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# CLEANER-DISINFECTANT COMPOSITION

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This invention relates to a cleaner-disinfectant composition particularly suitable for hard surface cleansing comprising in particular combination a halogenated phenolic germicide and detersive ingredients which on dissolution in water yields solutions having effective cleansing action combined with broadly effective disinfecting action, as hereinafter described.

Solid, granular detergent compositions intended to be dissolved in water to form detergent solutions have been used in households and industry for cleaning floors, walls, etc. These powders may contain alkaline inorganic detergent salt such as phosphate or carbonate and a minor proportion of an organic anionic or nonionic detergent as the active constituents. However, distribution and use of such compositions have been limited because these formulations are not particularly effective in destroying some of the common infectious bacteria. Therefore, the possible formulation of such a composition with both good disinfecting and detergent properties would be desirable, and such a product would be particularly valuable for use in hospitals, institutions, restaurants, hotels, the dairy and beverage industries, as well as homes.

The problem of microbial or bacterial contamination is an important one since man contacts infectious diseases through the spread of micro-organisms. Therefore, it is desirable that cleanser-disinfectant compositions be effective in destroying vegetative cells, including pathogenic organisms such as staphylococcus, if possible. It is well known that phenols and especially chlorinated phenols are effective germicides. It is also recognized that the chlorinated phenols are less soluble in water than the non-chlorinated compounds. Similarly, substituted chlorinated phenols having an alkyl or aralkyl group on the phenol molecule are known to have germicidal activity but such substituent reduces the solubility of the organic phenol still further, and the net result is that a difficult formulation problem exists because of their limited solubility.

In addition to the problems of water solubility mentioned above, this formulation problem is further complicated by the fact that in general phenolic germicides are less active in alkaline solutions than acid solutions. In addition, other ingredients such as inorganic salts, organic detergents, organic solubilizers, e.g., alcohol, etc., are known to have adverse effects on germicidal activity. Such effects are readily apparent by the formation of a non-homogeneous solution at use-dilution concentrations in water or by low phenol coefficients in the AOAC Phenol Coefficient test.

It has now been found that highly effective alkaline cleaning-distinfectant compositions which are particularly suitable for hard surface cleansing such as on floors and walls, comprise a major proportion, e.g. about 90 to 98.5% of water-soluble alkaline inorganic salts, and a minor proportion, e.g., about ½ to 5%, of a water-soluble aliphatic primary sulfated detergent and a minor proportion, e.g., 1 to 5%, of orthobenzyl-para-halogenated-phenol, said amounts being by weight of the above ingredients and proportioned so that the ratio of said detergent to said halogenated phenol is from the range of about 1:1 to about 1:4 by weight and a water solution containing from about ½ to about 2% by weight of said composition has a pH of about 9.4 to 10.2, with



said halogenated phenol being present in solution in a concentration thereby suitable for effective disinfectant action. In particular, there may be prepared a solid, granular, free flowing detergent composition stable upon aging which comprises about 55 to 80% of water-soluble alkaline inorganic normal builder salts, about 15 to 40% of water-soluble alkaline inorganic acid salt, preferably with about ½ to 3% of a water-soluble aliphatic primary fatty alcohol sulfate and about 1 to 4% of ortho-benzyl-para-halogenated phenol, the ratio of said detergent to said halogenated phenol being from about 1:2 to 3:4 by weight, said amounts being by weight of the above ingredients and proportioned to form a water solution having a pH of about 9.4 to 10.2 with said halogenated phenol essentially in solution and exhibiting effective disinfecting action. A preferred embodiment comprises about 35 to 55% by weight of sodium carbonate, about 15 to 25% by weight of sodium polyphosphate, about 20 to 30% by weight of sodium bicarbonate, about 2% by weight of sodium lauryl alcohol sulfate and about 3 to 4% by weight of ortho-benzyl-para-chlorophenol having a pH of about 9.6 to 10.0.

