United States Patent

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[54] **DETERGENT SOFTENER COMPOSITIONS**
5 Claims, No Drawings

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152, 137, 138, 8.8; 260/309.6; 117/139.5

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ABSTRACT: A detergent composition which also softens textiles and which is nonyellowing and further does not render the textile water repellent, comprising a surface active detergent component and an imidazoline oxide compound.

DETERGENT SOFTENER COMPOSITIONS

The present invention relates to a detergent composition which imparts to textiles laundered therewith an outstanding and superior degree of softness and, in particular, to detergent compositions containing an organic surface active agent as the detersive component, which agent may be anionic, cationic, nonionic, ampholytic or zwitterionic, and preferably anionic, in combination with certain specified imidazoline oxide compounds.

The employment of various compounds and compositions and particularly cationic quaternary ammonium compounds as softeners is very well known and conventional in the art. It is also known to employ these materials for their softening effect during a laundering operation and particularly in the rinse cycle of the laundering process. This technique has been necessitated by the fact that such cationic compounds as heretofor used are not compatible with the major type of detergent presently used in the washing cycle of the laundering operation.

By far the predominating type of detergent used in home laundering as well as in commercial and industrial laundering processes is of the anionic type and more particularly, is of the alkali metal higher alkyl benzene sulfonate type. The use of a cationic substance in conjunction with anionic detergent materials results in a precipitate which is completely ineffective as a fabric softener. This manifestation of incompatibility is also undesirable because it requires more detergent in order to accomplish the necessary and desirable degree of washing efficacy. As a consequence of these difficulties it is generally necessary and conventional to add the presently available cationic softeners to the clothes in the absence of any anionic detergent, and obviously where this is done during washing, it must be accomplished during the rinsing cycle.

Even when the cationic softeners are used in the rinse cycle or indeed as as a treatment for textiles generally apart from a laundering operation there arises still another great disadvantage in the fact that the quaternary ammonium softeners have a tendency to build up water repellency in the treated materials and this effect is cumulative producing after many treatments a water repellent textile which becomes difficulty launderable when soiled. Still another known disadvantage of the cationic softeners lies in their tendency to yellow fabrics when the latter are treated with such compounds whether in a laundering operation at any stage or again as a general treatment for textiles to soften them.

It is therefore, an object of this invention to provide a detergent composition which is not only highly efficacious for washing clothes, but is also outstanding for softening them as well.

It is still another object of this invention to provide both liquid and solid detergent compositions wherein the active detergent ingredient may be any of the conventional detergents such as anionic, cationic, nonionic, ampholytic or zwitterionic in combination with imidazoline oxide compounds whereby there is obtained a coaction between the two components to impart to the textiles laundered with such components an outstanding degree of cleanliness together with a remarkable degree of softness.

It is still another further object of this invention to provide a detergent composition in any suitable physical form from liquid to solid-state including gels, pastes, powders, tablets, etc., and the like which is outstanding in both cleaning and softening textiles therewith and which does not produce a noticeable yellowing of the textile material.

Still another object of this invention lies in the provision of detergent compositions which are characterized as "built" detergents, and which are not only outstanding in their laundering performance but are also superior and unique in producing a nonyellowing, nonwater repellent, soft finish, in laundered goods.

Still another object of this invention lies in providing processes for making and using the detergent compositions of this invention and particularly for using such compositions in a laundering process.

Other objects will appear hereinafter as the description proceeds.

The detergent compositions of this invention comprise (1) any of the conventional surface active detersive agents selected from the general classes of anionic, nonionic, cationic, ampholytic and zwitterionic agents in combination with (2) a higher alkyl-substituted imidazoline oxide compound.

The surface active compound of the compositions of this invention may as noted above be selected from any of the five major classes of detergents which include the anionic, cationic, nonionic, ampholytic and zwitterionic types.

The anionic surface active agents include those surface active or detergent compounds which contain an organic hydrophobic group and an anionic solubilizing group. Typical examples of anionic solubilizing groups are sulfonate, sulfate, carboxylate, phosphonate and phosphate. Examples of suitable anionic detergents which fall within the scope of the invention include soaps such as the water soluble salts of higher fatty acids or rosin acids such as may be derived from fats, oils and waxes of animal, vegetable or mineral origin e.g. the sodium soaps of tallow, grease, coconut oil, tall oil and mixtures thereof; and the sulfates and sulfonated synthetic detergents particularly those having at least 8 and about 8 to 30, and preferably about 12 to 22 carbon atoms, in the molecular structure.

