United States Patent [19]

Stokes

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[54] **DETERGENT COMPOSITIONS**

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[51] **Int. Cl.** **C11d 7/26**

[58] **Field of Search** ..... 252/89, DIG. 15; 260/515 P

[56] **References Cited**

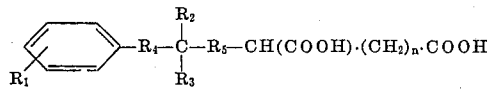
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Attorney—Louis F. Kline, Jr., Melvin H. Kurtz et al.

[57] **ABSTRACT**

A fabric-washing detergent composition incorporates, as a detergency builder, a water-soluble or water-dispersible salt of an alkylaryl dicarboxylic acid having the general formula:

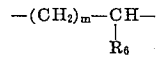


wherein

R_1, R_2 and R_3 are hydrogen atoms or alkyl groups;

R_4 is an alkylene chain containing from zero to eight carbon atoms and optionally incorporating in the chain other atoms as linking groups, such as —0—, —S—, —S0— and —$S0_2$—;

R_5 is a group similar to R_4 or is a group having the general formula:



wherein

R_6 is an alkyl group and m is 0 or 1; n is 0 or 1; and the total number of carbon atoms in R_1, R_2, R_3, R_4 and R_5 is from six to 30.

10 Claims, No Drawings

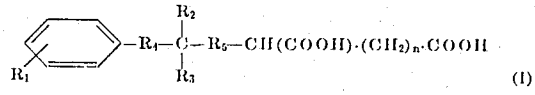
DETERGENT COMPOSITIONS

The present invention relates to detergent compositions, and particularly to detergent compositions adapted for use in fabric washing.

Detergent compositions adapted for heavy-duty fabric washing, particularly when such washing is to be conducted in fabric washing machines, normally comprise as major ingredients detergent-active compounds and detergency builders. The most commonly used detergency builders are the condensed phosphates, particularly sodium tripolyphosphate, although other inorganic or organic materials, such as sodium nitrilotriacetate and sodium ethane-1-hydroxy-1,1-diphosphonate, have been proposed.

It has been suggested that the use of condensed phosphates as detergency builders in detergent compositions contributes to eutrophication. Considerable effort has been expended to find some other detergency builders not containing phosphorus which are at least as effective as the presently-available materials while not being too expensive or having any deleterious properties affecting such use.

By the present invention it has been found that water-soluble or water-dispersible salts of alkylaryl dicarboxylic acids having the general formula:



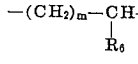
(I)

wherein

R_1, R_2 and R_3 are hydrogen atoms or alkyl or substituted alkyl groups;

R_4 is an alkyl chain containing from zero to eight carbon atoms and optionally incorporating in the chain, as linking groups, —O—, —S—, —SO— and $—SO_2—$;

R_5 is an alkyl chain containing from zero to eight carbon atoms and optionally incorporating in the chain, as a linking group, —O—, —S—, —SO— or $—SO_2—$, or R_5 is a group having the general formula:



wherein

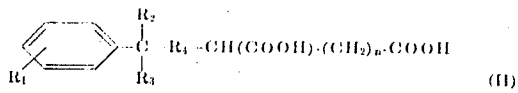
R_6 is hydrogen or an alkyl or substituted alkyl group and m is 0 or 1;

the total number of carbon atoms in the groups R_1, R_2, R_3, R_4 and R_5 is from six to 30; and

n is 0 or 1;

are effective detergency builders and can be used to advantage in detergent compositions.

Preferably, in formula I above, both R_4 and R_5 are alkyl chains containing from zero to eight carbon atoms and optionally incorporating in the chain other atoms as linking groups, for example —O—, —S—, —SO— or $—SO_2—$. Further preferred alkylaryl dicarboxylic acids of the invention are compounds having the general formula:

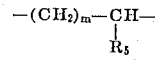


(II)

wherein

R_1, R_2, and R_3 are hydrogen atoms or alkyl groups (preferably linear);

R_4 is an alkyl chain containing from zero to eight carbon atoms, or a group having the general formula:

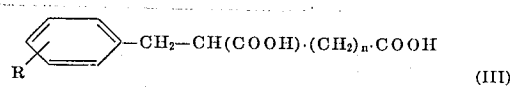


wherein

R is a hydrogen atom or an alkyl group (preferably linear) and m is 0 or 1;

the total number of carbon atoms in the groups R_1, R_2, R_3 and R_4 is from six to 30; and n is 0 or 1.