The desirable characteristics of the compositions of the present invention are the resultant or unitary effects produced by the particular combinations of ingredients and their proportions, alkalinity, etc. For the sake of simplicity, these factors will be discussed individually to some extent. In general, the exercise of careful choice in the components and in their proportions as described will result in satisfactory compositions exhibiting desired detersive and foaming properties, solubility in water under specific conditions at use concentrations and high phenol coefficients in the AOAC Phenol Coefficient test as herein described.

As indicated, the major ingredients are the water-soluble alkaline inorganic salts, usually from about 90–98.5% by weight. It is preferred for optimum effects to use a mixture of alkaline inorganic normal builder salts and acid salts proportioned to yield desired detersive properties and pH in solution. A variety of water-soluble alkaline inorganic normal builder salts may be employed. Among the suitable alkaline salts that may be mentioned are the alkali metal carbonates, phosphates and silicate salts such as sodium and potassium carbonate, sodium and potassium tripolyphosphates and pyrophosphates, trisodium orthophosphate and sodium silicates having an $Na_2O$ to $SiO_2$ ratio of about 1:1 to about 1:3.5 by weight. Such salts may be used alone or in any desired mixtures, the choice being influenced usually by economics or the particulate product features it is desired to emphasize. It is preferred to include an alkali metal polyphosphate such as sodium pyrophosphate or tripolyphosphate which is particularly effective herein for water softening and as a detergent aid in combination with other low cost detergent builders such as sodium carbonate or the sodium silicates. Such alkaline normal builder salts will generally form a major proportion of the composition, usually in an amount by weight of about 55 to 80% by weight of said mixture of ingredients.

The water soluble inorganic acid salts suitable for use are the alkali metal acid carbonates and various acid phosphates. Typical examples are sodium acid carbonate (bicarbonate) disodium phosphate and monosodium phosphate, with the acid carbonate as the preferred material for this composition. Such use of inorganic acid salts has multiple advantages also including added hard surface detergent action and buffering capacity for the composition. The proportion is generally a minor proportion of the total solids and is proportioned with the other ingredients so that the water solution containing ½ to 2% of the composition will have a pH from the range of 9.4 to about 10.2 as it has been found that germicidal

efficiency in this pH range is at an optimum. Usually said acid salts will be present in an amount by weight of about 15–40% of the said ingredients.

The detergent should be a water-soluble aliphatic primary sulfated detergent compatible with said germicide and inorganic salts. Particularly suitable detergents are the water-soluble primary sulfuric esters of aliphatic alcohols having the necessary compatibility, especially those containing 10 to 14 carbon atoms in the aliphatic group. It is preferred to use the alkali metal lauryl, coconut and myristyl alcohol sulfates, though other suitable water-soluble salts such as the ammonium and alkylolamine, e.g., triethanolamine salts may be employed also in suitable amount. Such detersive salts enhance the detergent action of the inorganic salts, emulsify oily soils, provide a minor amount of unstable foam and assist in the solubilization of the ortho-benzyl-para-halogenated-phenol. In particular, suitable compositions should be characterized by low foam levels in dilute solutions to eliminate foam streaks on the hard surfaces and to minimize the need for rinsing which would necessarily dilute the germicidal effectiveness. Accordingly, the detergent should be in minor amounts required for effective hard surface cleansing and low foam and the proportion required should be sufficient to solubilize the germicidal phenol in diluted use concentrations of product. Concentrations of about ½ to 5%, preferably ½ to 3%, of such detergent have been found to be satisfactory when proportioned with 1 to 5%, preferably 1–4%, of ortho-benzyl-para-chlorophenol or the like. In general, the ratio of detergent to said phenolic compound is from about 1:1 to 1:4 range, preferably 1:2 to 3:4 by weight in order to maintain the germicidal activity of the compositions at a high level without any substantial adverse effect by the detergent. Therefore, too high a proportion of said detergent tends to reduce germicidal effectiveness and too low a proportion also reduces germicidal effectiveness because of insolubilization of said germicide.