As examples of suitable, synthetic anionic detergents there may be cited the higher-alkyl mononuclear aromatic sulfonates such as the higher-alkyl benzene sulfonates containing from 10 to 16 carbon atoms in the alkyl group in a straight or branched chain e.g. the sodium salts of higher alkyl benzene sulfonates or of the higher-alkyl toluene, xylene, and phenol sulfonates; alkyl naphthalene sulfonate, ammonium diamyl naphthalene sulfonate, and sodium dinonyl naphthalene sulfonate. Mixed long chain alkyls derived from coconut oil, fatty acids and the tallow fatty acids can also be used along with cracked paraffin wax olefins and polymers of lower monoolefins In one preferred type composition there is used a linear alkyl benzene sulfonate having a high content of 3- (or higher) phenyl isomers and a correspondingly low content (well below 50%) of 2- (or lower) phenyl isomers; in other terminology the benzene ring is preferably attached in large part at the 3 or higher (e.g. 4, 5, 6, or 7) position of the alkyl group and the content of isomers at which the benzene ring is attached at the 2 or 1 position is correspondingly low. Particularly preferred materials are set forth in U.S. Pat. No. 3,320,174 of May 16, 1967, to J. Rubinfeld.

Other anionic detergents are the olefin sulfonates including long chain alkene sulfonates, long chain hydroxy alkane sulfonates or mixtures of alkene-sulfonates and hydroxy alkane sulfonates. These olefin sulfonate detergents may be prepared in known manner by the reaction of SO_3 with long chain olefins (of 8–25 and preferably of 12–21 carbon atoms) of the formula $RCH{=}CHR_1$, where R is alkyl and R_1 is alkyl or hydrogen to produce a mixture of sultones and alkene sulfonic acids which mixture is then treated to convert the sultones to sulfonates. Especially good characteristics are obtained by the use of a feed stock containing a major proportion i.e. above 70%, and preferably above 90%, of alpha olefins. Examples of such products are C_{14} alpha olefin sulfonate, C_{16} alpha olefin sulfonate, etc. Examples of other sulfate or sulfonate detergents are paraffin sulfonates, such as the reaction products of alpha olefins and bisulfites (e.g. sodium bisulfite), e.g. primary paraffin sulfonates of about 10–20, preferably about 15–20 carbon atoms; e.g. sodium *n*-pentadecane sulfonate, sodium *n*-octadecyl sulfonate, sulfates of higher alcohol; slats of alphasulfo fatty esters (e.g. of about 10–20 carbon atoms, such as metal alpha-sulfo myristate or alpha-sulfo tallowate).

Examples of sulfates of higher alcohols are sodium lauryl sulfate, sodium tallow alcohol sulfate; turkey red oil or other sulfated oils, or sulfates of mono- or diglycerides of fatty acids (e.g. stearic monoglyceride monosulfate), alkyl poly (etheneoxy) ether sulfates such as the sulfates of the condensation products of ethylene oxide and lauryl alcohol (e.g. with 1–20 etheneoxy groups per molecule); lauryl or other higher

alkyl glycerol ether sulfonates; aromatic poly (ethyeneoxy) ether sulfates such as the sulfates of the condensation products of ethylene oxide and nonyl phenol (e.g. having 1–10 etheneoxy groups per molecule and usually from 2–10 such groups).

The suitable anionic detergents include also the acyl sarcosinates (e.g., sodium lauroyl sarcosinate), the acyl esters (e.g. oleic acid ester) of isothionates, and the acyl N-methyl taurides (e.g. potassium N-methyl lauroyl or oleoyl tauride). In each instance the acyl moieties usually vary from fatty C_{10} to C_{20} and preferably C_{12} to C_{16}.

The most highly preferred water soluble anionic detergent compounds are the ammonium and substituted ammonium (such as mono, di- and triethanolamine), alkali metal such as sodium and potassium and alkaline earth metal (such as calcium and magnesium) salts of the higher alkyl benzene sulfonates, olefin sulfonates and higher alkyl sulfates, and the higher fatty acid monoglyceride sulfates. The particular salt will be suitably selected depending on the particular formulation and the proportions therein. Mixtures of various cations can also be used.

Nonionic surface active agents include those surface active or detergent compounds which contain an organic hydrophobic group and a hydrophilic group which is a reaction product of a solubilizing group such as carboxylate, hydroxyl, amido or amino with an alkylene oxide e.g. ethylene oxide or with the polyhydration product thereof e.g. polyethylene glycol.

