulfation. Conversely, when a greater proportion of alkylolamide sulfate is desired in the final mixture thereof with monoalkyl benzene sulfonate, the sulfation product mixture will have a higher viscosity, and a somewhat higher temperature in the operating range from 30 to 60° C. will be necessary.

The alkylolamide material may be added to the sul-

fonation reaction mixture in any suitable manner, for instance, by dissolving the amide in a solvent inert to sulfuric acid and sulfonic acid, by melting the amide and dispersing the melt in the sulfonation reaction mixture, or finally by reducing the alkylolamide material to a finely subdivided particle form, such as flakes or beads, and dispersing these particles in the liquid-phase sulfonation mixture.

In some cases it may be desired that the sulfonating agent (oleum or 95–100% sulfuric acid) be employed in such an amount as to leave insufficient sulfuric acid to sulfate all of the alkylolamide. If no adjustment of sulfuric acid is then made to provide for the presence of the necessary excess of sulfuric acid of the desired strength, a portion of the alkylolamide material will remain unsulfated in the mixture of acid sulfated alkylolamides and alkyl benzene sulfonic acid. The presence of such unreacted alkylolamide will tend to impart stability to the foam formed by aqueous wash solutions of the final detergent formulation and will furthermore improve the soil tolerance of this foam.

Upon completion of the sulfation treatment, the mixture of acid alkylolamide sulfate and alkyl benzene sulfonic acid is neutralized with a base (e. g., sodium hydroxide or sodium carbonate) capable of forming an queous slurry or solution of a mixture of water-soluble detergent salts of sulfated alkylolamides and alkyl benzene sulfonic acids. Inorganic detergent builders and other conventional additives which may be required by the specification for a particular detergent formulation can be added at this point to the neutralized slurry, or solution, which is then converted to the desired solid-particle form by known drying techniques.

The inorganic builders which may be present in the detergent formulations containing mixtures of detergent sulfated alkylolamides and alkyl benzene sulfonates are inorganic salt detergent builders, by which term is meant neutral inorganic salts of strong inorganic acids and alkaline salts of weak inorganic acids, compatible with the organic detergent materials and tending to improve their surface-active properties.

As illustrations of these builders, the following may be named: alkali metal and ammonium sulfates, carbonates, silicates, borates, and various polyphosphates, sodium salts being preferably so employed. The other conventional additives, usually present in small amounts of less than 5% by weight of the total finished solid detergent formulation, include anti-caking agents, e. g., sodium benzene sulfonate or sodium toluene sulfonate, optical bleaches, perfume, coloring agents, carboxymethyl cellulose and kindred detergent extenders, N-alkyl glycines and N-alkyl diglycines as skin emollients, and C_2–C_3 alkylolamides of higher saturated C_8–C_{18} fatty acids, which contribute to enhance the soil tolerance of the foam, e. g., lauric isopropanolamide, lauric glycerolamide, or lauric ethanolamide.

The following representative examples demonstrate the operation of the process of my invention.

Example 1

To 1 mol (245 g.) of C_{12}–C_{15} polypropylene benzene, cooled to a temperature of 5° C., 3.9 mols (365 g.) of 22% oleum were gradually added with stirring over a period of about 30 minutes. The reaction mixture was cooled by means of an ice-water bath, and, towards the end of the addition, the cooling was discontinued to allow the temperature to rise. The reaction mixture was digested for 1 hour at 40 to 50° C., whereupon 0.54 mol (173 g.) of stearic acid ethanolamide (stearic acid having been derived from hydrogenated tallow) was added as a molten liquid. The addition took about 60 minutes, the temperature being maintained at about 40° C. by means of occasional cooling. After the stearic ethanolamide was added to the sulfonation product mixture, the resulting mixture was digested between 44–48° C. for 1½ to 2 hours and neutralized with the aid of a solution of NaOH. The slurry was then ready to receive the addition of inorganic detergent builders and such other additives as may have been required by a particular specification, prior to spray-drying it to the desired solid particle form.

