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SYNERGISTIC ANTIBACTERIAL COMPOSITION

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No Drawing. Continuation of application Ser. No. 800,732, Feb. 19, 1969, which is a continuation-in-part of application Ser. No. 642,327, May 31, 1967, which in turn is a continuation-in-part of application Ser. No. 444,411, Mar. 31, 1965. This application Jan. 19, 1970, Ser. No. 4,471

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ABSTRACT OF THE DISCLOSURE

The specification discloses germicidal compositions containing phenolic germicides, such as p-tert-amylphenol, o-phenylphenol, o-benzyl-p-chlorophenol, and polybromosalicylanilide, such as 3,4',5-tribromosalicylanilide and 4',5-dibromosalicylanilide.

This application is a continuation of my co-pending application, Ser. No. 800,732, filed Feb. 19, 1969, now abandoned, which in turn is a continuation-in-part of my copending application Ser. No. 642,327, filed May 31, 1967, now abandoned, which in turn is a continuation-in-part of my application Ser. No. 444,411, filed Mar. 31, 1965, now abandoned.

The present invention is directed to an antimicrobial composition.

In recent years the attention of hospital authorities and sanitarians has been directed to the pressing need for effective sanitation procedures in hospitals and similar environments. The need for stringent sanitation has been pointed out by the increased frequency of troublesome infections caused by antibiotic resistant strains of bacteria.

One of the valuable practices which has developed is the regular use of antimicrobial compositions for the control of staphylococcal types of bacteria. Antibacterial agents are used in the treatment of all critical areas which are subject to contamination by such bacteria, for example, wards, corridors, nurseries, surgeries, washrooms, laundries, and various items of hospital equipment. These areas include surfaces of various types, such as glass, steel, linoleum, wood, waxed surfaces, ceramic tile, vinyl, vinyl asbestos, and the like. It is therefore necessary that effective antimicrobial compositions be capable of providing antibacterial action on a wide variety of surfaces.

In the past, one type of antibacterial agent, known as a "disinfectant," which destroys disease germs or other harmful microorganisms, has been used to provide a germ-free environment. Another type of antibacterial agent which has been used is the so-called "sanitizer," i.e., an agent which prevents or diminishes recontamination. It will be appreciated that practical sanitation includes both the immediate and complete removal or destruction of bacterial contaminants as well as the provision of a sterile surface which has the ability to destroy bacteria and other dangerous microorganisms which may recontaminate a previously sterile surface. Such a surface can be referred to as a self-sanitizing surface.

It is an object of this invention to provide antimicrobial compositions which can effectively decontaminate a surface by destroying substantially all of the bacteria on various types of surfaces commonly found in hospitals.

It is another object to provide an antimicrobial composition which can impart a substantial degree of self-sanitizing properties to surfaces treated with the composition.

It is another object to provide a synergistic mixture of germicidal compounds.

Another object of the invention is to provide antimicrobial detergent compositions characterized by a synergistic germicidal action.

These and other related objects are achieved by means of an antimicrobial composition comprising germicidal amounts of polybromosalicylanilide and a phenolic compound.

The term "germicidal amount" as used herein, including the appended claims, is intended to indicate an amount of a germicidal or antimicrobial material which will kill a substantial number or amount of bacteria within a reasonable contact time and/or provide a substantial degree of protection against recontamination.

It has been discovered that a synergistic increase in antimicrobial activity occurs when a polybromosalicylanilide is combined with certain phenolic compounds in an alkaline environment, i.e., at a pH above 7. Such synergistic compositions are provided by a mixture, preferably a solution, comprising a polybromosalicylanilide, e.g., 3,4',5-tribromosalicylanilide (TBS) and/or 4',5-dibromosalicylanilide (DBS) in combination with a germicidally active phenolic compound as hereinafter described. These antimicrobial compositions can be provided per se, i.e., the antimicrobial compounds in combination with a vehicle or a solvent, or they can be employed in formulations containing other compatible ingredients, such as wetting agents, dispersing agents, detergents, chelating agents, fillers, perfumes, dyes, and suitable solvents for the various ingredients.