As examples of such nonionic surface active agents there may be noted the condensation product of alkyl phenol with ethylene oxide, e.g. the reaction product of nonyl phenol with about 6–30 ethylene oxide units; condensation products of alkyl thiophenols with 10–15 ethylene oxide units; condensation products of higher fatty alcohols such as tridecyl alcohol with ethylene oxide; ethylene oxide addends of monoesters of hexahydroic alcohols and inner ethers thereof such as sorbitan monolaurate, sorbitol mono-oleate and mannitan monopalmitate, and the condensation products of polypropylene glycol with ethylene oxide.

Other nonionics include the alkylolamine condensates of higher fatty acids, such as lauric and myristic mono- and diethanolamide; the higher alkyl amine oxides such as as lauryl dimethyl amine oxide, lauryl bis (hydroxy ethyl) amine oxide; higher alkyl mono- and disulfoxides, phosphine oxides and the like.

Cationic surface active agents may also be employed. Such agents are those surface active detergent compounds which contain an organic hydrophobic group and a cationic solubilizing group. Typical cationic solubilizing groups are amine and quaternary groups.

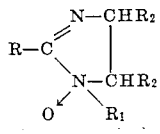
As examples of suitable synthetic cationic detergents there may be noted that diamines such as those of the type $RNHC_2H_4NH_2$ wherein R is an alkyl group of about 12–22 carbon atoms, such as N-2-aminoethyl stearyl amine and N-2-aminoethyl myristyl amide; amide-linked amines such as those of the type $R_1CONHC_2H_4NH_2$ wherein R_1 is an alkyl group of about 9–20 carbon atoms, such as N-2-aminoethyl stearyl amide and N-amino ethyl myristyl amide; quaternary ammonium compounds wherein typically one of the groups linked to the nitrogen atom is an alkyl group of about 12–18 carbon atoms and three of the groups linked to the nitrogen atom are alkyl groups which contain 1–3 carbon atoms including such 1–3 carbon atoms alkyl groups bearing inert substituents, such as benzyl group, and there is present an anion such as halogen, acetate, methylsulfate, etc. Typical quaternary ammonium detergents are ethyl dimethyl stearyl ammonium chloride, benzyl dimethyl stearyl ammonium chloride, trimethyl stearyl ammonium chloride, trimethyl cetyl ammonium bromide, dimethyl ethyl lauryl ammonium chloride, dimethyl propyl myristyl ammonium chloride, and the corresponding methosulfates, acetates, etc.

Examples of suitable ampholytic detergents are those containing both the anionic and cationic group having a hydrophobic organic group, which is advantageously a higher aliphatic radical, e.g. about 10–20 carbon atoms. Among these are the N-long chain alkyl amino carboxylic acids [e.g. of the formula $RR_2NR'COON$]; N-long chain alkyl imino dicarboxylic acids (e.g. of the formula $RN(R'COOM)_2$) and the N-long chain alkyl betaines (e.g. of the formula $RR_3R_4N^+$ ——$R'COO^1$) where R is a long chain alkyl group, e.g. of about 10–20 carbons, R' is a divalent radical joining the amino and carboxylic portions of an amino acid (e.g. an alkylene radical of 1–4 carbon atoms), M is hydrogen or a salt forming metal, $R_2$is a hydrogen or another mono valent substituent (e.g. methyl or other lower alkyl), and R_3 and R_4 are mono valent substituents joined to the nitrogen by carbon-to-nitrogen bonds (e.g. methyl or other lower alkyl substituents). Examples of specific ampholytic detergents are N-alkyl-beta amino propionic acids; N-alkyl-beta-imino dipropionic acids and N-alkyl, N, N-dimethyl glycine; the alkyl group may be for example that derived from coco fatty alcohol, lauryl alcohol, myristyl alcohol (or a lauryl-myristyl mixture), hydrogenated tallow alcohol, cetyl, stearyl or blends of such alcohols. The substituted amino propionic and imino dipropionic acids are often supplied in the sodium of other salt forms which may likewise be used in the practice of this invention. Examples of other amphoteric detergents are the fatty imidazolines such as those made by reacting a long chain fatty acid (e.g. of 10–20 carbon atoms) with diethylene triamine and monohalo carboxylic acids having 2–6 carbon atoms, e.g. 1-coco-5-hydroxyethyl-5-carboxyethyl imidazoline; betaines containing a sulfonic group instead of a carboxylic group; betaines in which the long chain substituent is joined to the carboxylic group without an intervening nitrogen atom e.g., inner salts of 2-trimethylamino fatty acids such as 2-trimethylaminolauric acid, and compounds of any of the previously mentioned types in which the nitrogen atom is replaced by phosphorous.

