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LAUNDERING PROCESS AND COMPOSITION

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7 Claims. (Cl. 252—135)

The present invention is directed to a laundering process and composition, and more particularly to a laundering process in which a new degree of efficiency may be achieved.

This application is a continuation of my application Ser. No. 273,836, filed Apr. 18, 1963.

It has long proved desirable to automate laundering processes in order to achieve maximum efficiency. Furthermore, it has long proved desirable to reduce the cost of commercial laundering without decreasing the effectiveness of the laundering. Thus, at the present time, commercial laundering operations involve the use of a wide variety of chemicals, many of which are added in granular or powdered form. These powders are hygroscopic and as laundries are humid, these powders are difficult to manipulate with automatic dispensing and processing equipment.

This invention has as an object the provision of a novel laundering process, with novel laundering compositions.

This invention has as another object the provision of a laundering process in which maximum utilization may be made of automatic dispensing and operating equipment.

This invention has as still another object the provision of a laundering process in which the most basic and thus the lowest cost chemicals are used throughout, and yet which achieves a higher degree of effectiveness.

This invention has as still another object, the provision of a laundering process in which the wetting power, colloidal suspending power, dispersing power, and bleaching power of the laundering solutions are completely changed and markedly improved by using an excess of a sodium glassy phosphate (preferably in the range of 65 to 67 percent P_2O_5 balance Na_2O) above that necessary to sequester to zero hardness the plant water, plus hardness that is carried in by the work, plus the conversion to sodium soaps of any calcium or magnesium soaps that may be on the incoming work and any insoluble soaps that may have accumulated on the washing equipment (wash wheels). This excess of sodium glassy phosphate should be in the range of 350 to 3500 p.p.m. Using soap as an indicator with the standard five minute lather factor, this excess can be measured by titrating the washing solution as used with a standard hardness solution of 11.089 grams dried anhydrous calcium chloride which is equivalent to 10.0 grams $CaCO_3$ per liter as shown in my Patent No. 2,574,047. Thus, the excess of glassy phosphate that I require would be equivalent to an excess of ability to sequester 100 to 1000 p.p.m. of hardness calculated as $CaCO_3$.

Hereinafter, the presence of this excess of glassy phosphate is referred to as "preemptive sequestering."

Other objects will appear hereinafter.

These and other objects are achieved by the laundering process of the present invention in which the entire laundering process is effected with aqueous agents. Specifically, the process is initiated by contacting the material to be cleaned with water to which concentrated solutions of alkali, soap, bleach, sour, fabric softener and starch have been added. The concentrated alkali solution containing per 100 gallons the equivalent of between about 19 gallons of 50 weight percent sodium hydroxide (contains approximately 6.364 pounds of sodium hydroxide per gallon of 50 weight percent solution) to one gallon of 41 degree Baumé liquid sodium silicate (containing approximately 4.75 pounds of anhydrous solids) to four gallons of the 50 weight percent sodium hydroxide to 16 gallons of 41 degree Baumé sodium silicate, with the total amount of such 50 weight percent sodium hydroxide and such 41 degree Baumé sodium silicate equaling 20 gallons in each instance, or the equivalent thereof, together with from 4 to 40 pounds (based on the total of 100 gallons) of sodium phosphate containing between approximately 65 and 67 weight percent of P_2O_5, based on the combined weight of the P_2O_5 and the sodium oxide. Where the concentrated alkali solution is to be used on heavy soil, particularly where a flush is to precede the break operation, I prefer to use 6 ounces of non-ionic surfactant to each 100 gallons as formulated above.

The sodium phosphate which may be utilized in the present invention is an aqueous solution of a clear, transparent, glassy amorphous sodium phosphate having between approximately 65 and 67 weight percent of P_2O_5 based on the combined weight of the P_2O_5 and the sodium oxide. The preparation of such sodium phosphate and its properties are described in my United States Letters Patent 2,574,047 issued Nov. 6, 1951, the disclosure of which is incorporated herein by reference. This phosphate is commercially available under the trademark "Hy-Phos," and will be referred to herein as "Hy-Phos."