Particularly preferred alkylaryl dicarboxylic acids of the invention are compounds having the general formula:



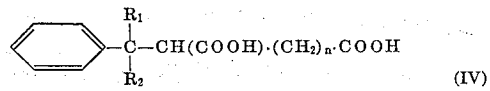
(III)

wherein

R is an alkyl group (preferably linear) containing from eight to 20, preferably from 12 to 16 carbon atoms, and

n is 0 or 1.

Another particularly preferred type of alkylaryl dicarboxylic acids of the invention are compounds having the general formula:



(IV)

wherein

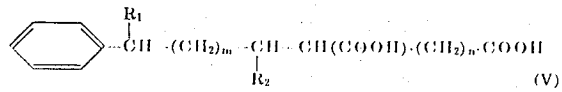
R_1 and R_2 are hydrogen atoms or alkyl groups,

R_1 and R_2 together contain from eight to 20, preferably from 12 to 18, carbon atoms, and

n is 0 or 1.

Preferably R_1 and R_2 make up a linear alkyl chain.

Another particularly preferred type of alkylaryl dicarboxylic acid of the invention are compounds having the general formula:



(V)

wherein

R_1 and R_2 are hydrogen atoms or alkyl groups (preferably linear), R_1 and R_2 together contain from eight to 20, preferably from 12 to 18, carbon atoms,

m is 0 or 1, and

n is 0 or 1.

A detergent composition according to the invention comprises at least one detergent-active compound and at least one water-soluble or water-dispersible salt of an alkylaryl dicarboxylic acid as defined above, the weight ratio of the detergent-active compound to the dicar-

boxylic acid salt being within the range of about 10:1 to about 1:10.

The water-soluble or water-dispersible salt of the alkylaryl dicarboxylic acid is preferably an alkali-metal salt, such as sodium, potassium or lithium salt, sodium salts being particularly preferred, but other cations, such as ammonium and substituted ammonium, may be used if desired.

Preferably the weight ratio of the detergent-active compound to the alkylaryl dicarboxylic acid salt is within the range of about 2:1 to about 1:4.

The alkylaryl dicarboxylic acid salt normally comprises at least about 5 percent, and preferably from about 20 to about 50 percent, by weight of the detergent composition, although even higher levels may be required if the detergent composition is to be used at low concentrations or in water which is particularly hard.

Alkylaryl malonic acid derivatives (ie compounds of formula I above wherein *n* is 0) can be made by malonic ester synthesis techniques in which a sodium malonic acid diester is reacted with a halogen derivative, eg a chlorine derivative, of an alkyl benzene, with the elimination of a sodium halide. The resultant alkylaryl malonic diester is subsequently hydrolyzed to give the desired salt. A variety of materials can be made by the use of different alkyl benzenes halogenated in different positions on either the alkyl radical, in the benzene ring or in other substituent groups in the benzene ring. In some cases it may be necessary or desirable, especially when the halogen atom is attached to the benzene ring, to activate the halogen radical by the presence of other groups such as carboxy groups (preferably esterified with eg methanol or ethanol).

Alkylaryl succinic acid derivatives ie compounds of formula I above wherein *n* is 1) are most conveniently made from alkyl benzenes or derivatives thereof by their reaction with maleic anhydride. Suitable alkyl benzenes are commercially available with a variety of alkyl radicals, but the preferred alkyl benzenes are those with secondary linear C_8–C_{20} alkyl groups and which are commercially available and biodegradable. The reaction can be accomplished by free radical catalysis directly between alkyl benzene and maleic anhydride, in which case the maleic anhydride tends to react at the carbon atom in the alkyl chain adjacent to the benzene ring. Alternatively, the benzene ring may be substituted by some group before reaction with maleic anhydride, in which case the latter can become attached to the substituent group. This is facilitated if the starting material is an alkyl phenol, various types of which are commercially available. For example an alkyl phenol may be reacted with allyl alcohol to give an alkyl phenyl allyl ether which has a terminal unsaturated bond and is readily reacted with maleic anhydride. The resultant alkylaryl succinic anhydride derivative can be hydrolyzed to give the desired salt.