The synergistic germicidal mixture can be used in conjunction with any suitable carrier or vehicle. The vehicle can be solid, semi-solid, or a liquid, and the germicides can be either dispersed or dissolved in the vehicle.

For example, the mixture of germicides can be dispersed in a vehicle such as a soap or detergent bar, a liquid detergent formulation, or an aerosol formulation.

These compositions may exist in the form of true solutions, that is, a single phase system, or in the form of dispersions or multiphase systems comprising solid and liquid phases, or immiscible liquid phases.

The polybromosalicylanilide can be a mixture of polybromosalicylanilides containing varying amounts of the bromo substituent, preferably a mixture of 3,4',5-tribromosalicylanilide and 4',5-dibromosalicylanilide. Alternatively, the tribromosalicylanilide may be employed in a substantially pure form which may contain small amounts of dibromo and/or tetrabromo substituted compounds.

It will be appreciated that the polybromosalicylanilides are relatively insoluble materials. Generally, the alkali metal or ammonium salts of the compound per se are preferred for solubility reasons. The alkali metal or ammonium salts can be provided in situ by employing an appropriate alkaline vehicle or solvent. Accordingly, the polybromosalicylanilides and salts thereof are to be understood as being included within the scope of this invention.

The phenolic compounds which have been found to synergize when in combination with the above-mentioned polybromosalicylanilides are p-tert-amylphenol, o-benzyl-p-chlorophenol, and o-phenylphenol.

The synergistic antimicrobial compositions can be conveniently incorporated into a vehicle comprising a short chain aliphatic alcohol, preferably an alkanol having 1 to 4 carbon atoms, e.g., methanol, ethanol, n-propanol, i-propanol, ethylene glycol, propylene glycol, and the like. It is preferred to dissolve the germicide in a solvent or a solvent system, for example, in an alkaline mixture of one of the above-mentioned monohydric alkanols and water. The weight to weight ratio of alkanol to water can range from 1:5 to about 5:1.

The germicidal performance of the synergistic compo-

sition can be coupled with a cleaning action through the use of a suitable detergent or cleaning agent in the formulation.

The selection of an organic detergent for use in conjunction with the antimicrobial compositions of this invention is not narrowly critical. Tht detergent may be any water soluble anionic or nonionic compound having detergent properties. A detergent acts by altering the interfacial effects at the various phase boundaries within the system, and the terms "detergency" and "detergent" are used to refer to the cleaning of solid objects by means of a liquid bath in such a way that the cleaning process primarily involves a physico-chemical action other than solution, though solubility factors may be involved, for example, in preventing or diminishing redeposition of soil and dirt removed from the surface.

Examples of suitable anionic detergents which fall within the scope of the term "detergent" include the soaps, i.e., water-soluble salts of higher fatty acids, or rosin acids, such as may be derived from fats, oils, and waxes of animal, vegetable, or marine origin. Preferred soaps include the alkali metal salts, particularly sodium and potassium salts of tallow, grease, coconut oil, tall oil, and mixtures of such oils and the fatty acids thereof. Other detergents include synthetic anionic detergents, such as the sulfated and sulfonated synthetic detergents, particularly those having from about 8 to 26, and preferably from about 12 to 22, carbon atoms in the hydrophobic portion of the molecule. Such sulfated and sulfonated synthetic detergents can be derived from saturated higher fatty acids having from about 8 to about 26 carbon atoms. Examples of suitable saturated higher fatty acids are myristic acid, palmitic acid, stearic acid, arachidic acid, behenic acid, and lignoceric acid.

As examples of suitable anionic detergents there may be mentioned the higher alkyl mononuclear aromatic sulfonates, such as higher alkyl benzene sulfonates containing from about 10 to about 16 carbon atoms in the alkyl group, e.g., sodium salts of tetrapropyl, hexyl, octyl, nonyl, decyl, dodecyl, and keryl benzene sulfonates. Higher alkyl toluene, xylene, and phenol sulfonates may be used also, as well as the higher alkyl naphthalene sulfonates, such as sodium diisopropyl naphthalene sulfonate, ammonium diamyl naphthalene sulfonate, and sodium dinonyl naphthalene sulfonate.

