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DETERGENT COMPOSITION

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The present invention relates to improved detergent compositions in the field of the so-called "nonionic" detergents.

An object of the present invention is to raise the measured detergency value of nonionic detergents to a level far above that previously attainable. This and other objects of the invention are accomplished by the addition of a builder and a base to the nonionic detergent.

The nonionic detergents are all condensation products of ethylene oxide and a nucleus which may vary from one product to another. Likewise, the number of mols of ethylene oxide used for each mole of the nuclear compound may vary. Among the nonionics which have been satisfactorily built to a high detergency value by the present invention are listed the following:

Detergent	Manufacturer's Definition		
	Nucleus	Mols of Ethylene Oxide	Cloud Point, ° C.
Triton X-100	Iso-octyl phenol	10	62
Energetic W-100	Alkylated Phenol		53
Sterox SK	Mercaptan		48
Sterox AJ	Alcohol		
Nonic 218	Tertiary dodecyl-mercaptan.		59
Nonic 261	do		
Synthetics AR-150	Rosin Acids		61
Synthetics AF-150			93

The cloud points are given to further characterize the detergents, it being known that this temperature point is determined by the length of the polyoxyethylene chain which forms the solubilizing group of the nonionic detergent.

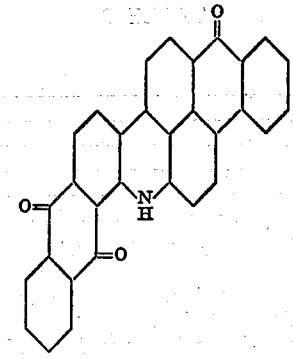
The builder found most satisfactory for purposes of this invention is a water-soluble anionic polyelectrolyte, namely the sodium salt of styrene-maleic anhydride copolymer sold by Monsanto Chemical Company as Stymer S. The bases found useful for purposes of this invention appear to be limited to ammonia and organic amides as ordinarily used bases such as the phosphates and the carbonates appear to impair rather than enhance the "building" properties of the Stymer S.

It appears that the maximum detergency value of nonionics built in accordance with this invention is obtained at about pH 10. As the pH of the mixture is lowered from pH 10, the detergency value is progressively lowered also, but raising the pH above pH 10 does not appear to effect any substantial change. It is believed that amines or ammonia are essential to maintain a buffered solution in which the pH is held at or near the optimum, particularly in the presence of the ordinary contaminating materials found in laundering dirty articles.

In the following description and examples detergency value is expressed in terms of a "detergency ratio" based on controlled laundering of samples soiled with pigment. "Detergency ratio" is determined as follows:

A sample of prepared and bleached type 180 cotton

sheeting is padded with about 65% of its weight of a dispersion of 30 grams Amanthrene Olive Green B Paste per liter and allowed to dry at room temperature. Amanthrene Olive Green B is a vat color having the formula:



The soiled fabric has then a reflectance of 25–30%. Swatches of 2" x 4" are then cut from the soiled fabric and a safety pin is attached to one 2-inch end of each swatch to serve as a weight. Individual swatches are then scoured in the generally known way in the Atlas Launderometer (Technical Manual and Year Book of the American Association of Textile Chemists and Colorists). Each glass jar contains one fabric sample, 200 ml. detergent solution and 5 rubber stoppers #0 and the mouth of the jar is covered with a stainless steel disc to prevent entrapment of the swatch in the lid of the jar. The launderometer is run for 30 minutes after which the samples are rinsed in the jars 3 times with 200 ml. water. Four samples are run for each detergent composition or concentration and the results averaged. The samples are allowed to dry at room temperature.

Four samples are always run with 0.25% of an 80% tallow soap in distilled water as a standard.

The reflectances of the samples are measured with a Photovolt photoelectric reflectometer under a tristimulus green filter. The reflectance of each sample is measured before and after scouring. After the reflectance differences are formed and averaged, the "detergency ratio" is determined by the following formula.

$$D=100\frac{R_d}{R_s}$$

R_d is the reflectance increase produced by the detergent. R_S is the reflectance increase produced by 0.25% tallow soap.

