Patented Sept. 26, 1939

2,174,110

UNITED STATES PATENT OFFICE

2,174,110

DETERGENT AND METHOD OF MAKING SAME

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No Drawing. Application February 12, 1934, Serial No. 710,957

10 Claims. (Cl. 260—400)

This invention relates to detergents and a method of making the same, and has particular reference to detergents that may be used equally well in hard or soft waters.

As is well known, ordinary soap is usually the sodium salt of a fatty acid. These soaps function properly in soft water but form insoluble compounds in hard water. In many industrial processes these insoluble compounds are highly undesirable and form a serious detriment to the successful operation of the process. To overcome this difficulty, a number of hard water detergents have been developed and perhaps one of the most successful from a commercial standpoint is in the form of an alkyl sodium sulphate. The reaction of this detergent with hard water forms, for the most part, soluble sulphates such as calcium sulphate, which is the principal salt formed, and other metallic sulphates in minor quantities.

The chief objection to a detergent in the form of an alkyl sodium sulphate is the expense of making the same. The formation of such detergent is usually accomplished by reducing the natural fatty acids such as found in lard, palm oil, or any of the glycerides, to an alcohol. This reduction is made by treating the acids or glycerides with hydrogen under heat and pressure in the presence of a catalyst, such as palladium or platinum or a combination of the two. The alcohol thus formed is then treated with sulphuric acid to form an alkyl sulphate and this, in turn, is treated with a base, such as sodium hydroxide or sodium carbonate to form an alkyl sodium sulphate.

It is the primary object of the present invention to provide a novel method of forming a new detergent which method shall be simple and inexpensive to carry out and by practicing the same a new detergent shall be formed that is useful equally well in soft or hard waters. That is, the detergent thus formed when used with hard water shall form water soluble salts.

Another object is to provide a detergent which shall be highly efficient and which, by reason of its chemical composition, shall have a much greater emulsifying power on oils and greases than ordinary soap or any of the present hard water soaps or detergents.

A further object is to provide a detergent of the aforesaid character which shall be water soluble and which shall possess good foaming characteristics.

The foregoing and other objects and advantages will become more apparent as the description proceeds and will be pointed out in the appended claims.

In carrying out my invention, I react a suitable hydrocarbon-containing compound having either a large molecule (containing a large number of carbon atoms) or a small molecule, or a mixture of both, such reaction being carried out in accordance with that disclosed in my copending application, entitled "Method of halogenating compounds and product resulting therefrom," filed December 29, 1933, Serial No. 704,591 now Patent No. 2,046,090, dated June 30, 1936. As a specific example of such compounds, I refer particularly to the natural fatty acids such as are found in lard, palm oil, or any of the glycerides, or paraffin wax, kerosene, and similar compounds. These may be used singly or in any combination desired and may be represented by the structural formula

where R represents the additional carbon and hydrogen atoms forming the particular molecule or group of molecules in any specific compound.

As disclosed in the aforementioned application, the compound or compounds are subjected to the action of chlorine and sulphur dioxide gases, while the temperature is controlled to prevent polymerization of the compound or other internal structural change in the molecules. This reaction introduces one or more sulphonic groups into the compound and produces reaction products which are easily hydrolyzed. The reaction products thus formed are then further reacted upon by treating with sulphuric acid or they may be improved by blowing air therethrough. This is speeded up by the addition of water and free chlorine. In actual practice, the step of improving the product may be carried out simultaneously with the step of forming the reaction product.

The compounds thus formed are then treated with a basic reagent such as sodium hydroxide or sodium carbonate to produce a detergent.

The advantage in this method lies not only in the ease and comparatively inexpensive manner of carrying out the above reactions, but also in the fact that the compound or compounds which form the starting point may be hydrocarbons having a relatively large molecule. In other words, the aforementioned natural fatty acids each have a molecule of 18 or less carbon atoms and form the basis of most present day soaps or detergents. With my improved method, compounds such as paraffin wax, having a larger molecule and containing more than 18 carbon atoms may be easily reacted upon to produce a detergent having a relatively large molecule.

The mechanics of soap as a detergent are not well understood. It has been claimed by some that the cleansing effect is due partially to a solvent action while others claim that the bulkiness of the alkyl group which is in more or less

of a colloidal condition envelopes the particles of dirt and includes them in itself. Still others claim that there is an ionization of the salt and a reaction between the metallic ion and that of the oils in the dirt particles. The felting of wool is attributed to this property of soap. In all probabilities, the cleansing action of soap is due to a combination of these various properties and such being the case, it follows that the larger the molecule the greater would be the carrying capacity for dirt and the greater its value as a detergent. Hence, by using a hydrocarbon having a relatively large molecule, as, for example, paraffin wax, as contrasted to the usual hydrocarbon of 18 or less carbon atoms, it is obvious that my method of making a detergent produces a superior product.