In order to illustrate the manner in which the concentrated solutions used in the present invention may be prepared:

Concentrated soap solution may be made to 100 gallons as follows: 18 to 40 pounds of 41 to 42 titer 94 to 98 percent anhydrous soap is dissolved in 15 to 20 gallons of boiling water. To this, 2 to 4 pounds of tetrasodium pyrophosphate is added. I prefer to add also 6 ounces by weight of conventional optical brightener.

Concentrated "Hy-Phos" solution is made by suspending 100 pounds of "Hy-Phos" plates in a 20 mesh nylon dissolving net suspended in a 55 gallon plastic lined tank so that the bottom of the net is 10 inches above the bottom of the tank. The tank should first be filled two-thirds full with water between 120 and 140° F. When the "Hy-Phos" is completely dissolved (about 20 minutes), additional water is added to bring the level up to 50 gallons. The solution is then stirred by pumping the solution from the bottom of the tank into the top of the tank. This solution contains 2 pounds per gallon and is used to make up the concentrated alkali and concentrated bleach solutions.

Concentrated bleach solution may be made by pumping through a plastic pipe with a plastic pump 4 to 10 gallons of 16 percent bleach solution into a 120 gallon plastic lined tank. To this, 2 to 20 gallons of concentrated "Hy-Phos" solution is then added. Water is then added to make 100 gallons of solution. This is thoroughly mixed by pumping with a plastic pump and plastic pipes drawing from the bottom and pumping into the top of the tank.

Concentrated sour solution is made by dissolving 5 to 15 pounds of zinc silicofluoride in 80 gallons of water in a 120 gallon plastic lined tank. After making the solution to 100 gallons with water, the solution is thoroughly mixed by pumping from the bottom of the tank into the top of the tank with a plastic pump and plastic pipes.

Concentrated alkali solution may be made by pumping 10 gallons of 50 percent liquid caustic soda into a 50 gallon plastic lined steel tank. Ten gallons of 41° Baumé liquid sodium silicate is then pumped into this tank. Five gallons of water is then run through the pump and lines. This solution is then circulated with a plastic pump and plastic pipe, sucking from the bottom and feeding into the top of the tank for 4 minutes to allow for proper rise of heat of reaction to 120 to 150° F. Ten additional gallons of water are now added and the circulation with plastic pump is continued for 4 more minutes to complete the reaction between the caustic soda and sodium silicate without lowering the heat of reaction temperature by too great a dilution. At this point, the temperature should still be between 110 and 140° F. The solution may then be transferred to a 120 gallon steel tank where it is again circulated from bottom to top while an additional 20 gallons of water is added by rinsing out the 50 gallon plastic lined tank and pumping the rinse water into the 120 gallon steel tank. Ten gallons of "Hy-Phos" concentrate is now measured into the 50 gallon plastic lined tank and transferred into the 120 gallon steel tank which is still being thoroughly mixed by a circulating pump as previously described. Rinse water is then run into the 50 gallon plastic lined tank and transferred to the 120 gallon steel tank until the total volume reaches 100 gallons. Two minutes of further continued mixing by circulating from botmo to top in the 120 gallon tank completes the batch of concentrated alkali solution. However, if the concentrated alkali solution is to be used for heavy soil or where a flush is to be used before the break, 6 fluid ounces of a non-ionic organic detergent is added after the water necessary to bring the solution up to 100 gallons volume is reached. This allows 2 minutes for the non-ionic detergent to be blended into the mixture.

As heretofore indicated, this mixture may be varied from 19 gallons of caustic to 1 gallon of silicate to 4 gallons of caustic to 16 gallons of silicate, together with from 2 to 20 gallons of concentrated phosphate solution. The non-ionic detergent may be raised from 3 to 16 fluid ounces to a 100 gallon batch.

The ratio of the sodium silicate to the "Hy-Phos" may be varied over an appreciable range, as heretofore noted. In particular, the amount of the "Hy-Phos" which should be present in the mixture is to a considerable degree dependent upon the amount of hardness in the water available at the subject laundry.

Since the nature of the water, the nature of the material to be laundered and the nature of equipment used in the cleaning operation will all come into play, it is unrealistic to speak in terms of absolute quantities of sodium silicate and "Hy-Phos." Rather, approximations as to such absolute quantities may be given with the extent of permissible variation, and with guide posts setting forth those factors which bear on the extent of variation.