The preferred anionic detergent compounds are selected from the general class of the linear alkyl benzene sulfonates, and olefin sulfonates, and particularly those characterized by a linear alkyl or alkenyl chain from $C_{10}$to C_{22}. It is, of course, understood that the carbon chain length represents in general an average chain length since the methods for producing such products usually employ reagents of mixed chain lengths. Substantially pure olefins, as well as alkylating compounds which are used in other techniques can be employed to give alkylated benzenes, wherein the alkyl moiety is substantially (i.e. at least 90%) of one chain length, i.e. C_{12}, C_{13}, C_{14}, etc. Still further, it is preferred that the linear alkyl benzene sulfonates contained a low content of 2-phenyl isomers thereof. The most preferred isomers are those which contain below about 35% of the 2-phenyl material. In producing olefin sulfonates, a similar situation obtains, i.e. use of mixed olefin chain length feed stock. However, again olefins of substantially one chain length are available and may be used to make the sulfonate detergent.

Water soluble builder salts may also be present, in the usual proportions, in the detergent formulation where heavy duty cleaning is desired. These salts include phosphates and particularly condensed phosphates (e.g. pyrophosphates and tripolyphosphates), silicates, borates, and carbonates (including bicarbonates), as well as organic builders such as salts of nitrilotrilacetic acid or ethylenediaminetetracetic acid. Sodium and potassium salts are preferred, although alkaline earth metals, amine, alkylolamine and ammonium are contemplated. Specific examples are sodium tripolyphosphate, potassium pyrophosphate, sodium hexametaphosphate, sodium carbonate, sodium bicarbonate, sodium sesquicarbonate, sodium tetraborate, sodium silicate, salts (e.g. sodium slats) of methylenediphosphonic acid, trisodium nitrilotriacetate, or mixtures of such builders, including mixtures of pentasodium-tripolyphosphate and trisodium nitrilotriacetate in a ratio, of these two builders, of 1:10 to 10:1, e.g., 1:1. The proportions of builder salt may be for example 50 parts or more (e.g. 50 to 1000 parts) per 100 parts of detergent.

The imidazoline oxide compounds useful in the present invention are characterized by the following formula:



R is a higher alkyl group from about C_{10} to about C_{30} and which may be saturated or unsaturated; R_1 is lower alkyl, e.g. C_1 to C_4: lower alkylol from C_1 to C_4, simple derivatives of lower alkyl such as haloalkyl, cyanoalkyl, alkoxyalkyl, and even those alkyl derivatives which contain water solubilizing groups such as carboxylic and sulfonic acid groups present preferably in their salt form; R_2 may be hydrogen, lower alkyl, halogen, hydroxy, sulfonyl alkyl, sulfonamide, carboxamide, as well as simple derivatives of alkyls such as haloalkyl, hydroxyalkyl and the like. The preferred compounds are those wherein the higher alkyl R groups range from C_{14} to about C_{20}, the R_1 groups are lower alkyl of 1–5 carbon atoms and lower alkylol and preferably 2-hydroxyethyl, and the R_2 groups preferably hydrogen.

Illustrative higher alkyl groups suitable as the R groups include:

n-hexyl
isohexyl
n-heptyl
isoheptyl
n-octyl
isooctyl
n-nonyl
isononyl
n-decyl
n-dodecyl
tert-dodecyl
2-propylheptyl
5-ethylnonyl
2-butyloctyl
n-undecyl
n-tridecyl
n-tetradecyl
n-pentadecyl
tert-octadecyl
2, 6, 8-trimethylnonyl
7-ethyl-2-methyl-4-undecyl
n-hexadecyl
n-octodecyl
eicosyl
docosyl
tricosyl
pentacosyl
triacontyl etc.

Among the unsaturated moieties there may be employed:

decenyl
dodecenyl
tetradecenyl
hexadecenyl
heptadecenyl
octadecenyl
eicosenyl
n-hexenyl
isohexenyl
n-heptenyl
isoheptenyl
n-octenyl
iso-octenyl
n-nonenyl
isononenyl
n-decenyl
n-dodecenyl
tert-dodecenyl
2-propylheptenyl
5-ethylnonenyl
2-butyloctenyl
n-undecenyl
n-tridecenyl

n-tetradecenyl
n-pentadecenyl
tert-octadecenyl
2, 6, 8-trimethylnonenyl
7-ethyl-2-methyl-4-undecenyl
n-hexadecenyl
n-octadecenyl
eicosenyl
docosenyl
tricosenyl
pentacosenyl
triacontenyl, etc.

