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DISINFECTANT COMPOSITIONS

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This invention is concerned with improvements in or relating to disinfectant compositions.

Many disinfectant compositions are now well-known, the great majority of which are aqueous solutions or emulsions of phenolic compounds. However, known disinfectants suffer from a variety of drawbacks, among which may be mentioned selective action against only certain organisms, reduction in efficiency by organic matter or some specific inhibitor, high toxicity, corrosive action on the skin or mucous membrane, production of scum when diluted in hard or brackish waters or reduction of efficiency therein and immiscibility with sea water.

It is an object of the present invention to provide a new and improved disinfectant composition.

The disinfectant compositions according to the invention are aqueous solutions essentially containing the following phenols in the proportions by weight stated:

	Percent
p-Chlor-m-cresol	1-6
o-Phenyl phenol	0.5-10
o-Benzyl-p-chlorphenol	0.5-5
A polychlor phenol	1-5

The compositions according to the invention further preferably contain alkali-metal or ammonium ions to increase the solubility of the phenols present. The pH of the compositions preferably does not exceed 11. A convenient quantity of alkali metal (preferably sodium) or ammonium ions is from 0.2-2% by weight (calculated as alkali metal or ammonium hydroxide).

A preferred composition according to the invention comprises an aqueous solution, having a phenol content equivalent to 1-6% of p-chlor-m-cresol, 0.5-5% of o-phenyl phenol, 0.5-5% of an alkali metal salt, preferably sodium salt of o-phenyl phenol, 0.5-5% of o-benzyl-p-chlorphenol and from 1-5% of an alkali metal salt, preferably sodium salt of a polychlorphenol.

We have found that the compositions according to the invention have a range of action against gram positive and gram negative bacteria, fungi and fungal and bacterial spores substantially greater than disinfectant compositions hitherto proposed. Thus, known disinfectant compositions, whilst active against certain organisms, have failed against other important organisms. The compositions according to the invention have, however, been found to be very effective against most, if not all, of the micro-organisms which it is desired to combat, for example, in hospitals. In particular, the compositions according to the invention, besides being active against such common organisms as *Staphylococcus aureus*, *Streptococcus pyogenes* and *Pseudomonas pyocyaneus*, are highly effective against *Mycobacterium tuberculosis* and various sporulating organisms as well as many pathogenic fungi. It should

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be pointed out that, in the compositions according to the invention, both the nature of the phenolic ingredients used and the proportions in which they are present are important for success. Thus, we have found, for example, that compositions containing the same components but in different proportions do not possess the same wide range of action as do the compositions according to the invention. The compositions according to the invention are also generally effective in the presence of various kinds of organic matter.

The compositions according to the invention preferably also contain from 0.5-5% of p-chlor-m-xenol, which component has been found to enhance the biocidal activity of the composition, particularly against gram negative bacteria.

The compositions according to the invention further preferably contain a water-miscible (or partially water-miscible) alcohol for the purpose of further aiding the solubility of the phenols thereby reducing risk of precipitation on dilution with, for example, hard or brackish water. Alcohols containing from 1-4 carbon atoms are very satisfactory, examples of which are methanol, ethanol, propanol, iso-propanol, iso-butanol, etc.; a concentration of from 5-25% of alcohol has been found to be advantageous.

The compositions according to the invention further preferably contain a compatible surface active agent. Anionic surface active agents are particularly useful and examples of such substances are alkyl sulphate salts, such as sodium lauryl sulphate, mixed alkyl aryl sulphate salts and various sulphonated oils, e.g. sulphonated castor oil. The detergents sold as Teepol, Comprox and Iranapol have been found to be very satisfactory.

The preferred polychlorphenols for use in the compositions according to the invention are tri-, tetra- and pentachlorphenol.

The compositions according to the invention may be formulated in any convenient way. Thus, for example, the parent phenols may be conveniently mixed with water, alcohol and surface active agent, and the necessary quantity of alkali metal or ammonium hydroxide may be added to give the desired proportion of alkali metal or ammonium ions. Alternatively one or more of the phenols may be added as their salts.