Suds are a good yardstick of the extent of preemptive sequestering. Once concentrated soap solution has been added, whether to the break or to the first suds, no further additions of soap solution will be necessary and there will be copious suds on all subsequent suds, flushes and bleach operations and through the first 2 hot rinses after the bleach. Furthermore, the amount of soap in pounds per 100 pounds of wash will be of the order of about one-third the amount usually necessary for the same type of wash done by present conventional methods.

I have found that a large number of beneficial results flow from the compositions and laundering processes of my invention which achieve preemptive sequestering. Thus, the overall quantities of soap required to achieve a given degree of laundering is appreciably less in the process of my invention than in prior processes. In addition, the extent of penetration of the soap, of the alkali and of the bleach is appreciably higher in the process of my invention than in prior processes. The process of my invention achieves greater wetting power per unit quantity of detergent used due to the preemptive sequestering, as well as greater colloidal suspending power and lower interfacial tension in respect to the soap and detergent systems being used.

The laundry process of my invention may include eight stages, although as hereinafter indicated, the first stage, namely the flush, may be eliminated. A number of the stages, as set forth below, are effected using conventional techniques, and are included herein solely for the sake of

completeness. However, each of the stages of the present invention is effected using liquids, without the necessity for the addition of solids. By the use of liquids, automatic dispensing, proportioning, and operating equipment may be readily utilized, so that the laundering process of the present invention may be readily automated. The eight stages of the laundering process of the present invention are:

1. Flush;
2. Break;
3. Suds;
4. Bleach;
5. Rinse;
6. Sour;
7. Blue; and
8. Starch.

The soiled garments to be laundered may be divided into two types, namely greasy soiled garments, such as overalls from filling stations which are contaminated with mineral grease, and soiled garments derived from other sources. The flush is eliminated from the laundering process when the same is utilized with the greasy soiled garments where live steam is connected to the washing equipment (wheel), but is included when the same is utilized with heavily soiled garments, derived from other sources. With the greasy soiled garments, the first step constitutes one long break, brought to 170 to 210° F. with live steam followed by many rinses, in which the mineral grease is removed.

Due to the highly corrosive action of the chemicals used in the laundering process of the present invention, the entire process should be performed using plastic pipe, plasticly lined or stainless steel vessels, plasticly lined pumps and further equipment. As suitable plastics for the formation of the piping and equipment, may be mentioned polyvinyl chloride, polyethylene, buna N, rubber, Teflon, and the like.

Within the limits heretofore set up, the relatively low ratios of caustic soda to high ratios of silicate are to be preferred for greasy soiled garments due to the greater efficacy of these compositions in terms of increasing the colloidal suspending power of the soap thereby eliminating redeposition on rinsing. With soiled garments derived from other sources, namely soiled garments which are soiled with materials other than mineral hydrocarbons, the relatively high ratios of caustic soda to silicate are to be preferred because of the advantage possessed by these materials of achieving a lowering of the interfacial tension of the water to fatty acids.

The process of the present invention may be effected using conventional laundry wheel equipment, and the equipment forms no part of the present invention.

In the description preceding Examples I, II, and III the term "concentrated alkali solution" will be used. In 100 gallons of concentrated alkali solution, there will be 20 gallons of the mixture of 50 weight percent sodium hydroxide and 41 degree Baumé sodium silicate, with the ratio being between 19 gallons of sodium hydroxide and 1 gallon of sodium silicate to 4 gallons of sodium hydroxide and 16 gallons of sodium silicate, and with the amount of "Hy-Phos" being present being between 4 pounds and 40 pounds per total of 100 gallons.

Flush

As heretofore indicated, a flush is advisable with all types of heavily soiled garments. The exact quantity of chemicals to be used in the flush will vary depending on the nature of the wash, the size of the equipment, etc. The requisite amount of concentrated alkali solution is determined by testing. Thus, in the process of the present invention the flush is effected at a pH of between 10.0 and 11.5. Thus, a sufficient amount of concentrated alkali solution should be added to the flush water to bring the pH up to between 10.0 and 11.5. I have found that a very small amount of a synthetic non-ionic organic detergent in the alkali mix increases the wetting power of the flush. For example, with an 800 pound dry weight laundry load, about 6 fluid ounces of a non-ionic detergent Triton X–100 should be present in 100 gallons of concentrated alkali solution. The chemical structure of the non-ionic detergent is not critical, and a wide variety of such materials, which are presently commercially available, may be used. Many of these materials are derived by condensing ethylene oxide with organic substances such as phenols or fatty acids.