The higher alkyl R radicals, whether they are saturated or unsaturate, may be of the linear or nonlinear, i.e. branched chain, types. It is preferred, however, that the R groups be straight chain, i.e. linear. Where an unsaturated higher alkyl moiety is employed, the double bond may be present anywhere in the chair, and as a matter of fact, it may also be possible to employ alkyls containing two or three unsaturation points, although these are much less preferred.

Those imidazoline compounds which are useful in the present invention include the following:

1-ethyl-2-decyl-1-imidazoline oxide
1-methyl-2dodecyl-1 -imidazoline oxide
1-methyl-2-tridecyl-1-imidazoline oxide
1-propyl-2-tetradecyl-1-imidazoline oxide
1-butyl-2-hexadecyl-1-imidazoline oxide
1-pentyl-2-octadecyl-1-imidazoline oxide
1-isopropyl-2-nonadecyl-1-imidazoline oxide
1-isobutyl-2-eicosyl-1-imidazoline oxide
1-(2-methylbutyl)-2-uncosyl-1-imidazoline oxide
1-(2-hydroxyethyl)-2-pentadecyl-1-imidazoline oxide
1-(2-hydroxypropyl)-2-pentacosyl-1-imidazoline oxide
1-(2-hydroxybutyl)-2-tricosyl-1-imidazoline oxide
1-(2-hydroxypentyl)-2-triacontyl-1-imidazoline oxide
1-(3-hydroxypropyl)-2-docosyl-1-imidazoline oxide
1-(3-hydroxybutyl)-2-decenyl-1-imidazoline oxide
1-(4-hydroxypentyl)-2-dodecenyl-1-imidazoline oxide
1-ethyl-2-tridecenyl-1-imidazoline oxide
1-methyl-2-tetradecenyl-1-imidazoline oxide
1-methyl-2-pentadecenyl-1-imidazoline oxide
1-propyl-2-hexadecenyl-1-imidazoline oxide
1-butyl-2-heptadecenyl-1-imidazoline oxide
1-pentyl-2-octadecenyl-1-imidazoline oxide
1-isopropyl-2-eicosenyl-1-imidazoline oxide
1-isobutyl-2-pentacosenyl-1-imidazoline oxide
1-(2-methyl butyl)-2-octacosenyl-1-imidazoline oxide
1-(2-hydroxyethyl), 2-n-heptadecenyl, 1-imidazoline oxide
1-(2-hydroxyethyl), 2-n-octadecenyl, 1-imidazoline oxide
1-(2-hydroxyethyl), 2-n-eicosenyl, 1-imidazoline oxide
1-ethyl, 2-n-heptadecenyl, **-n-heptadecenyl, imidazoline oxide**
1-n-propyl, 2-n-heptodecenyl, 1-imidazoline oxide
1-isopropyl, 2-n-heptadecenyl, 1-imidazoline oxide
1-isobutyl, 2-n-heptadecenyl, 1-imidazoline oxide
1-(2-hydroxyethyl), 2-n-decyl, 1-imidazoline oxide
1-(2-hydroxyethyl), 2-octadecyl, 1-imidazoline oxide
1-(3-hydroxypropyl), 2-n-heptadecynl, 1-imidazoline oxide
1-(2-hydroxyethyl), 2-dodecyl, 1-imidazoline oxide
1-(2-hydroxyethyl), 2-tetradecyl, 1-imidazoline oxide
1-(a-hydroxyethyl), 2-hexadecyl, 1-imidazoline oxide
1-(2-hydroxyethyl), 2-n-heptadecenyl, 3,4-dimethyl, 1-imidazoline oxide
1-ethyl, 2-n-heptadecenyl, 3,4-diethyl, 1-imidazoline oxide
1-(2-hydroxyethyl),-2-n-heptodecyl-1-imidazoline oxide
1-isobutyl-2-n-octodecyl-1-imidazoline oxide

The quantity of imidazoline oxide compounds may vary considerably in the composition of this invention. Generally, the imidazoline oxides should comprise from about 1% to about 20% by weight of the detergent composition with a preferred range being from 2–10% by weight.