Another group of anionic detergents includes sulfated and sulfonated aliphatic alcohols having from 8 to 26 carbon atoms, preferably 12 to 22 carbon atoms, corresponding to the above-mentioned fatty acids, such as sodium dodecyl sulfate, sodium hexadecyl sulfate, triethanolamine dodecyl sulfate and sodium oleyl sulfate; sulfated and sulfonated fatty oils, acids, and esters such as the sodium salts of sulfonated castor oil and sulfated red oil; sulfated hydroxyamides such as sulfated hydroxyethyl lauramide; the sodium salt of lauryl sulfoacetate; the sodium salt of dioctyl sulfosuccinate; and the sodium salt of oleyl methyl tauride can also be used.

Additional anionic detergents which can be employed include the sulfuric acid esters of polyhydric alcohols esterified with higher fatty acids, e.g., coconut oil monoglyceride monosulfate, tallow diglyceride monosulfate; and the hydroxy sulfonated higher fatty esters, such as the higher fatty acids esters of low molecular weight alkylol sulfonic acids, e.g., oleic acid ester of isethionic acid.

The synergistic germicidal composition herein disclosed can be used in conjunction with nonionic sulface active agents, i.e., compounds in which the small highly ionized group characteristic of ionic type surface active agents has been replaced by a long chain containing a series of weakly hydrophillic groups, such as ether linkages or hydroxyl groups. Such nonionic surface active agents are well known in the art, and include such agents as the condensation products of alkyl phenols with alkylene oxides, e.g., the reaction product of isooctylphenol with

from about 6 to aobut 30 ethylene oxide units; the condensation products of higher fatty alcohols, such as tridecyl alcohol, with alkylene oxides; the condensation products of fatty oils, such as tall oil with alkylene oxides; alkylene oxide adducts of monoesters of hexahydric alcohols and ethers thereof, e.g., sorbitan monolaurate, sorbitol mono-oleate, and mannitan monopalmitate. Other nonionics include the condensation products of polypropylene glycols with alkylene oxides and the higher fatty acid alkylolamides, such as diethanolamide of coconut oil fatty acids, and the like.

Other suitable nonionic detergents include the surface active derivatives of polyglycerols.

These anionic and nonionic detergents are merely illustrative. Many other suitable detergents and surface active agents are known to those in the art and they are described in the literature, e.g., in Surface Active Agents, by Schwartz and Perry, Interscience Publishers, New York, 1949.

The effect of metallic ions the antimicrobial composition can be controlled or eliminated through the use of an effective amount of a chelating agent. Suitable chelating agents include inorganic materials such as condensed polyphosphates, e.g., pyrophosphates, tripolyphosphates, metaphosphates, and the like, preferably alkali metal and ammonium salts of condensed polyphosphates. The term "alkali metal" as used herein refers to metals of Group I*a* of the Periodic Table, particularly sodium and potassium.

Other suitable chelating agents include organic compounds such as amino-dicarboxylic acids, e.g., ethylenediaminetetraacetic acid, nitrilotriacetic acid, diethylenetriaminetetraacetic acid, ethylenedinitrilotetraacetic acid, and the like; hydroxycarboxylic acids such as citric acid, tartaric acid, gluconic acid, and the like.

Other suitable chelating agents include oil soluble materials such as beta-diketone, e.g., acetyl acetone; amines, such as methylamine; oxemes; and hydroxyamic acids. Lignin which contains a phenolic hydroxy group may also be used.

In addition to preventing discoloration due to the presence of metallic ions, chelating agents have been found to be useful in preventing etching of glass containers which may occur at high pH's.