A prime purpose of the flush is to remove large quantities of loose dirt cheaply and raise the temperature of the wash load. I have found that the use of the aforesaid mixtures of "Hy-Phos," caustic soda, and sodium silicate and small amounts of non-ionic detergent achieve a more complete removal of loose dirt from the soiled garments than any other flush known to me.

The flush using the aforementioned concentrated alkali solution is preferably performed at 125° F. to 135° F. instead of the normal 105° F. to 115° F., when garments which are prone to contain protein stains, such as blood, are being cleaned. Thus, it is possible to avoid the denaturation of the protein resulting in its fixation in the garment, which is most apt to occur if the garment is subjected to an elevated temperature without lowering the temperature of the flush so much that live steam must be used to get the break up to 165° F. to 170° F. If it is known that the soil in the garments is largely derived from non-proteinaceous sources, then the flush may be effected at a relatively high temperature, such as 140° F. to 160° F.

Break

The break is normally effected in the same vessel used for the flush. Thus, the flush is drained from the vessel, as through its bottom, and then the break is commenced.

For an 800 pound dry weight heavily soiled laundry load such as kitchen towels, I have found it advisable to add a sufficient amount of concentrated alkali solution to give a final pH in the break water of between 11.0 and 12.0. This will be achieved by adding between 8 and 10 gallons of the concentrated alkali solution. No concentrated soap solution is added to the break with this type load.

Where a break is to be performed on a load having lesser soil, such as family wash, concentrated soap solution would be added, as well as concentrated alkali solution. However, the pH of the break would be in the range of 11 to 11.5. This should be followed with one or more suds operations.

With very little soil such as sheets, towels and pillow cases from transient hotels, the break, suds and bleach would be done in a single operation in which case the pH would be brought to 10.3 to 10.5 with concentrated alkali, concentrated soap and concentrated bleach solutions. In this case, the temperature of the break would be 145° F. to 150° F.

Except where the break and bleach are done in one operation, the temperature of the break should be 165° F. to 170° F.

Suds

Except when washing very heavily soiled material, such as kitchen towels, where no concentrated soap solution is added to the break but such soap solution is added to the first suds (in which case 6 gallons of concentrated soap solution would be used in the first suds operation for an 800 pound load), all the suds are effected with clear water. In this manner there is no expenditure for laundry chemicals, and the conventional necessity for soap and alkali in normal sudsing procedures is eliminated. I have found that on using from 1 to 3 or so repetitive sudsing operations with clear water that there is a sufficient amount of entrained material from the break to achieve satisfactory sudsing. The suds operation should be performed with very hot water, such as water of the order of 160° F. to 170° F. The sudsing operation must bring the pH of the wash down to 10.9 to 10.7.

Bleach

The bleaching operation is preferably performed with conventional oxidizing bleaches, and in particular with sodium hypochlorite. However, other conventional bleaches may be used, such as hydrogen peroxide.

The bleach is preferably effected with the oxidizing bleach added in the form of a solution. Thus, a bleach solution may be prepared as explained in "concentrated bleach solution."

From one-quarter to one-half gallon of such concentrated bleach solution may be added per 100 pounds of wash during the bleach. The bleach should be effected at a pH of between 10.3 and 10.5 and a temperature of between 140° F. and 155° F., and preferably 145° F. to 150 °F., as these conditions effect minimum destruction of the garment fibers.

Rinses

The rinses are effected with clear water, and preferably include first two hot rinses, such as at a temperature of 160° F. to 170° F., and then two cold rinses which will reduce the temperature to about 100° F. The purpose of the rinse is to get the pH of the garments to below 9.0 and the temperature down to about 100° F.