In "built" detergents, the organic cleaning agent, i.e. the anionic, nonionic, etc., compound, may comprise from about 5% to upwards of 75% by weight of the total formulation, and usually varies from 5% to 35% by weight. In liquid compositions, the amount of water used is relatively high in order to

obtain pourable and generally stable systems. In these, total solids may vary from a few percent, i.e. 2–10%, upwards of about 50–60% with the organic detergent present, usually in amounts from about 2–25% and preferably 5–15%. In solid formulation, i.e., powder, etc., total solids may run as high as 90% or more and here the organic detergent may be used at the high concentrations above indicated, but usually the range is 5–25%. The second major component of the "built" or heavy duty liquids, and this is true of the solid (i.e. powdered or tableted types) formulations also, is the alkaline builder salt, and the amount thereof again may vary considerably e.g. from 5–75% of the total composition. In solid formulations larger percentages are generally employed e.g. 15–50%, whereas in the liquid types the salts are used in lesser amounts e.g. 5–25% by weight of the total composition.

In any of the contemplated systems the amount of the imidazoline oxide softener will be governed primarily by economic considerations, since as pointed out above as little as 1% thereof based on the total detergent formulation gives noticeable and marked softening effects. Of course, it is understood that to obtain a significant degree of softening based on the above figures, one is expected to employ the detergent composition in its usual amount, which based on the wash water, is about 0.15% and based on the "load" is about 2.5%. From these figures it is evident that significant softening is obtained where the softener is used at extremely low concentrations e.g. 0.02% by weight based on the clothing load and in the neighborhood of 0.001% when calculated on the basis of the treating bath e.g. wash water and the like.

In view of the wide latitude in the concentrations of the components of detergent compositions, it is convenient to define the amount of softener to be used in terms of the organic detergent present. A useful and operative range of detergent to softener is 40:1 to 1:10, preferably 15:1 to 1:2 and most preferred is a range of 5:1 to 1:1. In formulating the aqueous, liquid, pourable, detergent compositions of this invention, it is desirable to have present adjuvants for improving, if necessary, and/or desired the homogeneity and pourability (i.e. viscosity) thereof. Particularly useful are the nondetergent alkali metal benzene sulfonates, such as sodium toluene sulfonate, sodium xylene sulfonate, and sodium cumene sulfonate; and water soluble alcohols, preferably saturated, aliphatic, monohydric alcohols such as ethanol and isopropanol. Such additives are especially advantageous in heavy duty formulations containing large amounts of builder salts. These compounds may be used singly or in admixtures in amounts from about 1% to about 20% by weight based on the total weight of the aqueous composition.

The following Examples will serve to illustrate the present invention without being limited thereof. Parts are by weight unless otherwise indicated.

Example I

A composition of the following components is formulated;

sodium linear tridecyl benzene sulfonate	11.0%
1-(2-hydroxyethyl), 2-*n*-hectadecenyl, 1-imidazoline oxide	10.3 10.3%
pentasodium tripolyphosphate	40.0%
sodiumcarboxy methylcellulose	1.0%
a stilbene brightener	0.2%
a triazole brightener	0.1%
sodium sulfate	27.4%
water	10.0%

The above composition, obtained as a drum dried powder from a slurry of the components at a concentration of 39% solids and water, is then used in a normal washing procedure to ascertain the degree of softening and cleansing obtained with the composition. In a normal laundering operation wherein the clothes are put through the normal sequence of a wash cycle, a spin, a rinse and several spin-drying cycles, 10 grams of the above formulation is used in combination with a load of terry cloth towels. After the final spin cycle the towels are dried and rated as to softness on a scale of 1–10. A rating of 1 corresponds to the results obtained with the above composition in the absence of the imidazoline oxide softener, and such a rating indicates that the towels are quite harsh. A rating of 10 is considered excellent insofar as softness and fluffiness are concerned. A rating of 5, generally, can not be distinguished by the layman from a rating of 1. Ratings of 8 to 10 are notably and outstandingly soft. In the instant examples, the towels are found to have a rating on the softness scale of 10. In this example, the towels employed are unsoiled but significantly no effect on the towels insofar as whiteness is concerned is obtained as a result of the presence of the imidazoline oxide softener.