The chelating agents are employed in an effective or chelating amount, that is to say, an amount which is sufficient to prevent or diminish the undesirable effects of metal ions or etching, as mentioned above. The actual amount will depend on various factors, particularly the concentration of undesirable metal ions in the water used to prepare the composition. It will be appreciated that the amount of the chelating agent is not narrowly critical nor is the presence of a chelating agent necessary to the achievement of synergistic antimicrobial activity. Generally, the chelating agent is employed in amounts ranging from about 0.1 to about 5 percent.

In formulating antimicrobial detergent compositions, the polybromosalicylanilide is generally added to and admixed with a portion of the total amount of the solvent, e.g., an alcohol-water mixture. To the resulting admixture there is added sufficient water, preferably deionized water, to provide a clear liquid admixture. Then the soap or synthetic detergent may be added and the resulting admixture stirred until clear. The phenolic germicide can be added to or dissolved in the balance of the alcohol in a separate vessel and then added to the polybromosalicylanilide-containing mixture along with the chelating agent and the balance of the total amount of water. The pH can be adjusted, preferably to between about 10 and 11, with a 10 percent solution of an alkali metal or ammonium hydroxide or a 10 percent solution of sulfuric acid.

Broadly, antimicrobial detergent compositions of the present invention may contain from about 1 to about 5 weight percent of a suitable polybromosalicylanilide germicide, from about 3 to about 10 weight percent of a

suitable phenolic germicide, from about 4 to about 20 weight percent of an organic detergent, and at least about 0.2 weight percent of a chelating agent, the balance comprising an alcohol-water solvent and incidental impurities normally associated with the various ingredients and additives in the formulation.

In a preferred embodiment of the present invention there is provided an antimicrobial-detergent composition comprising from about 1 to 5 weight percent of a suitable polybromosalicylanilide germicide, from about 3 to 10 weight percent of a suitable phenolic germicide, from about 4 to 20 weight percent of tallow fatty acid potassium soap, at least about 0.2 weight percent of the tetrasodium salt of ethylenediaminetetraacetic acid, and the balance an alcohol-water solvent mixture, preferably comprising from about 4 to 88 weight percent alcohol and from about 3 to 75 weight percent water. Preferably, the germicide components, i.e., the polybromosalicylanilide and the phenolic compound, are present in a respective weight to weight ratio of from about 1:1 to about 1:10, usually from about 3:1 to about 1:3, and the solvent components are present in a weight to weight ratio of water and alcohol which is from about 3:1 to about 4:1.

A specific illustrative formulation within the contemplation of this invention is set forth in Table I below.

TABLE I

Components:	Percent by weight
Polybromosalicylanilide (1:1 mixture of 3,4',5-tribromosalicylanilide and 4',5-dibromosalicylanilide)	3.1
o-Benzyl-p-chlorophenol	5.0
Potassium tallow soap	5.0
Normal propanol	19.0
Tetra - sodium - ethylenediaminetetraacetic acid	0.25
Deionized water	67.65
	100.00

It has been discovered that the herein disclosed antimicrobial compositions are effective means for providing both disinfecting action and self-sanitizing action with respect to a wide variety of surface types, such as metal, vinyl, rubber, asphalt, ceramic tile, and painted surfaces. The term "disinfecting" refers to a rapid destruction of bacteria on a surface treated with the antimicrobial formulation, and the term "self-sanitizing" refers to the provision of protection against recontamination of the treated surface.

The ability of an antimicrobial composition to disinfect a surface was evaluated by the A.O.A.C. Use-Dilution Test as set forth in The Official Methods of Analysis, 9th edition, Association of Official Agricultural Chemists.

EXAMPLE 1

A modified A.O.A.C. Use-Dilution method was employed to evaluate and compare standard commercial disinfectant Composition A, a formulation representative of products containing one or more phenolic germicides such as o-phenylphenol, p-tertiary amylphenol, and o-benzyl-p-chlorophenol, with an antimicrobial composition representative of those herein disclosed, referred to as Composition B, containing a 1:1 mixture of 3,4',5-tribromosalicylanilide and 4',5-dibromosalicylanilide in admixture with o-benzyl-p-chlorophenol. In this test, steel cylinders, treated in accordance with the A.O.A.C. method up to the point of placing the cylinders in the Letheen broth, were held after removal from the disinfectant solution for varying periods of time, and then were recontaminated with a 1:100 dilution of a 48-hour serial broth culture of *S. aureus*. The recontaminated cylinders were then held overnight and then placed in Letheen broth for 48 hours at 37° C. Tubes showing turbidity indicate posive growth and ineffective treatment whereas clear tube indicate destruction of the test organism as a result of the self-sanitizing capacity of the treated surface. The results are tabulated in Table II below.