Sour

Since alkali in fabrics, at the high temperatures of drying and ironing, will turn them brown and ruin their tensile strength, the sour should be effected after the rinse. A wide variety of conventional sours may be utilized including ammonium silicofluoride, zinc silicofluoride, acetic acid, and where approprite safety equipment and procedure are available, hydrofluoric acid. The sour is prepared as explained in "concentrated sour solution" and is used at one-half gallon per 100 pounds of dry wash weight. For example, the sour may be effected at 110° F. to 130° F. using a pH of between 5 and 6. Bluing is not recommended in this process.

The use of fabric softener is always recommended in this process.

In order to illustrate the subject invention, I am presenting herewith three actual laundering operations.

EXAMPLE I

This laundering operation was achieved in a conventional Ellis Dryer type commercial washer, 54 by 120, nine pocket Y type. A load of 900 pounds dry weight industrial overalls which had been heavily soiled was cleaned as follows:

The flush was effected in two minutes at a temperature of 155° F. and a pH of 10.1. The concentrated alkali that was used for the flush contained in a total of 100 gallons, 6 gallons of 50 weight percent sodium hydroxide and 12 gallons of 41° Baumé sodium silicate solution and also contained 4 gallons of concentrated "Hy-Phos." Two gallons of this solution and 6 ounces of non-ionic detergent concentrated alkali solution plus sufficient water was used in the flush to give a level of liquid within the drum including the clothes of 11 inches.

The break was effected in 20 minutes at a temperature of 170° F. at a pH of 11.8 with medium suds. Twelve gallons of the concentrated alkali solution and a sufficient amount of water plus 5 gallons of concentrated non-ionic solution was used to reach a liquid level of 5½ inches in the drum. Concentrated non-ionic solution is made by adding 4 gallons of Triton X100 to 90 gallons of 120° F. water with gentle stirring. Six ounces of Tintapal 4BM optical brightener is stirred into one-half gallon of the above solution which then is stirred into the 90 gallons and sufficient water is added with continued stirring to increase the total volume to 100 gallons.

The break was followed with four successive rinses, each of two minutes duration, at a temperature of 170° F., with clear water. In each rinse there was sufficient entrained material to achieve satisfactory sudsing. The pH dropped to 11.5 in the first rinse, 11.1 in the second rinse, 10.5 in the third rinse, and 9.8 in the fourth rinse. In each rinse the level of liquid in the drum was 11 inches.

A two minute rinse was then used at a temperature of 130° F. The pH dropped to 9.0 and there was a light amount of suds. The liquid level in the drum during this rinse was likewise 11 inches. A final two minute rinse was effected at 100° F. whereby the pH dropped to 8.2 and the suds level to a light level. The level of liquid in the drum was likewise 11 inches.

The sour was effected for four minutes at a temperature of 110° F. using four gallons of concentrated sour solution containing 10 pounds of zinc silicofluoride per 100 gallons of sour solution. A sufficient amount of water was in the washer to achieve a 5½ inch liquid level in the drum and the pH during the sour was 5.7.

Starching was achieved in two minutes at a temperature of 80° F. and the pH of 5.9 using a solution containing 8 gallons of a concentrated starch solution containing 24 pounds of Staley cornstarch per 100 gallons of stock solution and 3 gallons of a fabric softener solution obtained from a concentrated fabric softener solution containing 3 gallons of CEI fabric softener per 100 gallons. The liquid level in the drum was 3½ inches.

EXAMPLE II

The washing was effected in an American Cascade 42 by 96 inch washer of the open pocket type. The laundry load was 400 pounds of flat work in a medium solied state.

The break was effected in 7 minutes at a temperature of 160° F. and a pH of 11.4 under heavy sudsing conditions. The concentrated alkali solution used for the break contained per 100 gallons, 4 gallons of 50 weight percent sodium hydroxide and 8 gallons of 41° Baumé sodium silicate, and 4 gallons of concentrated "Hy-Phos." Two gallons of this alkali solution and 2 gallons of concentrated soap solution containing 18 pounds of 42 titer 97 to 98 weight percent anhydrous soap and 6 ounces optical brightener with a sufficient amount of water so that the level of liquid within the washer was 5 inches above the floor of the drum.

No additional soap was added through the remainder of the washing operation, the suds in each of the later stages, where obtained, being derived from the soap solution present during the break.