Example II

Example I is repeated, except that in place of the imidazoline oxide used in that example, there are used the following:

a. 1-(2-hydroxyethyl), 2-*n*-heptadecyl, 1-imidazoline oxide
b. 1-(2-hydroxyethyl), 2-n-octadecyl, 1-imidazoline oxide
c. 1-(2-hydroxyethyl), 2-n-eicosyl, 1-imidazoline oxide
d. 1-(3-hydroxy n-propyl). 2-n-heptadecenyl, 1-imidazoline oxide
e. 1-(2-hydroxyethyl), 2-n-eicosenyl, 1-imidazoline oxide
f. 1-ethyl, 2-n-heptadecenyl, 1-imidazoline oxide
g. 1-isobutyl, 2-n-octadecyl, 1-imidazoline oxide
h. 1-(2-hydroxyethyl), 2-n-decyl, 1-imidazoline oxide
i. 1-(2-hydroxyethyl), 2-n-dodecyl, 1-imidazoline oxide

The results obtained in each of the above instances are excellent insofar as the softening characteristics are concerned.

Example III

A composition of the following is formulated:
10 grams linear dodecyl benzene sulfonate
40 grams sodiumtripolyphosphate
4 grams of the imidazoline oxide of Example I

Terry cloth towels laundered, using a conventional wash cycle spin, rinse cycle, and spin-dry cycles are found to have a softness rating of 10 plus.

Example IV

The preceding example is repeated except that in place of the benzene sulfonate there are used 10 grams of a C_{14} linear aliphatic alcohol condensed with 9 moles of ethylene oxide as the surfactant, and in place of the 4 grams of imidazoline oxide only 2.5% grams are employed.

The results obtained with this composition are comparable to the preceding example.

Example V

This example illustrates the preparation and use of a heavy duty liquid formulation.

Ingredient	%	Active %
linear dodecyl benzene sulfonate sodium salt (50%	20%	10%
sodium xylene sulfonate solution (40%)	20%	8%
imidazoline oxide of Example I	4%	4%
tetrapotassium pyrophosphate (60%)	25%	15%
water	31%	31%

The above formulation results in a clear, single phase, liquid composition. When employed in the usual manner in a laundering operation employing terry cloth towels, the formulation results in the production of clean towels which have a softness rating of 10 plus.

Example VI

The previous example is repeated except that the benzene sulfonate is replaced in each and separate instances by the following anionic detergent compounds:

a. sodium lauryl sulfate in an amount to provide 10% active component

b. a mixture of linear dodecyl benzene sulfonate, sodium salt, and sodium lauryl sulfate in a one to one weight ratio to provide a total of 10% active ingredient

c. sodium alkenyl sulfonate wherein the alkenyl moiety consists of 20% C_{15}, 29% C_{16}, 28% C_{17}, 14% C_{18}, and 1% C_{19}. This surfactant material is used to provide 10% actives in the formulation.

In each instance the results obtained are comparable to those obtained in Example V.

Example VII

Example V is once again repeated except that part of the pyrophosphate is replaced by sodium nitrilotriacetate to provide 12.5% actives of the pyrophosphate and 7.5% actives of the nitrilotriacetate. The results obtained are excellent insofar as the softness rating is concerned.

Example VIII

Example V is once again repeated, but in this instance all of the pyrophosphate is replaced by sodium nitrilotriacetate whereby 15% actives of the latter are employed. The softness characteristics of the tested terry cloth towels are found to be outstanding with a rating of at least 10.

In each of the above examples, 6 through 8, it is of course understood that the water content is adjusted as required to give 100% total of the listed ingredients.

Example IX

Each of the four liquid formulations prepared in Examples V and VI is repeated except that in place of 8% actives of the sodium xylenesulfonate there are used 5% actives of this material and again the water content is adjusted accordingly.

Example X

Example IX is again repeated except that in place of sodium xylenesulfonate there are used the following hydrotropic materials in the amounts indicated.

a. 5% active sodium toluene sulfonate

b. 7% active sodium toluene sulfonate

c. 3% active sodium cumene sulfonate

d. 6% active sodium cumene sulfonate

e. 10% active sodium cumene sulfonate

In each instance the results are again found to be outstanding insofar as the softness of the resultant cleansed towels are concerned.

Example XI

Examples V and VI are once again repeated except that the tetrapotassium pyrophosphate used in these examples to the extent of 15% active is replaced by the same material to the extent of 5% active component. The water content is adjusted accordingly. The results obtained are comparable to those produced in the preceding examples, the towels being outstandingly soft and having a rating in the area of 8–10.

Example XII

Examples V and VI are once again repeated except that the inorganic builder, tetrapotassium pyrophosphate, used in these examples is replaced by the following inorganic builder salts in the amount indicated:

a. 10% sodium carbonate

b. 15% sodium borate

c. 7.5% sodium borate

d. 15% sodium carbonate

Once again the results produced are outstanding with all of the towels being outstandingly satisfactory in their softness characteristics.