TABLE II

Viability check following recontamination at times indicated	Number of turbid tubes out of ten	
	Composition A	Composition B
1 hour	10+	0
1 day	10+	0
2 days	10+	0
3 days	10+	0
6 days	10+	0
7 days	10+	2+
14 days	10+	10+

The data indicates that Composition A showed no activity against recontamination while Composition B provided a prolonged self-sanitizing effect which lasted up to 7 days.

EXAMPLE II

The antimicrobial compositions herein disclosed were evaluated for disinfecting action on various types of surfaces encountered in hospitals, such as linoleum, rubber, asphalt, vinyl, and painted plasterboard by a second modified A.O.A.C. Use-Dilution Test. In this modified proceduce, samples were cut into pieces 5 x 30 millimeters and sterilized overnight in dessicators filled with ethylene oxide. The surfaces were then inoculated by a calibrated platinum loop with about 100,000 cells of *S. aureus*. The inoculated samples were then dried for 20 minutes at 37° C. The samples were then immersed in 10 milliliters of the use-dilution of the test products previously described as Compositions A and B for a period of 10 minutes and then transferred into the Letheen broth and incubated for 48 hours. The data obtained is set forth in Table III below.

TABLE III

Surface	Number positive tubes per indicated total tubes [1]	
	Composition A	Composition B
Linoleum, unwaxed	44/50	27/50
Vinyl, unwaxed	50/50	31/50
Rubber, unwaxed	50/50	36/50

[1] Samples incubated in Letheen broth.

The data indicates that Composition A was ineffective on linoleum, vinyl and rubber surfaces, whereas Composition B was substantially more effective in destroying *S. aureus* on these types of surfaces.

EXAMPLE III

In another series of tests, performed as described above on various surfaces, the disinfecting action of Composition B was compared with a commercial germicide, designated as Composition C, in which the active ingredients are a 1:1 mixture of 3,4',5-tribromosalicylanilide and 4',5-dibromosalicylanilide in combination with lauryldiethylenetriamine. The results obtained are set forth in Table IV below.

TABLE IV

Surface	Number positive tubes per indicated total tubes [1]	
	Composition B	Composition C
Steel cylinder	0/30	10/10
Painted plasterboard	0/20	10/10
Ceramic tile	0/20	10/10

[1] Samples incubated in Letheen broth.

The data indicate that a 10 minute immersion in Composition C is not effective to destroy the microorganisms whereas the absence of positive tubes for Composition B

signifies complete destruction of the same microorganisms within the 10 minute period of exposure.

EXAMPLE IV

In other series of tests, the synergistic sanitizer action of Composition B-type formulations was evaluated by the second modified A.O.A.C. Use-Dilution Test, as described above. Samples of porous asphalt tile were treated with a series of antimicrobial compositions each of which contained about 5.02 weight percent potassium tallow soap, about 19 weight percent n-propanol, about 0.25 weight percent tetrasodium salt of ethylenediamine tetraacetic acid, about 0.59 weight percent potassium hydroxide, from about 3 to about 8 weight percent of a germicidal composition, as described in Table V below, and the balance water, to make 100 percent. The pH of each antimicrobial composition was about 10.1. The samples were sterilized in ethylene oxide and then immersed in the antimicrobial composition at Use-Dilution for a period of 10 minutes and then inoculated with an active broth culture of *S. aureus*. After inoculation, the samples were incubated overnight at 37° C. and then subcultured to a nutrient broth for a period of 48 hours. Any degree of turbidity after 48 hours in the nutrient broth indicated the presence of active bacteria. In the table below, the grading represents the number of tubes out of a total of 10 replicates which showed turbidity.