Alkylaryl malonic and succinic acid derivatives corresponding to formula V above may be prepared by reacting an alpha-olefin or an internal olefin with the malonic anhydride or succinic anhydride, and subsequently adding benzene, by a Friedal-Crafts reaction, across the double bond in the alkenyl chain of the resulting alkenyl malonic anhydride or alkenyl succinic anhydride. The anhydride can then be hydrolyzed to obtain its salt.

A detergent composition of the invention will contain at least one detergent-active compound. The water-soluble or water-dispersible salts of the alkylaryl dicarboxylic acids of the invention themselves have some limited detergent-active properties, but as these compounds are deliberately selected for use as precipitant detergency builders, for which purpose they must have substantially water-insoluble calcium salts, these compounds are not considered as detergent-active compounds for the purposes of this specification. The detergent-active content of the composition will generally be from about 5 to about 50 percent, preferably from about 5 to about 35 percent, and particularly preferably from about 10 to about 25 percent, by weight of the composition. The nature of the detergent-active compound or compounds in the composition is not an essential feature of the invention. Any of the detergent-active compounds conventionally incorporated in or proposed for use in fabric-washing detergent compositions may be used, and those skilled in the art of formulating such detergent compositions will be familiar with these detergent-active compounds and the various amounts and combinations in which they may advantageously be used. The detergent-active compound or compounds may be anionic, nonionic, amphoteric or zwitterionic in character.

Typical anionic detergent-active compounds are water-soluble or water-dispersible salts of various organic acids. The cations of such salts are generally alkali-metals, such as sodium and, less preferably, potassium; other cations, such as ammonium and substituted ammonium, can be used if desired. Examples of suitable organic acids are: alkyl benzene sulphonic acids, the alkyl chains of which contain from about eight to about 20 carbon atoms, such as p-dodecyl benzene sulphonic acid, linear alkyl (C_{10-15}) benzene sulphonic acid, 2-phenyl dodecane sulphonic acid, 2-phenyl octadecane sulphonic acid and 3-phenyl dodecane sulphonic acid; the mixtures of sulphonic acids obtained by reacting linear and branched, saturated and unsaturated hydrocarbons, such as alkanes and olefins, particularly linear "cracked-wax" or "Ziegler" alpha-olefins, containing from about eight to about 22 carbon atoms, with sulphur trioxide; alkyl sulphonic acids obtained by reacting alkanes containing from about eight to about 22 carbon atoms with sulphur dioxide/oxygen or sulphur dioxide/chlorine (followed by hydrolysis in the latter case), or by the addition of bisulphite to olefins, particularly linear "cracked-wax" or "Ziegler" alpha-olefins, containing from about eight to about 22 carbon atoms; alkyl sulphuric acids obtained by reacting aliphatic alcohols containing from about eight to about 22 carbon atoms with sulphur trioxide; alkyl ether sulphuric acids, obtained by reacting molar quantities of aliphatic alcohols containing from about six to about 18 carbon atoms with from about 1 to about 15 moles of ethylene oxide, or a suitable mixture of ethylene oxide and propylene oxide, and subsequently reacting the alkoxylated alcohol with sulphur trioxide to yield the required acid; and natural or synthetic aliphatic carboxylic acids, such as those derived from natural sources such as tallows, coconut oil, palm oil, palm kernel oil and groundnut oil.