It is significant that water solutions containing 0.5 to 2% of said mixtures should be substantially clear because the germicidal compound tends to separate rapidly in cloudy water dispersions. Such separation during use results in non-homogeneous mixtures with respect to the germicide and, hence, the disinfectant action will vary widely. To achieve the desired clarity, both the type of detergent and its concentration should be carefully correlated with the type and amount of said germicide.

The suitable phenolic germicidal compounds are the ortho-benzyl-para-halogenated-phenol derivatives wherein the halogen is selected from the group consisting of chlorine, bromine and iodine. Ortho-benzyl-para-chlorophenol is a particularly satisfactory compound in compositions of the invention. The instant compositions are outstanding because of their potency against a wide variety of bacteria and fungi in low concentrations in addition to the other desirable properties. Heretofore, alkaline detergent compositions containing phenolic germicides have generally been singularly effective against either Gram-negative (*Salmonella typhosa*) or Gram-positive (*Staphylococcus aureus*) organisms. The instant alkaline compositions are effective against both types of organisms as well as fungi.

The effectiveness of this composition against standard test micro-organisms can be demonstrated in the AOAC Phenol Coefficient test (8th Edition (1955), p. 87) and in the AOAC Use-dilution test (8th Edition (1955), p. 91). In the former, the diluted concentration sufficient to kill bacteria in broth culture during a ten minute exposure period is compared with the concentration of phenol required for a kill under identical conditions. In the latter test, the bacteria are dried on a metal loop which is then exposed to the germicidal solution before transfer to a subculture tube and incubation for 48 hours at 37° C. No growth should be evident in any of the subculture tubes if the diluted composition is effective. Further, as a check against "stasis" because of carry-over of dried germicidal solution on the metal loop, the metal loops are generally re-subcultured and incubated for another 48 hour period at 37° C. to demonstrate that a true kill is obtained as opposed to "stasis" or inhibition of growth.

The new compositions may also beneficially include suitable amounts of adjuvant materials such as coloring agents, perfumes, and other additives.

The new compositions are advantageously marketed in the form of dry, free flowing granules containing the ingredients in homogeneous admixture, such that a definite weight of product may be used to give a solution of definite proportions of the ingredients. The compositions are prepared by adding in a suitable manner either powdered ortho-benzyl-para-chlorophenol or a concentrated solution of ortho-benzyl-para-chlorophenol in isopropanol for example to a blend of the granular inorganic compounds and dry detergent using a suitable dry blender, e.g., ribbon mixer, sigma mixer, twin shell blender, twin cone blender, rotary drum, etc. Any suitable particle size may be employed as desired. Color solution and perfume may advantageously be combined with the concentrated germicidal solution in the manufacture of this product if desired.

The invention is illustrated by the following examples, but it is not intended that the invention be limited solely to the variations and proportions set forth. All concentrations are expressed in percent by weight of the indicated ingredients unless otherwise specified.

## EXAMPLE I

A solid hard surface detergent composition with disinfectant properties was prepared from the following ingredients using the method of production described above:

| Ingredient: | Percent (by wt.) |
|---|---|
| Sodium carbonate | 42.8 |
| Sodium bicarbonate | 26.0 |
| Pentasodium tripolyphosphate | 20.0 |
| Trisodium phosphate | 4.3 |
| Sodium lauryl sulfate | 2.0 |
| Ortho-benzyl-para-chlorophenol | 3.0 |
| Color, perfume, inert, etc. | Remainder |

This composition was formed by dry-mixing the above ingredients resulting in a dry, free flowing, granular product whose color remained stable during accelerated aging tests at 140° F. Hard surface cleansing performance of a 1.85% solution in water was characterized by excellent detergency, low unstable foam and a non-streaked appearance after cleaning. Further, the 1.85% solution in water was clear at pH 9.8 and exhibited good disinfectant properties against a broad spectrum of micro-organisms as measured by the AOAC Phenol Coefficient and use dilution tests. Test results follow:

(A) Phenol coefficient (10 min. kill at 20° C.)
  (1) Against *Salmonella typhosa,* 5.0
  (2) Against *Staph. aureus,* 3.0

(B) Use dilution (1.85% concentration)
  (1) Against *Staphylococcus aureus*—no growth in the ten subculture or the ten resubculture tubes.
  (2) Against *Salmonella choleraesuis*—no growth in the 10 subculture or the 10 resubculture tubes.
  (3) Against *Tri. interdigitale*—no growth in the 10 subculture or the 10 resubculture tubes.