TABLE V

Germicide	Percent	Number of tubes having live bacteria out of 10 replicates
1:1 mixture of 3,4',5-tribromosalicylanilide and 4',5-dibromosalicylanilide	3	5
Do	8	5
Ortho-benzyl-parachlorophenol	5	10
Do	8	10
1:1 mixture of 3,4',5-tribromosalicylanilide and 4',5-dibromosalicylanilide plus Ortho-benzyl-parachlorophenol	3 5	0

Table V shows that ortho-benzyl-parachlorophenol was ineffective to provide a germicidal residue on the porous sample, whereas the polybromosalicylanilide evidenced a substantially greater self-sanitizing activity. However, the combined germicides provided greater self-sanitizing action than the polyhalosalicylanilide alone.

EXAMPLE V

Table VI below illustrates the synergistic disinfecting action of antimicrobial formulations described in Example IV. The disinfecting action of the formulation was measured by the standard A.O.A.C. Use-Dilution Test in which steel cylinders are exposed to the germicide for 10 minutes and then incubated in Letheen broth. The data shows that 8 percent of the polybromosalicylanilide is ineffective to disinfect after a 10 minute exposure and that 3 of the cylinders treated with the 5 percent ortho-benzyl-parachlorophenol-containing composition were still contaminated with live bacteria, whereas the combined polybromosalicylanilide and ortho-benzyl-parachlorophenol was effective to kill all the contaminating bacteria.

TABLE VI

Germicide	Percent	Number of tubes having live bacteria out of 10 replicates
1:1 mixture of 3,4',5-tribromosalicylanilide and 4',5-dibromosalicylanilide	3	10
Do	8	10
Ortho-benzyl-parachlorophenol	5	3
1:1 mixture of 3,4',5-tribromosalicylanilide and 4',5-dibromosalicylanilide plus Ortho-benzyl-parachlorophenol	3 5	0

Table VII below shows the results of a series of tests which demonstrate the synergistic antimicrobial activity of the herein disclosed combinations of phenolic germicides and polybromosalicylanilides. The tests upon which the results are based were conducted according to the modified A.O.A.C. method described in Example I. All the test formulations containing about 3 weight percent of the polybromosalicylanilide and about 5 weight percent of either o-phenylphenol or p-tert-amylphenol (columns 4, 5, 9, 10, 14, and 15) showed no positive tubes out of the 10 replicates, indicating no survival of the organism used to contaminate the tube. In contrast, the formulations containing only one of the germicides were not effective in destroying the bacterial contaminant (columns 1–3, 6–8, and 11–13). The presence of a chelating agent or of different types of detergents did not affect the results.

TABLE VII

	Compositions [1]														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1:1 mixture of TBS and DBS	8			3	3	8			3	3	8			3	3
Para-t-amylphenol		8		5			8		5			8		5	
Ortho-phenylphenol			8		5			8		5			8		5
Potassium-tallow soap	5	5	5	5	5										
Alkyl benzene sulfonate (linear)						5	5	5	5	5					
Neodol 25-9 [2]											5	5	5	5	5
Isopropanol	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Na_2 nitrilotriacetate	0.5	0.5	0.5	0.5	0.5										
Dihydroxyethylglycene						1	1	1	1	1					
Potassium hydroxide (to pH 11)	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59
Number of positive tubes out of 10	10+	10+	10+	0+	0+	10+	10+	10+	0+	0+	10+	10+	10+	0+	0+

[1] Parts by weight (balance to 100 parts with H_2O).
[2] Neodol in a condensate of 9 moles of ethylene oxide with 1 mole of straight chain primary alcohols having 12 to 15 carbon atoms and a maximum of 28% of the molecules having methyl branching.

The antimicrobial compositions Nos. 1–25 given in Table VIII below were prepared in accordance with the procedure set forth hereinbefore.