To demonstrate the importance of the base used to obtain the proper pH in the compositions of this invention, a stock solution of 0.2% Triton X-100 and 0.05% Stymer S was prepared and divided into five portions. To each of these portions, there was added 0.2% of one of the following bases; namely, tetrasodium pyrophosphate, borax, soda ash, disodium phosphate and ethanolamine. The detergency ratio of each of these five compositions was determined by the procedure outlined above at a wash temperature of 180° F. and the results are tabulated in Table "A" below:

TABLE A

Base:	Detergency ratio
Tetrasodium pyrophosphate	93
Borax	98
Soda ash	82
Disodium phosphate	107
Ethanolamine	170

Another stock solutionf of 0.2% Triton X–100 and 0.05% Stymer S was divided into five portions for demonstrating the effect of pH in the laboratory. The pH of each portion was adjusted to the values shown in Table B below with small amounts of hydrochloric acid or sodium hydroxide and the detergency ratio of each portion was determined by the procedures outlined above at a wash temperature of 180° F. The results are shown in Table B, below:

TABLE B

pH:	Detergency ratio
8.0	130
9.1	150
10.1	165
11.0	173
11.5	161

It should be noted that this procedure was for the purposes of laboratory evaluation only, as contaminants under ordinary laundry conditions might cause the pH to shift in either direction, depending on the nature of the contaminating materials.

The invention will be better understood by reference to the following examples.

Example 1

To 0.2% of Triton X-100, which has an unbuilt detergency ratio of 85 at a wash temperature of 180° F. and of 90 at 140° F., was added .05% Stymer S and 0.1% NH_3 as 28% NH_4OH. The detergency ratio of this composition, determined in accordance with the procedure outlined above, was 141 at a wash temperature of 140° F. and 170 at a wash temperature of 180° F. This example was repeated with the same composition omitting the ammonia, and the detergency ratio was reduced to 128 at 140° F. and 145 at 180° F. The entire example was then repeated three times, once with monoethanolamine substituted for the ammonia, once with diethanolamine substituted for the ammonia, and once with triethanolamine substituted for the ammonia. In all three instances the results obtained with the compositions containing the amines duplicated the results obtained with the composition containing the ammonia, within the range of ordinary experimental error.

Example 2

To 0.2% Energetic W–100, which has an unbuilt detergency ratio of 55 at a wash temperature of 180° F. and of 84 at 140° F., was added .05% Stymer S and 0.1° NH_3 as 28% NH_4OH. The detergency ratio of this composition determined in accordance with the procedure outlined above was 124 at a wash temperature of 140° F. and 193 at a wash temperature of 180° F. This example was repeated with the same composition omitting the ammonia, and the detergency ratio was reduced to 118 at 140° F. and 145 at 180° F. The entire example was then repeated three times, once with monoethanolamine substituted for the ammonia, once with diethanolamine substituted for the ammonia, and once with triethanolamine substituted for the ammonia. In all three instances the results obtained with the compositions containing the amines duplicated the results obtained with the composition containing the ammonia, within the range of ordinary experimental error.

Example 3

To 0.2% Sterox SK, which has an unbuilt detergency ratio of 21 at a wash temperature of 180° F. and of 22 at 140° F., was added .05% Stymer S and 0.1% NH_3 as 28% NH_4OH. The detergency ratio of this composition determined in accordance with the procedure outlined above was 112 at a wash temperature of 140° F. and 121 at a wash temperature of 180° F. This example was repeated with the same composition omitting the ammonia, and the detergency ratio was reduced to 79 at 140° F. and 66 at 180° F. The entire example was then repeated three times, once with monoethanolamine substituted for the ammonia, once with diethanolamine substituted for the ammonia, and once with triethanolamine substituted for the ammonia. In all three instances the results obtained with the compositions containing the amines duplicated the results obtained with the composition containing the ammonia, within the range of ordinary experimental error.

Example 4

To 0.2% of Sterox AJ, which has an unbuilt detergency ratio of 63 at a wash temperature of 140° F., was added .05% Stymer S and 0.1% NH_3 as 28% NH_4OH. The detergency ratio of this composition determined in accordance with the procedure outlined above was 132 at a wash temperature of 140° F. This example was repeated with the same composition omitting the ammonia, and the detergency ratio was reduced to 116 at 140° F. The entire example was then repeated three times, once with monoethanolamine substituted for the ammonia, once with diethanolamine substituted for the ammonia, and once with triethanolamine substituted for the ammonia. In all three instances the results obtained with the compositions containing the amines duplicated the results obtained with the composition containing the ammonia, within the range of ordinary experimental error.