Examples of suitable nonionic detergent-active compounds are: compounds formed by condensing ethylene oxide with an hydrophobic base formed by the condensation of propylene oxide with propylene glycol; the

polyethylene oxide condensates of alkyl-phenols, eg the condensation products of alkyl-phenols having an alkyl group containing from about six to 12 carbon atoms in either a straight chain or branched chain configuration, with ethylene oxide, the said ethylene oxide being present in amounts equal to 5 to 25 moles of ethylene oxide per mole of alkyl-phenol (the alkyl substituent in such compounds may be derived from polymerized propylene, diisobutylene, octene, dodecene, nonene, for example); those derived from the condensation of ethylene oxide with the product resulting from the reaction of propylene oxide and ethylenediamine, such as compounds containing from about 40 percent to about 80 percent polyoxyethylene by weight and having a molecular weight of from about 5,000 to about 11,000 resulting from the reaction of ethylene oxide groups with a hydrophobic base constituted of the reaction product of ethylenediamine and excess propylene oxide, said hydrophobic base having a molecular weight of the order of 2,500 to 3,000; the condensation product of aliphatic alcohols having from eight to 18 carbon atoms, in either straight chain or branched chain configuration, with ethylene oxide, eg a coconut alcohol-ethylene oxide per mole of coconut alcohol, 6 to 30 moles of ethylene oxide per mole of coconut alcohol, the coconut alcohol fraction having from 10 to 14 carbon atoms; long chain tertiary amine oxides corresponding to the following general formula, $R_1R_2R_3N \rightarrow O$, wherein R_1 is an alkyl radical of from about 8 to 18 carbon atoms and R_2 and R_3 are each methyl, ethyl or hydroxy ethyl radicals, such as dimethyldodecylamine oxide, dimethyloctylamine oxide, dimethyldecylamine oxide, dimethyltetradecylamine oxide and dimethylhexadecylamine oxide, N-bis (hydroxyethyl) dodecylamine oxide; long-chain tertiary phosphine oxides corresponding to the following formula, $RR'R''P \rightarrow O$, wherein R is an alkyl, alkenyl or monohydroxyalkyl radical ranging from 10 to 18 carbon atoms in chain length and R′ and R″ are each alkyl or monohydroxyalkyl groups containing from one to three carbon atoms, such as dimethyldodecylphosphine oxide, dimethyltetradecylphosphine oxide, ethylmethyltetradecylphosphine oxide, cetyldimethylphosphine oxide, dimethylstearylphosphine oxide, cetylethylpropylphosphine oxide, diethyldodecylphosphine oxide, diethyltetradecylphosphine oxide, bis (hydroxymethyl) dodecylphosphine oxide, bis (2-hydroxyethyl) dodecylphosphine oxide, 2-hydroxypropylmethyltetradecylphosphine oxide, dimethyloleylphosphine oxide, and dimethyl-2-hydroxydodecylphosphine oxide; and dialkyl sulphoxides corresponding to the following formula, $RR'S \rightarrow O$, wherein R is an alkyl, alkenyl, beta- or gamma-monohydroxyalkyl radical or an alkyl or beta- or gamma-monohydroxyalkyl radical containing one or two other oxygen atoms in the chain, the R groups ranging from 10 to 18 carbon atoms in chain length, and wherein R′ is methyl, ethyl or alkylol; such dodecyl methyl sulphoxide, tetradecyl methyl sulphoxide, 3-hydroxytridecyl methyl sulphoxide, 2-hydroxydodecyl methyl sulphoxide, 3-hydroxy-4-decyloxybutyl methyl sulphoxide, 3-hydroxy-4-dodecyloxybutyl methyl sulphoxide, 2-hydroxy-3-decyloxypropyl methyl sulphoxide, 2-hydroxy-3-dodecyloxypropyl methyl sulphoxide, dodecyl ethyl sulphoxide, 2-hydroxydodecyl ethyl sulphoxide, dodecyl-2-hydroxy ethyl sulphoxide.