The suds operation was performed for four minutes at a temperature of 170° F. and a pH of 10.9 using clear water. A sufficient amount of water was present to give a level of 5 inches above the bottom of the drum, and heavy suds were secured.

The bleach was effected for 7 minutes at a temperature of 150° F. with a pH of 10.5 using two gallons of concentrated bleach solution derived from a 100 gallon stock solution containing 6 gallons of concentrated "Hy-Phos" solution and 4 gallons of 14 weight percent sodium hypochlorite. A sufficient amount of solution was present to reach a level of 5 inches above the floor of the drum. Heavy suds were obtained.

The bleach was followed with two successive rinses with clear water at a temperature of 170° F., each rinse occupying two minutes. A sufficient amount of clear water was used in each instance to reach a level of 10 inches about the drum. The pH during the first rinse was 9.8 and during the second rinse was 9.3. During the first rinse, heavy suds were obtained and during the second rinse medium suds were obtained.

Two further rinses, each of 2 minutes duration, at successive temperatures of 130° F. and 100° F. were used. The pH of the first rinse was 8.7 and of the second rinse was 8.2. Light suds were obtained during the first rinse and very light suds were obtained during the second rinse.

A sufficient amount of rinse water was present to equal the level of 10 inches above the drum.

A three minute sour at 110° F. was used employing 3 gallons of the concentrated sour solution. The pH during the sour was 5.6 and the liquid level during the sour was 5 inches.

A softening step was then used for two minutes at 80° F. and the pH of 5.8, with the liquid level being 10 inches above the drum. The liquid contained 2 gallons of the fabric softener stock solution (no starch) referred to in Example I.

EXAMPLE III

800 pounds dry weight of very heavily soiled kitchen towels were washed in the same Ellis Dryer referred to in Example I.

A flush was used exactly as in Example I except that the temperature was 130° F. and the pH was 10.2. Two gallons concentrated alkali solution was used.

An 8 minute break at a temperature of 165° F. was used using 10 gallons of concentrated alkali solution containing 10 gallons of 50 weight percent sodium hydroxide and 10 gallons of 41° Baumé and 4 gallons of concentrated "Hy-Phos" solution and 3 fluid ounces non-ionic TX100 per 100 gallons of the stock solution. A sufficient amount of liquid was used during the break to achieve a level of 5½ inches above the floor of the drum and the pH was 11.8. No soap was used on this break.

Suds were achieved at a temperature of 170° F. for 5 minutes and the pH of 11.6 using 6 gallons of soap solution derived from a concentrated soap solution containing per 100 gallons: 36 pounds of soap, 4 pounds of tetra sodium pyrophosphate, 6 ounces of a commercial optical brightener designated Tintapal 4BM. Heavy suds were obtained and a sufficient amount of the liquid was present to equal a level in the drum of 5½ inches.

A second suds was achieved by emptying the first suds, and introducing clear water for five minutes at 170° F. at a pH of 11.3 to a height of 5½ inches above the floor of the drum. Heavy suds were achieved during this second suds step. No soap added.

A 2 minute flush at 170° F. with clear water was achieved at a pH of 10.8, and a sufficient amount of water to equal the level of 11 inches above the floor of the drum. Medium suds were obtained during this flush stage. No chemicals of any type were added.

An 8 minute bleach was used employing 4 gallons of a concentrated bleach solution containing per 100 gallons: 8 gallons of 16 weight percent sodium hypochlorite and 6 gallons of concentrated "Hy-Phos" solution. The pH during the bleach was 10.4, there were heavy suds, and a sufficient amount of liquid was present to equal the level of 5½ inches above the floor of the drum.

The bleach was followed by four successive two minute rinses using clear water, the first two at 170° F., the third at 130° F. and the fourth at 100° F. A sufficient amount of water was used in connection with each rinse to equal the level of 11 inches above the floor of the drum. The pH during the first rinse was 9.7, during the second rinse was 9.2, during the third rinse was 8.6 and during the fourth rinse was 8.1. The amount of suds during the first rinse was heavy, during the second rinse was medium, during the third rinse was light, and during the fourth rinse was very light.