Particularly useful compositions according to the invention are those equivalent to the following composition.

p-Chlor-m-cresol	1-6%, preferably 2-6%.
o-Phenyl phenol	0.5-5%, preferably 0.5-3%.
Sodium o-phenylphenate	0.5-5%, preferably 0.5-3%.
o-Benzyl-p-chlorphenol	0.5-5%, preferably 0.5-2%.
p-Chlor-m-xenol	0.5-5%, preferably 0.5-2%.
Sodium pentachlorphenate	1-5%.
C ₁ -C ₄ alcohols	5-25%.
Surface active agent	10-40%.
Water	To 100%.

An example of a formulation according to the invention which has proved especially effective is given as follows, for the purpose of illustration only.

4% p-chlor-m-cresol
1.5% o-phenyl phenol
1.5% sodium o-phenylphenolate
1% o-benzyl-p-chlorphenol

1% p-chlor-m-xlenol
3% sodium pentachlorophenate
10% iso-propanol
28% Teepol 514
Water to 100%

The composition according to the above-mentioned example has the following properties:

It is a clear amber fluid, stable to both heat and cold. Refluxing at 100° C. for 4 hours does not destroy its germicidal activity, whilst, if held at 0° C. for several weeks, it does not crystallise out or deposit.

It is only mildly alkaline, 1%, 2% and 5% dilutions in tap water having pH values of 8.2, 8.4 and 8.6 respectively.

In the recommended dilutions, it is non-corrosive to skin at 1% and mucous membrane at 0.5% as evidenced by its successful application in cases of acute vulvo vaginitis.

All dilutions in distilled or hard water are crystal clear to slightly opalescent, and free from deposit or scum, an advantage particularly applicable to instrument sterilisation. It is miscible with sea and brackish waters, forming clear to opalescent solutions. Germicidal tests were carried out upon the composition according to the above-mentioned example with the following results:

Germicidal Test Results

Using *B. coli*, *Ps. pyocyaneus*, *Proteus vulgaris* and *S. aureus* in a series of suspension tests conducted at 18° C., a 0.5% soln. of the composition in hard water killed all the test organisms in less than 2½ mins. Similar tests performed in the presence of 20% blood serum, 20% skimmed milk or 1% linseed oil soap soln. again showed complete destruction of the organisms by a 2% dilution in less than 2½ mins.

Linen strips infected with the dried test organisms are sterilised in 30 mins. at 18° C. by a 3% soln. of the composition, even in the presence of 1% linseed oil soap soln.

Fungicidal properties are demonstrated by the destruction of *Trich. inderdigitale*, *Trich. acuminatum* and *Candida albicans* in 30 mins. by a 2% soln. of the composition at 18° C.

Against *Trichomonas vaginalis*, a solution of 1 part of the composition of the example in 700 parts of water destroyed the parasite, in organic medium, within 5 minutes at 36°.

Comparative Results

For comparison several well-known types of disinfectant were tested; these were Liquor chlorxylenolis B.P. (L.C.X.), Liquor cresolis saponatus B.P. (L.C.S.) and a disinfectant of the coal tar-oil type according to British Standard Specification No. 2462.

The results obtained compared with the composition of the above example show the advantages of the latter in germicidal efficiency.

Tests were performed in distilled water (W) and 10% blood serum (S) by the Rideal-Walker (R.W.) (B.S.S. 541:1934) and Food and Drug Administration of the United States (F.D.A.) methods.