Example 2

In another illustrative example of the practice of my invention, 0.6 mol (146 g.) of a C_{12}–C_{15} polypropylene benzene was placed into a 2-liter three-necked flask equipped with a stirrer, a thermometer and a dropping funnel. The contents of the flask were cooled to 5° C., and 3 mols (280 g.) of 20% oleum were added gradually over a 45 minute period from the dropping funnel, continuously cooling the flask to maintain the temperature at 10° C. When the addition was finished, the mixture was digested for 40 minutes at 30 to 35° C. and the contents were finally cooled at 25° C. Thereupon, ethanolamide of stearic acid obtained from hydrogenated tallow was added to the cooled mixture in an amount to 0.5 mol (157 g.) in the form of crushed flakes over a period of 20 minutes. When the addition was terminated, the resulting mixture was digested from ½ to 2 hours at 40 to 45° C., and finally was neutralized with caustic to give an aqueous slurry having a light yellow color. After adding the necessary organic builders and other specified additives and spray-drying, a white detergent powder was obtained which contained 20% by weight of an organic mixture of alkylolamide sulfate, alkylolamide and alkyl benzene sulfonates. The foam performance, i. e., the quality, stability and persistence of the foam of dilute aqueous solutions prepared with mixed detergent compositions containing sulfated alkylolamides of higher saturated fatty acids is highly satisfactory, as well as their detergency which favorably compares with the detergencies of a number of popular efficient detergents of the trade. The data on foam performance and detergency can be found in my copending application Serial No. 420,183, mentioned hereinbefore.

Although in the aforegiven description of the preparation of detergent mixtures of sulfated alkylolamides of higher saturated fatty acids and alkyl benzene sulfonates, sulfuric acid in excess and varying in strength from 30% oleum down to 95% sulfuric acid has been suggested as the sulfonating agent for the production of the sulfonated hydrocarbon (alkyl benzene sulfonic acid) which is to serve in the subsequent sulfation of the alkylolamide as a solubilizing medium for the alkylolamide material, other appropriate sulfonation techniques may be employed to produce the necessary sulfonated hydrocarbon solubilizer. For instance, the hydrocarbon, such as alkyl benzene, may be sulfonated in a known manner with sulfur trioxide or chlorosulfonic acid, care being taken not to use an excess of either of these powerful sulfonating agents and to separate any remaining reactive sulfur trioxide or sulfonyl chloride from the sulfonation product mixture. Thereafter, excess of sulfuric acid varying in strength from 80 to 100%, and preferably from 95 to 100% strong, is admixed to the sulfonated hydrocarbon, such as alkyl benzene sulfuric acid, and the alkylolamide to be sulfated is added to the mixture of sulfuric and sulfonic acids, either as a melt or in a finely comminuted state (e. g., as flakes). The mixture is then digested at 30 to 60° C. to complete sulfation of the alkylolamide, and the sulfation product is neutralized, yielding a slurry of water-soluble alkylolamide sulfates and alkyl benzene sulfonates. Following the addition of detergent builders and such other additives as may be specified, the slurry is dried to the desired particle form and size. As indicated hereinbefore, the term "sulfonated hydrocarbon" refers to sulfonic acids, such as straight- and branched-chain alkane sulfonic acids, cycloalkane sulfonic acids, alkylcycloalkane sulfonic acids, alkyl aryl sulfonic acids (including alkyl benzene and alkyl naphthalene sulfonic

acids), sulfonic acids of alkylated heterocyclic compounds and aralkyl aryl sulfonic acids (i. e., sulfonic acids in which the aromatic nuclei are linked through a methylene group). These sulfonic acids may be prepared beforehand and then employed as solvents or solubilizing media in the sulfation of alkylolamides of higher saturated fatty acids, in amounts equal to at least 100% by weight of the alkylolamides and sufficient to solubilize these alkylolamides and their sulfates so as to facilitate the sulfation process. The employment of such sulfonic acids in accordance with my invention enables the preparation of many useful formulations containing mixtures of alkylolamide sulfates with a variety of sulfonates, endowed with varying degrees of surface-activity, possessing valuable characteristics, and suitable for a number of specialized applications.

Example 3

In another illustrative example, a mixture of 2.0 mols (196 g.) of 100% H_2SO_4 and 0.51 mol (156 g.) of n-hexadecane sulfonic acid was heated to 40° C., whereupon 0.40 mol (127 g.) of stearic ethanolamide was added as crushed flakes to the acid mixture. After completing the addition of the alkylolamide in about 15 minutes, the mixture was digested at 43–47° C. for 2 hours and neutralized with a solution of caustic. The neutralized sulfation product mixture or slurry contained sodium n-hexadecane sulfonate and sodium sulfate of the ethanolamide of stearic acid. It was then reduced to small solid particles by drying the neutralized slurry in a spray drier.

Whenever the particular sulfonated hydrocarbon itself is a solid, a sufficient amount thereof may be dissolved in an appropriate solvent inert to sulfuric acid under the conditions prevailing in the sulfation of alkylolamides by sulfuric acid, so as to enable the dissolved sulfonated hydrocarbon to act as a solubilizing medium for the alkylolamides in the course of their sulfation in the aforedescribed temperature range from about 30 to about 60° C., and preferably from about 40 to about 50° C., and employing an excess of sulfuric acid having a strength from 80 to 100%, and preferably from 95 to 100%.