Examples of suitable amphoteric detergent-active compounds are: derivatives of aliphatic secondary and tertiary amines, in which the aliphatic radical may be straight chain or branched and wherein one of the aliphatic substituents contains from about 8 to 18 carbon atoms and one contains an anionic water solubilizing group, such as sodium-3-dodecylaminopropionate, sodium-3-dodecylaminopropanesulphonate and sodium N-2-hydroxydodeecyl-N- methyl-taurate

Examples of suitable zwitterionic detergent-active compounds are: derivatives of aliphatic quaternary ammonium compounds, sulphonium compounds and phosphonium compounds in which the aliphatic radical may be straight chain or branched and wherein one of the aliphatic substituents contains from about eight to 18 carbon atoms and one contains an anionic water solubilizing group, such as 3-(N,N-dimethyl-N-hexadecyl-ammonium) propane-1-sulphonate betaine, 3-(N,N-dimethyl-N-hesacdeyl-ammonium)-2-hydroxypropane-1-sulphonate betaine, 3-(dodecylmethyl-sulphonium) propane-1-sulphonate betaine, and 3-(cetylmethyl-phosphonium) ethane sulphonate betaine.

Further examples of suitable detergent-active compounds commonly used in the art are given in "Surface Active Agents, Volume I" by Schwartz and Perry (Interscience 1949) and "Surface Active Agents, Volume II" by Schwartz, Perry and Berch (Interscience 1958), the disclosures of which are included by reference herein.

The water-soluble or water-dispersible salt or salts of the alkylaryl dicarboxylic acids of the invention present in a detergent composition of the invention may be the only detergency builder or detergency builders in that detergent composition. However, if desired, mixtures of one or more salts of the alkylaryl dicarboxylic acids of the invention with one or more known detergency builders may be used. As one of the objects of the invention is to provide an effective detergent composition containing either no phosphorus or at most only a low level of phosphorus, it is preferred that any such other detergency builders should not be phosphorus-containing compounds. Usually the total amount of detergency builders in a detergent composition of the invention will be from about 5 to about 70 percent by weight of the detergent composition. Many detergency builders are known, and those skilled in the art of formulating fabric-washing detergent compositions will be familiar with these materials. Examples of known detergency builders are sodium tripolyphosphate; sodium orthophosphate; sodium pyrophosphate; sodium trimetaphosphate; sodium ethane-1-hydroxy-1,1-diphosphonate; sodium carbonate; sodium silicate; sodium citrate; sodium oxydiacetate; sodium nitrilotriacetate; sodium ethylenediaminetetraacetate; sodium salts of long-chain dicarboxylic acids, for instance straight chain (C_{10} to C_{20}) succinic acids and malonic acids; sodium salts of alpha-sulphonated long-chain monocarboxylic acids; sodium salts of polycarboxylic acids, ie acids derived from the polymerization or copolymerization of unsaturated carboxylic acids and unsaturated carboxylic acid anhydrides, such as maleic acid, acrylic acid, itaconic acid, methacrylic acid, crotonic acid and aconitic acid, and the anhydrides of these acids, and also from the copolymerization of the above acids and anhydrides with minor amounts of other monomers, such as vinyl chloride, vinyl acetate, methyl methacrylate, methyl acrylate and styrene; and

modified starches such as starches oxidized, for example using sodium hypochlorite, in which some anhydroglucose units have been opened to give dicarboxyl units.

In addition to the detergent-active compounds and detergency builders, a detergent composition of the invention may contain any of the conventional fabric-washing detergent composition ingredients in any of the amounts in which such conventional ingredients are usually employed therein. Examples of these additional ingredients are lather boosters, such as coconut monoethanolamide and palm kernel monothanolamide; lather controllers; inorganic salts such as sodium sulphate and magnesium sulphate; bleaching agents such as sodium perborate, sodium percarbonate, trichloroisocyanuric acid, and sodium and potassium dichloroisocyanurates; antiredeposition agents, such as sodium carboxymethylcellulose; and, usually present only in minor amounts, perfumes, colorants, fluorescers, corrosion inhibitors, germicides and enzymes.

A detergent composition of the invention can be prepared using any of the conventional manufacturing techniques commonly used or proposed for the preparation of fabric-washing detergent compositions, such as slurry-making followed by spray-drying or spray-cooling, and subsequent dry-dosing of sensitive ingredients not suitable for incorporation prior to the drying step. Other conventional techniques, such as noodling, granulation, and mixing by fluidization in a fluidized bed, may be utilized as and when necessary. Such techniques are familiar to those skilled in the art of fabric-washing detergent composition manufacture.