TABLE VIII

[Compositions Nos. 1–25]

Components:	Percent by weight
n-Propanol	17.5.
Potassium hydroxide (50%)	3–3.3.
Potassium tallow soap	4.4.
Tetrasodium salt of ethylenediamine tetraacetic acid	1.0.
Germicide	Varied per Table IX below.
Water	Balance to 100%.

The ability of the antimicrobial compositions Nos. 1–25 to disinfect a surface was evaluated by a modified A.O.A.C. Use-Dilution Test (see The Official Methods of Analysis, 9th edition, Association of Official Agricultural Chemists). In this test, steel cylinders, treated in accordance with the A.O.A.C. method up to the point of placing the cylinders in the Letheen broth, were held after removal from the disinfectant solution for 24 hours, and then were recontaminated with 200–300 cells per cylinder of a 24 hour serial broth culture of *S. aureus*. The recontaminated cylinders were then held overnight and then placed in Letheen broth for 48 hours at 37° C. Tubes showing turbidity indicate positive growth and ineffective treatment whereas clear tubes indicate destruction of the test organism as a result of the self-sanitizing capacity of the treated surface. The results are tabulated

TABLE IX

Germicide	+	Composition Number																							
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1:1 mixture of 3,4',5-tribromosalicylanilide and 4',5-dibromosalicylanilide (i.e., PBS)		2	2	2			3	3	3			4	4	4	4		5	5	5		6	6	6		
p-Tertiary amyl phenol		6			6		5			5						4	3			3	2		2		2
o-Phenyl phenol			6			6		5			6		4		4			3			3				
Number of tubes out of 10s showing growth (+)		0+	0+	10+	6+	7+	1+	3+	6+	10+	6+	0+	5+	5+	10+	10+	0+	3+	10+	10+	10+	0+	5+	6+	10+	10+

in Table IX wherein compositions Nos. 3–5 are controls for the synergistic antimicrobial compositions Nos. 1 and 2 of the invention, compositions Nos. 8–10 are controls for the synergistic antimicrobial compositions Nos. 6 and 7 of the invention, compositions Nos. 13–15 are controls for the synergistic antimicrobial compositions Nos. 11 and 12 of the invention, compositions Nos. 18–20 are controls for the synergistic antimicrobial compositions Nos. 16 and 17 of the invention, and compositions Nos. 23–25 are controls for the synergistic antimicrobial compositions Nos. 21 and 22 of the invention.

The synergistic antimicrobial compositions Nos. 1, 2, 6, 7, 11, 12, 16, 17, 21 and 22 of the invention containing two germicides gave significantly greater degree of kill (50%–100%) than did the control compositions Nos. 3–5, 8–10, 13–15, 18–20 and 23–25 containing the single germicides (0%–50%) as shown by the data in Table X below which are calculated from the data in Table IX.

TABLE X

	Weight percent Germicide in composition		
	PBS	p-Tertiary amylphenol	o-Phenyl phenol	Percent tubse showing kill
Composition number:				
3	2			0
8	3			50
13	4			50
18	5			0
23	6			40
4		6		50
9		5		0
14		4		0
19		3		0
24		2		0
5			6	30
10			5	40
15			4	0
20			3	0
25			2	0
1	2	6		100
6	3	5		90
11	4	4		100
16	5	3		100
21	6	2		100
2	2		6	100
7	3		5	70
12	4		4	50
17	5		3	70
22	6		2	50

What is claimed is:

1. A synergistic antibacterial composition comprising p-tert-amylphenol, and a 1:1 mixture of 3,4'5-tribromosalicylanilide and 4',5-dibromosalicylanilide, the weight ratio of the phenolic compound to the polybromosalicylanilide compounds being from about 1:1 to about 1:3.

2. The composition of claim **1** wherein the phenolic compound and the polybromosalicylanilide compounds are dissolved in a solvent comprising from about 4 to about 88 weight percent of an alcohol selected from the group consisting of a short chain monohydric alkanol having from 1 to 4 carbon atoms, ethylene glycol and propylene glycol, and from about 3 to about 75 weight percent water.

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