The foregoing test results are particularly significant since the germicidal activity is outstanding, particularly in said alkaline system.

As indicative of the importance of the pH range, a similar composition was prepared wherein the ingredients were proportioned so that a 1.5% water solution had a pH of 10.8. This formulation contained 65.8% sodium carbonate, 2% sodium bicarbonate, 25% tetrasodium pyrophosphate, 4% ortho-benzyl-para-chlorophenol, 1%

sodium lauryl sulfate, with perfume and color, as the remainder.

This composition exhibited markedly reduced disinfectant levels. The A.O.A.C. Use-dilution test results for the 1.5% concentration follow:

*Staphylococcus aureus organism*

Subculture tubes ---------- Growth in 8 out of 10 tubes
Resubculture tubes ------- Growth in 8 out of 10 tubes

Similar compositions were prepared as in Example I containing ortho-chloro-para-phenyl-phenol or ortho-phenyl-phenol as the germicide in place of the ortho-benzyl-para-chlorophenol of Example I. These compositions had a similar pH but were found to have markedly reduced germicidal activity.

EXAMPLES II–VI

The following formulations are prepared as in Example I and when diluted to a 1.5% concentration in water exhibit a similar pH, solubility and cleansing-disinfectant properties also:

| Ingredient | Percent (by wt.) | | | | |
|---|---|---|---|---|---|
| | II | III | IV | V | VI |
| Sodium carbonate | 49.7 | 53 | 37.5 | 40 | 54 |
| Sodium bicarbonate | 34 | 20 | 26 | 26 | 20 |
| Pentasodium tripolyphosphate | | | 20 | 20 | |
| Tetrasodium pyrophosphate | 18 | 18 | | | 18 |
| Trisodium phosphate | | | 4.3 | 4.4 | |
| Ortho-benzyl-para-chlorophenol | 4 | 4 | 4 | 3 | 4 |
| Sodium lauryl sulfate | 2 | 3 | 3 | 2 | 2 |
| Color, perfume, inert, etc | Remainder | | | | |
| pH of 1.5% solution | 10.0 | 10.1 | 9.8 | 9.7 | 10.0 |

As further indicative of the importance of said ingredients in the relationship set forth, it has been found that similar compositions containing various detergents such as sodium dodecyl benzene sulfonate, higher alkyl phenol-ethylene oxide condensates or sodium disulfonated dodecyl diphenyl oxide form cloudy solutions with decreased effectiveness.

The new compositions of this invention present several additional advantages. For example, the compositions are relatively simple to prepare on present equipment without changes in design. Furthermore, the ingredients are readily available through commercial channels at economically attractive prices. In addition, the new compositions can be used on a wide variety of surfaces without fear of damage. Other advantages will be readily apparent to those skilled in the art.

Numerous modifications and variations of the embodiments of this invention may be made without departing from the spirit and scope thereof. Accordingly, it is to be understood that the invention is not to be limited except as defined in the appended claim.

What is claimed is:

1. A solid granular free flowing detergent composition particularly suitable for hard surface cleaning and disinfection consisting essentially of about 35 to 55% by weight of sodium carbonate and about 15 to 25% by weight of sodium tripolyphosphate, as water soluble inorganic normal builder salts, about 20 to 30% by weight of sodium bicarbonate as water soluble inorganic acid salt, about 2% by weight of sodium lauryl alcohol sulfate and about 3 to 4% by weight of ortho-benzyl-para-chlorophenol, said amounts being by weight of total solids proportioned to form a water solution containing from about ½ to 2% by weight of said solids having a pH of about 9.6 to 10 with said chlorophenol essentially in solution and exhibiting thereby effective disinfecting action against a broad spectrum of microorganisms.

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