By using such conventional manufacturing techniques, a detergent composition of the invention may be prepared in any of the common physical forms associated with fabric-washing detergent compositions, such as powders, flakes, granules, noodles, cakes, bars and, in some cases, liquids.

The following Examples, in which, unless otherwise stated, all parts and percentages are expressed by weight, illustrate the invention in greater detail.

Examples 1–4

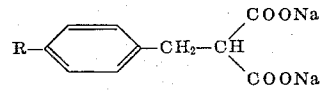
Preparation of disodium p-decyl benzyl malonate

A chloromethylation solution was prepared by treating a mixture of paraformaldehyde (252.8 g) and methanol (256 g) at 10°C with chlorosulphonic acid (1164 g), which was added slowly with stirring so that the temperature was kept below 30°C. The preparation was completed by stirring the mixture for a further 2-3 hours.

Decyl benzene (610 g) was treated with the chloromethylation solution (1022 g) prepared as above, which was added slowly with stirring so that the temperature was kept at about 35°C. The reaction was completed by stirring for a further 4 hours and the mixture was then neutralized with aqueous sodium carbonate. The crude oily product was distilled in vacuo and a middle fraction, equivalent to a crude yield of 87 percent p-decyl-benzyl-chloride, collected.

A solution of sodium ethoxide was prepared by stirring metallic sodium (9.0 g) under anhydrous conditions in dry ethanol (300 ml). Diethyl malonate (55 g) was added dropwise with stirring to this solution at about 50°C and the reaction continued for 15 minutes. p-Decyl-benzyl-chloride (90 g) was then added dropwise and after the initial reaction the mixture was refluxed for a further 3 hours. The ethanol was removed by distillation under reduced pressure and the product taken up in ether. The ether extract was washed neutral with water and then dried and the ether removed by distillation to yield the crude dimalonate ester derivative. The ester was saponified by heating it under reflux for 4 to 5 hours with a 10 percent excess of 10 percent methanolic sodium hydroxide. The solvent was removed and the residue taken up in acetone and filtered, and then washed on the filter with acetone to remove excess alkali and dried to yield 100 g of the required salt.

The same procedure was followed to make the corresponding dodecyl, hexadecyl and octadecyl compounds, with adjustments to the quantities of the reactants so as to use the same molar quantities in each case. The products had the general formula:



(VI)

where

R is n-decyl (Example 1)
n-dodecyl (Example 2)
n-hexadecyl (Example 3)
n-octadecyl (Example 4)

Examples 5–8

The detergency building capacities of the four homologous alkyl benzyl malonates prepared as described in Examples 1 to 4 were determined by the following procedure.

Discs of desized cambric cotton were soiled with a radio-active synthetic sebum, deposited on the discs to the level of 1.5 percent from dilute benzene solution. After drying, the soiled discs were washed in a Terg-O-Tometer (supplied by US Testing Co. Inc.) with detergent solutions, containing 0.1 percent weight by volume of sodium dodecyl benzene sulphonate (prepared from DOB 055 ex Shell Chemicals Ltd) and an amount of the selected detergency builder, at 45°C for 10 minutes in 25°H water (ie 25 parts of calcium carbonate per 100,000 parts of water) at pH 10 using a repeatable degree of agitation at 70 cycles per minute. The percentage detergency of each material was determined by counting the radio-activity of each washed cotton disc before and after washing, and the detergency was calculated by the equation:

$$\text{Detergency} = (A_1 - A_2/A_1) \times 100\%$$

where A_1 is the corrected radio-active count before washing and A_2 is the corrected radio-active count after washing.

The results obtained for the detergency builders of the invention, together with a comparative result using sodium tripolyphosphate, are give in Table I below.