A sour was then effected for 4 minutes at a temperature of 110° F. using four gallons of a concentrated sour solution containing 12 pounds of zinc silicofluoride per 100 gallons of stock solution. The pH during the sour was 5.7 and a sufficient amount of liquid was present to equal the level of 5½ inches above the floor of the drum.

A softening step was then used for 2 minutes at 70° F. with a solution containing 3 gallons of concentrated fabric softener solution referred to in Example II. A sufficient amount of solution was used to equal the level of 11 inches above the floor of the drum and the pH was 5.9.

The laundering process of the present invention may be completely automated. Concentrated alkali, soap, bleach, sour and fabric softener may be utilized, and such solutions may be modified in concentration to achieve precise control, round the clock operation, and minimum manual regulation.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

I claim:

1. In a laundering process, the step which comprises subjecting soiled material to an aqueous solution to which has been added an aqueous concentrate comprising an amount of sodium hydroxide, sodium silicate, and glassy sodium phosphate equivalent to the following concentrations per 100 gallons of solution: between about 4 to 19 gallons of 50 weight percent sodium hydroxide, and about 1 to 16 gallons of 41° Baumé liquid sodium silicate, with the total amount of such 50 weight percent sodium hydroxide and such 41° Baumé sodium silicate equaling not more than 20 gallons, and, on the basis of said 100 gallons of solution, between about 4 and 40 pounds of glassy sodium phosphate; the amount of said concentrate in said aqueous solution to which the soiled material is subjected providing an amount of glassy sodium phosphate capable of sequestering about 100 to 1000 parts per million of hardness (calculated as $CaCO_3$), in excess of the amount of said phosphate required to provide zero hardness in said aqueous solution, considering the hardness inherently present in the water, the other components of the laundering solution and the hardness derived from the soiled material.

2. A laundering process in accordance with claim 1 in which the pH in the step is between about 10 to 12.

3. A laundering process in accordance with claim 1 in which the pH in the step is between about 10 and 12 and at a temperature between about 165–170° F.

4. A laundering process in accordance with claim 1 in which the material treated in the step is subsequently subjected to a bleaching step, in which the material is subjected to an aqueous solution to which has been added an aqueous concentrate comprising an amount of oxidizing bleaching agent and glassy sodium phosphate equivalent to the following concentrations per 100 gallons of solution: between about 4 to 10 gallons of 16% bleach solution and about 2 to 20 gallons of a 2 pound per gallon glassy sodium phosphate solution; the amount of said concentrate in said aqueous solution in which the material is to be bleached providing an amount of glassy sodium phosphate capable of sequestering about 100 to 1000 parts per million of hardness (calculated as $CaCO_3$) in excess of the amount of said phosphate required to provide zero hardness in said aqueous solution, considering the hardness inherently present in the water, the other components of the bleaching solution and the hardness derived from the material to be bleached.

5. The process of claim 4 in which the bleaching step is effected at a pH of between about 10.3 and 10.5 at a temperature of between about 140° F. and 155° F.

6. The process of making an aqueous concentrate for use in laundering, based on 100 gallons of concentrate, which comprises reacting together the equivalent of between about 4 to 19 gallons of 50 weight percent sodium hydroxide and about 1 to 16 gallons of 41° Baumé liquid sodium silicate, the total amount of such 50 weight percent sodium hydroxide and such 41° Baumé sodium silicate equalling not more than about 20 gallons; stirring said reaction mixture until the temperature thereof rises to about 120° F. to 150 F.; diluting and cooling said reaction mixture by the addition of water thereto while continuing the stirring; adding the equivalent of from about 2 to 20 gallons of 2 pound per gallon solution of glassy sodium phosphate; and thereafter adding such water as is necessary to provide 100 gallons of said concentrate.

7. The process of claim 6 wherein the reaction mixture is cooled by the addition of about 30 gallons of water.

References Cited

UNITED STATES PATENTS

2,574,047	11/1951	Mackenzie	252—135 X
2,938,764	5/1960	Blomfield	252—99 X
3,081,265	3/1963	Burr	252—135 X

OTHER REFERENCES

Bennett, "The Chemical Formulary," (1943) Chemical Pub. Co., Inc., Brooklyn, New York, pp. 478 and 479 relied on.

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