Example 5

To 0.2% of Nonic 218, which has an unbuilt detergency ratio of 65 at a wash temperature of 180° F. and of 78 at 140° F., was added .05% Stymer S and 0.1% NH_3 as 28% NH_4OH. The detergency ratio of this composition determined in accordance with the procedure outlined above was 128 at a wash temperature of 140° F. and 146 at a wash temperature of 180° F. This example was repeated with the same composition omitting the ammonia, and the detergency ratio was reduced to 104 at 140° F. and 129 at 180° F. The entire example was then repeated three times, once with monoethanolamine substituted for the ammonia, once with diethanolamine substituted for the ammonia, and once with triethanolamine substituted for the ammonia. In all three instances the results obtained with the compositions containing the amines duplicated the results obtained with the composition containing the ammonia, within the range of ordinary experimenta' error.

Example 6

To 0.2% of Nonic 261, which has an unbuilt detergency ratio of 44 at a wash temperature of 180° F. and of 25 at 140° F., was added .05% Stymer S and 0.1% NH_3 as 28% NH_4OH. The detergency ratio of this composition determined in accordance with the procedure outlined above was 104 at a wash temperature of 140° F. and 127 at a wash temperature of 180° F. This example was repeated with the same composition omitting the ammonia, and the detergency ratio was reduced to 72 at 140° F. and 69 at 180° F. The entire example was then repeated three times, once with monoethanolamine substituted for the ammonia, once with diethanolamine substituted for the ammonia, and once with triethanolamine substituted for the ammonia. In all three instances the results obtained with the compositions containing the amines duplicated the results obtained with the composition containing the ammonia, within the range of ordinary experimental error.

Example 7

To 0.2% of Synthetics AR–150, which has an unbuilt detergency ratio of 71 at a wash temperature of 180° F. and of 90 at 140° F., was added .05% Stymer S and 0.1% NH_3 at 28% NH_4OH. The detergency ratio of this composition determined in accordance with the pro-

cedure outlined above was 139 at a wash temperature of 140° F. and 154 at a wash temperature of 180° F. This example was repeated with the same composition omitting the ammonia, and the detergency ratio was reduced to 122 at 140° F. and 128 at 180° F. The entire example was then repeated three times, once with monoethanolamine substituted for the ammonia, once with diethanolamine substituted for the ammonia, and once with triethanolamine substituted for the ammonia. In all three instances the results obtained with the compositions containing the amines duplicated the results obtained with the composition containing the ammonia, within the range of ordinary experimental error.

The quantity of nonionic and the quantity of builder used in the above examples has been arbitrarily chosen for test purposes and the invention should not be construed as limited thereto. It has been determined in the laboratory that increasing the quantity of either or both above the level shown in the examples will not substantially raise the detergency ratio of the composition. It has also been determined that lesser quantities of each will still give good results. The amount of nonionic detergent should not be less than 0.05% and the amount of builder should not be less than about .03% as its building action is gradually lowered as its concentration is lowered below 0.05%.

Thus it will be seen that the present invention provides a detergent composition comprising a nonionic active ingredient, a builder, and a limited number of buffering bases which permits obtaining a new high in detergency value.

I claim:

1. A detergent composition consisting essentially of a water solution of at least 0.05% of a synthetic organic nonionic detergent, at least 0.03% of a water-soluble sodium salt of a styrene-maleic anhydride copolymer for building the detergency value of said detergent and a base selected from the group consisting of ammonia, monoethanolamine, diethanolamine and triethanolamine in an amount sufficient to give the composition a pH above 9.

2. A composition as set forth in claim 1 wherein the base is monoethanolamine.

3. A composition as set forth in claim 1 wherein the base is diethanolamine.

4. A composition as set forth in claim 1 wherein the base is triethanolamine.

5. A composition as set forth in claim 1 wherein the base is ammonia.

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