Table I

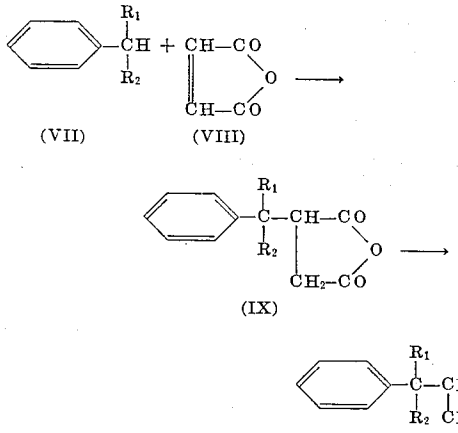
Detergency Builder	Detergency Efficiency at % shown		
	0.2	0.3	0.4
Disodium n-decyl benzyl malonate of Example 1	25	67	75
Disodium n-dodecyl benzyl malonate of Example 2	45	84	89
Disodium n-hexadecyl benzyl malonate of Example 3	24	76	87
Disodium n-octadecyl benzyl			

malonate of Example 4	23	55	70
Sodium tripolyphosphate	52	63	72

These results show that the detergency builders of the invention are effective and, when used at a level of 0.3 percent or above, are equivalent to or better than sodium tripolyphosphate.

Example 9

Preparation of phenylhexadecyl succinate



(VII) (VIII) (IX) (X)

500 ml of hexadecyl benzene (VII) ($R_1 + R_2 = C_{15}$), 25 ml of maleic anhydride (VIII) and 15 g of benzoyl peroxide (acting as a free-radical catalyst) were heated together at 100°C for seven hours. The unchanged hexadecyl benzene was removed by distillation under vacuum, and the residue factionated to give 5 g of phenylhexadecyl succinic anhydride (IX) (B.p. 214°–216°C at 0.2 mm Hg). This was hydrolyzed with caustic soda solution to give the disodium salt (X).

The detergency building properties of compound (X) were tested by incorporating it in a detergent formulation having as essential constituents:

Components	Parts	
	Example 9	Comparative Example A
Sodium dodecyl benzene sulphonate	18	18
Compound (X)	50	—
Sodium tripolyphosphate	—	50
Anhydrous sodium alkaline silicate	10	10
Sodium sulphate	12	12

The detergencies of these two formulations were compared by the same method as used in Examples 5 to 8, except that the water used was 18° hard and contained both calcium and magnesium ions in a weight ratio of 2:1. The detergency of the formulation of Example 9 was tested at several product concentrations. The results are given in Table II below.

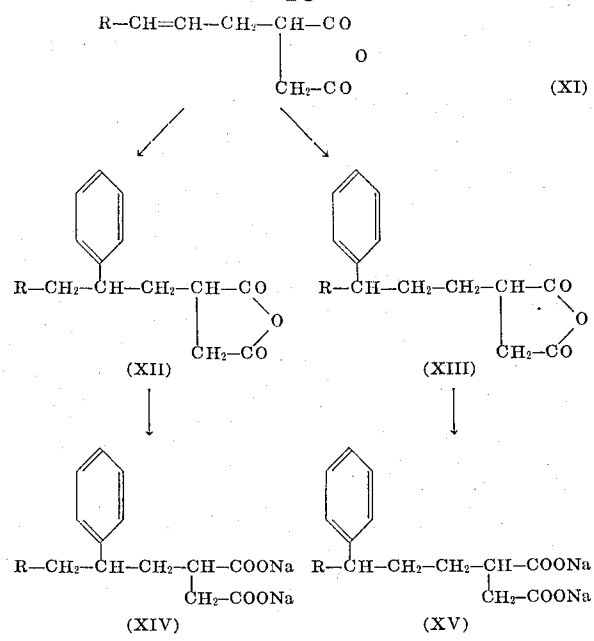
Table II

Formulation	Detergency at a product concentration of: 0.15%	0.20%	0.30%
Example 9	52	76	91
Comparative Example A	77	—	—

These results show that disodium phenylhexadecyl succinate is an effective detergency builder.