Example XIII

In this and the following examples there are illustrated compositions containing an imidazoline oxide softener described in the present invention in combination with other ingredients which formulations may be employed either in the wash cycle of a conventional laundering operation or in a rinse cycle since no detergent material is employed in these formulations.

A composition is prepared of the following ingredients.

Ingredient	%
1-(2-hydroxyethyl), 2-*n*-heptadecenyl, 1-imidazoline oxide	12.5
sodium xylene sulfonate	10.0
polar brilliant blue, 1% solution	1.5
perfume	0.1
water	To 100%

The above ingredients are blended and stirred with moderate heat to produce a homogeneous, albeit opaque liquid. The liquid is then used in conjunction with a conventional powdered detergent formulation in a washing machine to the extent of 60 grams of the said liquid in conjunction with about 3/4 cup of powdered detergent. Towels laundered with this combination are found to have a rating of 10.

Example XIV

A composition of the following components is formulated:

1-(2-hydroxyethyl), 2-*n*-heptadecenyl, 1-imidazoline oxide (12.6% active ingredient)	30.00%
Ditallow dimethyl ammonium chloride (0.25% active ingredient)	0.50%
Polar brilliant blue (1% active ingredients)	0.60%
Perfume	0.10%
Water	To 100%

The above composition was then used in a normal washing procedure to ascertain the degree of softening and cleaning obtained with the composition as in Example I. The towels received a rating of 10.

Example XV

A composition of the following components is formulated:

1-(2-hydroxyethyl), 2-*n*-heptadecenyl, 1-imidazoline oxide	12.5%
Sodium xylene sulfonate	10.0%
Polar Brilliant Blue, 1% solution	1.5%
Perfume	0.1%
Water	To 100%

The above composition was then employed as a wash cycle fabric softener by addition thereof during the wash cycle of a normal washing procedure so as to ascertain the degree of softening thereof. The towels which were employed during the washing procedure received a rating of '10.

Example XVI

A composition of the following components is formulated:

Sodium linear alkyl benzene sulfonate, average C_{13} 1-(2-hydroxyethyl), 2-*n*-heptadecynl, 1-imidazoline oxide	10.% 4.0%
Sodium xylene sulfonate	8.0
Potassium pyrophosphate	15.0%
Water	to 100%

The above composition was then employed as a heavy duty liquid detergent by addition thereof during the wash cycle of a normal washing procedure, so as to ascertain the degree of

softening thereof. The towels which were employed during the washing procedure received a rating of 10.

Example XVII

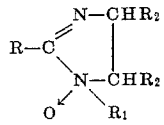
A composition of the following components is formulated:

2-coco-1-imidazoline oxide (12.7% active ingredients)	23.0%
Sodium xylene sulfonate (8% active ingredients)	20.0%
A stilbene brightener	1.5%
Water	to 100%

The above composition was then used in a normal washing procedure to ascertain the degree of softening and cleansing obtained with the composition as in Example I. The towels received a rating of 10.

What is claimed is:

1. A detergent-fabric softening composition consisting essentially of an imidazoline oxide compound having the formula



wherein R is selected from the group consisting of higher alkyl and higher alkenyl groups having from about 10 to about 30 carbon atoms, R_1 is selected from the group consisting of lower alkyl, lower alkoxy, lower alkyl, halo lower alkyl, and and R_2 is selected from the group consisting of hydrogen, lower alkyl, halogen, hydroxy, sulfonyl alkyl, sulfonamide, carboxamide, haloalkyl and hydroxyalkyl wherein the alkyl portion is in the range of 6–20 carbon atoms, and a detergent selected from the group consisting of anionic, nonionic, cationic, ampholytic and zwitterionic detergents, wherein said imidazoline oxide is present in an amount of about 1 to about 20 percent by weight and said detergent is present in an amount of from about 5 to about 75 percent by weight.

2. The detergent-fabric softening composition of claim 1 wherein the detergent is a higher alkyl (10–20 carbon atoms) mononuclear aromatic sulfonate.

3. The detergent-fabric softening composition of claim 1 wherein the detergent is a linear alkyl benzene sulfonate wherein the alkyl portion is in the range of 10–20 carbon atoms.

4. The detergent-fabric softening composition of claim 1 wherein the imidazoline compound is 1-(2-hydroxyethyl)2-n-heptadecenyl-1-imidazoline oxide.

5. The detergent-fabric softening composition of claim 1 which contains, in addition to the detergent component and the imidazoline component, a water-soluble builder salt.