	Composition of Example		L.C.X.		L.C.S.		Coal tar-oil product	
	(W)	(S)	(W)	(S)	(W)	(S)	(W)	(S)
R.W. Coeff. (<i>S. typhi</i>).....	6.6	4.5	4.3	2.5	3.0	2.5	7.0	5.0
P.D.A. Coeff. (<i>S. typhi</i>).....	5.0	3.1	3.7	1.7	2.2	1.8	6.1	4.4
F.D.A. <i>Staph. aureus</i>	3.3	1.8	1.5	0.8	1.7	1.5	0.7	0.4
F.D.A. <i>Strep. haemolyticus</i>	6.4	2.2	3.0	1.4	2.7	1.5	1.4	1.1
F.D.A. <i>Ps. pyocyaneus</i>	1.9	1.9	0.1	-----	2.2	1.6	0.9	0.4

Tuberculocidal Tests

Concentration required to kill *M. tuberculosis* (human strain) in less than 5 mins.

	Percent
Composition of example.....	1
L.C.X.	2
L.C.S.	1
Coal Tar product.....	5

Sporicidal Tests

Concentration required to kill the spores of *B. subtilis* in less than 5 mins.

	Percent
Composition of example.....	1
L.C.X.	5
L.C.S.	1
Coal tar product.....	1

Fungicidal Tests

Concentration required to kill *Trich. inderdigitale* in less than 5 mins.

	Percent
Composition of example.....	2
L.C.X., greater than.....	10
L.C.S., greater than.....	5
Coal tar product.....	10

The following table gives two further examples of representative compositions (A and B) according to the invention.

	Composition A	Composition B
p-chlor-m-cresol.....	3%.....	2.5%.
o-phenyl-phenol.....	1%.....	1.5%.
sodium o-phenylphenate.....	2%.....	3.0%.
o-benzyl-p-chlorphenol.....	1.5%.....	1.0%.
p-chlor-m-xlenol.....	1.5%.....	1.5%.
sodium pentachlorophenate.....	2.0%.....	4.0%.
	plus: ethanol, 20%; "Comprox," 35%; Water to 100%.	plus: iso-butanol, 25%; Sodium dodecyl benzene sulphonate, 20%; Water to 100%.

The compositions A and B as shown in the above table are conveniently prepared by dissolving the parent phenols the required amount of water, alcohol and surface active agent, followed by the addition of the necessary quantity of caustic soda equivalent to the sodium salts referred to.

We claim:

1. A disinfectant composition comprising an aqueous solution containing from 1-6% by weight of a first phenolic compound selected from the group consisting of p-chlor-m-cresol and its alkali metal and ammonium salts, from 0.5-10% of a second phenolic compound selected from the group consisting of o-phenyl-phenol and its alkali metal and ammonium salts, from 0.5-5% of a third phenolic compound selected from the group consisting of o-benzyl-p-chlorphenol and its alkali metal and ammonium salts and from 1-5% of a fourth phenolic compound selected from the group consisting of pentachlorophenol and alkali metal and ammonium salts of said fourth phenolic compound.

2. The composition of claim 1 which is a clear solution having a pH not exceeding 11.

3. A composition as claimed in claim 1 which contains from 0.2-2% by weight calculated as the corresponding hydroxide of at least one ion selected from the group consisting of alkali metal and ammonium ions.

4. A composition as claimed in claim 3 in which all of said ions are sodium ions.

5. A composition as claimed in claim 1 which also contains a lower alkanol containing from 1-4 carbon atoms.

6. A composition as claimed in claim 5 in which said lower alkanol is selected from the group consisting of

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methanol, ethanol, propanol, iso-propanol and isobutanol.

7. A composition as claimed in claim 1 which also contains a compatible surface active agent.

8. A composition as claimed in claim 7 in which said surface active agent is selected from the group consisting of an alkyl sulphate salt, a mixed alkyl aryl sulphate salt and a sulphonated oil.

9. A disinfectant composition comprising an aqueous solution containing from 1-6% by weight of p-chlor-m-cresol, from 0.5-5% by weight of o-phenyl-phenol, from 0.5-5% by weight of an alkali metal salt of o-phenyl-phenol, from 0.5-5% by weight of o-benzyl-p-chlorphenol and from 1-5% by weight of an alkali metal salt of pentachlorophenol.

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