Example 10

Preparation of disodium phenylhexadecyl succinate



(XI) (XII) (XIII) (XIV) (XV)

50 g of hexadecenyl succinic anhydride (XI) was dissolved in 200 ml of benzene, 45 g of aluminum chloride was added in small portions so as to maintain the temperature of the reaction mixture at 40°–50°C. The mixture was then refluxed for 1½–2 hours, cooled to 10°C, and slowly diluted with 200 ml of water. 25 ml of concentrated hydrochloric acid was added, and the benzene was removed from the mixture under pressure. The residue was extracted with ether. The combined ether layers were washed with dilute hydrochloric acid and then with water, and dried with anhydrous sodium sulphate before the solvent was removed. The yield was 40 g of a mixture of 5- and 6-phenylhexadecyl succinic anhydride (XII and XIII), which was hydrolyzed to give the disodium salts (XIV and XV).

The detergency of the mixture of compounds XIV and XV was tested by the procedure used in Examples 5 to 8. The following results were obtained.

Table III

Detergency builder	Detergency at 0.15% builder concentration
Disdoium phenylhexadecyl succinates of formulas XIV and XV	60
Sodium tripolyphosphate	79

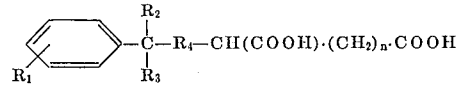
These results indicate that the disodium phenylhexadecyl succinates prepared as above possess reasonable detergency building properties.

What is claimed is:

1. A detergent composition consisting essentially of, by weight:

a. from about 5 to about 50 percent of a detergent-active compound selected from the group consisting of anionic, nonionic, amphoteric and zwitterionic detergent-active compounds; and

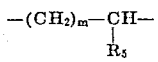
b. at least about 5% of a disodium salt of an alkylaryl dicarboxylic acid having the general formula:



wherein

R_1, R_2 and R_3 are hydrogen atoms or linear alkyl groups;

R_4 is an alkyl chain containing from zero to eight carbon atoms or a group having the general formula:



wherein

R_5 is a hydrogen atom or a linear alkyl group m is 0 or 1;

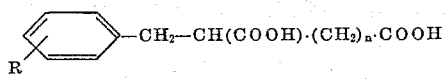
n is 0 or 1; and

the total number of carbon atoms in the groups R_1, R_2, R_3 and R_4 is from six to 30;

the weight ratio of said detergent-active compound to said salt of said alkylaryl dicarboxylic acid being in the range of about 10:1 to about 1:10.

2. A detergent composition according to claim **1** wherein said weight ratio is in the range of about 2:1 to about 1:4.

3. A detergent composition according to claim **2** wherein said alkylaryl dicarboxylic acid has the general formula:

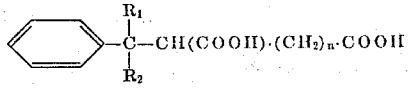


wherein R is a linear alkyl group containing from eight to 20 carbon atoms and n is 0 or 1.

4. A detergent composition according to claim **3** wherein R contains from 12 to 16 carbon atoms.

5. A detergent composition according to claim **4** wherein n is 0.

6. A detergent composition according to claim **2** wherein said alkylaryl dicarboxylic acid has the general formula:

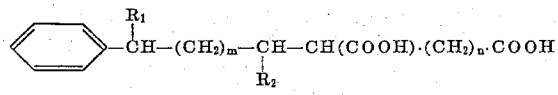


wherein

R_1 and R_2 are hydrogen atoms or linear alkyl groups and together contain from eight to 20 carbon atoms, and n is 0 or 1.

7. A detergent composition according to claim **6** wherein R_1 and R_2 together contain from 12 to 18 carbon atoms.

8. A detergent composition according to claim **2** wherein said alkylaryl dicarboxylic acid has the general formula:



wherein R_1 and R_2 are hydrogen atoms or linear alkyl groups and together contain from eight to 20 carbon atoms, m is 0 or 1 and n is 0 or 1.

9. A detergent composition according to claim **8** wherein R_1 and R_2 together contain from 12 to 18 carbon atoms.

10. A detergent composition according to claim **9** wherein R_2 is a hydrogen atom.

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