Another important consideration in connection with my invention lies in the control of the solubility of the detergent. Ordinary soap has an empirical formula of R–COO Na while a typical alkyl sodium sulphate soap has an empirical formula R-O-SO_3-Na. In ordinary soap it is the carboxyl group and in the other, the sulphate group which renders the product water soluble, although the sulphate is more soluble than the carboxyl. By being able to use a hydrocarbon having a large molecule, I am able to impart any desired degree of solubility to the detergent. This may be accomplished in a number of different ways, as, for example, by varying the degree of treatment with sulphuric acid or air, by varying the degree of treatment with the basic reagent and by varying the type of basic reagent used.

It is also well known that the shorter chain hydrocarbons produce the foaming qualities of the detergent at the lower temperatures, while at more elevated temperatures these shorter chain hydrocarbons lose their foaming properties and the longer chain hydrocarbons produce the foaming qualities. With my method, either the shorter, that is, at least five carbon atoms per molecule, or the longer chain hydrocarbons, can be used, or any mixture or combination thereof as may be desired to produce a detergent for any particular use. As referred to above, my method is especially applicable to the longer chain hydrocarbons, that is, hydrocarbons having more than 18 carbon atoms to the molecule. When these longer chain hydrocarbons are used, as, for example, one having 24 carbon atoms, a detergent is produced that is water soluble, and while not producing so voluminous a foam as the shorter chain hydrocarbons, nevertheless, the foam produced is longer lived even at very elevated temperatures and the emulsifying powers on oils and greases is approximately fifty times that of ordinary soap and about ten times that of an ordinary alkyl sodium sulphate soap.

While I have disclosed paraffin wax and kerosene as specific examples of relatively long chain hydrocarbons, I do not limit myself to these particular compounds as I may halogenate other compounds to effect substitution products as disclosed in my aforementioned copending application. Thus by "hydrocarbon-containing compounds" in the specification and claims I mean not only pure hydrocarbons and mixtures thereof, but also hydrocarbon derivatives such as fatty acids, animal and vegetable fats and oils and mixtures thereof. The substitution products may be used in accordance with the aforementioned or other similar reactions to produce a soap or detergent of the desired characteristics.

What I claim is:

1. The method of forming substitution products containing an atom selected from the group consisting of sulphur, selenium and tellurium, and oxygen and a halogen from hydrocarbon-containing compounds which comprises reacting said compounds with a mixture of a halogen and a dioxide of an element of the group consisting of sulphur, selenium and tellurium, hydrolyzing the reaction product, and treating the resultant compound with an oxidizing agent.

2. The method of forming substitution products containing sulphur, oxygen and chlorine from hydrocarbon-containing compounds which comprises reacting said compounds with a gaseous mixture of chlorine and sulphur dioxide, hydrolyzing the reaction product, and treating the resultant compounds with a free-oxygen containing gas.

3. The method of forming substitution products which comprises reacting a saturated hydrocarbon-containing compound with chlorine and sulphur dioxide, hydrolyzing the reaction product, and treating the resultant compound with air.

4. The method of forming substitution products which comprises reacting a saturated hydrocarbon-containing compound with chlorine and sulphur dioxide, hydrolyzing the reacted compound, and treating said hydrolyzed product with sulphuric acid.

5. The method of forming substitution products which comprises reacting a saturated hydrocarbon-containing compound with chlorine and sulphur dioxide, and simultaneously hydrolyzing the reaction product and treating the reaction product with a free-oxygen containing gas.

6. The method of forming substitution products which comprises reacting a saturated hydrocarbon-containing compound with chlorine and sulphur dioxide and treating said reacted compound with air in the presence of water and free chlorine.

7. The method of forming substitution products which comprises reacting a non-gaseous saturated aliphatic hydrocarbon compound with a mixture of gaseous chlorine and sulphur dioxide, hydrolyzing said reaction compounds and treating said hydrolyzed products with air.

8. The method of forming substitution products which comprises reacting a saturated hydrocarbon-containing compound with gaseous chlorine and sulphur dioxide, treating the resultant compounds with a free-oxygen containing gas, and hydrolyzing the treated compounds.

9. In the method of forming substitution products in which a saturated hydrocarbon-containing compound is treated with a gaseous mixture of chlorine and sulphur dioxide, the step of improving the products by treating said products with air.

10. In the method of forming substitution products in which a saturated hydrocarbon-containing compound is treated with a gaseous mixture of chlorine and sulphur dioxide, the step of improving the products by treating said products with a free-oxygen containing gas.

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