While certain preferred embodiments of the invention and specific examples illustrating the same have been given hereinabove, it will be understood that the invention in its broader aspects is not limited thereby and includes within its scope production of mixtures of sulfated alkylolamides of any saturated fatty acids, irrespective of the number of carbon atoms in its acyl portion, with any suitable sulfonated hydrocarbon by reacting a corresponding alkylolamide with sulfuric acid in the presence of such sulfonated hydrocarbon in liquid phase as a solubilizer or solvent for the alkylolamide. In addition, it will be understood that any modifications or variations of the aforedescribed process which do not depart from the spirit and scope of the invention are to be included within the definitions of the following claims.

I claim:

1. A process for preparing mixtures of C_9–C_{18} monoalkyl benzene sulfonates and sulfated C_2–C_7 alkylolamides of straight-chain C_8–C_{18} saturated fatty acids by sulfonating a C_9–C_{18} monoalkyl benzene with an excess of sulfuric acid varying in strength from 95% H_2SO_4 to 30% oleum in a ratio from about 2.5 to about 5.5 mols of 100% H_2SO_4 per one mol of said C_9–C_{18} monoalkyl benzene to form a mixture of a C_9–C_{18} monoalkyl benzene sulfonic acid and free sulfuric acid; adjusting the strength of free sulfuric acid in the sulfonation reaction product mixture to obtain an excess of sulfuric acid having an acid strength from about 90% H_2SO_4 to about 2% oleum; adding to the mixture of said sulfonic and free sulfuric acids from 0.25 to about 1 mol of a C_2–C_7 alkylolamide of a straight-chain C_8–C_{18} saturated fatty acid; digesting the mixture of acids and alkylolamide at about 30 to about 60° C. to sulfate the alkylolamide; neutralizing the sulfation reaction product mixture with a base to form a mixture of C_9–C_{18} monoalkyl benzene sulfonates and sulfated C_2–C_7 alkylolamides of straight-chain C_8–C_{18} saturated fatty acids; and drying this mixture to the solid-particle form.

2. A process for preparing mixtures of C_{12}–C_{15} polypropylene benzene sulfonates and sulfated C_2–C_7 alkylolamides of straight-chain C_8–C_{18} saturated fatty acids by sulfonating a C_{12}–C_{15} polypropylene benzene with an excess of sulfuric acid varying in strength from 95% H_2SO_4 to 30% oleum in a ratio from about 2.5 to 5.5 mols of 100% H_2SO_4 per one mol of said polypropylene benzene to form a mixture of C_{12}–C_{15} polypropylene benzene sulfonic acid and free sulfuric acid; adjusting the strength of free sulfuric acid in the sulfonation reaction product mixture to obtain an excess of sulfuric acid having an acid strength from about 90% H_2SO_4 to about 2% oleum; adding to the mixture of said polypropylene benzene sulfonic acid and free sulfuric acid from 0.25 to about 1 mol of a C_2–C_7 alkylolamide of a straight-chain C_8–C_{18} saturated fatty acid; digesting the mixture of acids and alkylolamide at about 30° to about 60° C. to sulfate the alkylolamide; neutralizing the sulfation reaction product mixture with a base to form a mixture of C_{12}–C_{15} polypropylene benzene sulfonates and sulfated C_2–C_7 alkylolamides of straight-chain C_8–C_{18} saturated fatty acids; and drying this mixture to the solid particle form.

3. A process as defined in claim 1, wherein the mixture of monoalkyl benzene sulfonic acid, free sulfuric acid and C_2–C_7 alkylolamide of straight-chain C_8–C_{18} saturated fatty acid is digested at a temperature from about 40° to about 50° C. to sulfate the alkylolamide.

4. A process as defined in claim 1, wherein the monoalkyl benzene is sulfonated with an excess of sulfuric acid varying in strength from 95% H_2SO_4 to 30% oleum in a ratio from about 3.0 to about 4.5 mols of 100% H_2SO_4 per one mol of said monoalkyl benzene, and wherein the strength of free sulfuric acid in the resulting sulfonation reaction product mixture is adjusted to provide an excess of sulfuric acid having an acid strength from about 95 to about 100% H_2SO_4.

5. A process as defined in claim 1, wherein the alkylolamide of straight-chain saturated fatty acid is a C_2–C_4 alkylolamide of a straight-chain saturated hydrogenated tallow fatty acid and said monoalkyl benzene is a C_{12}–C_{15} polypropylene benzene.

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