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GERMICIDAL SOAP

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This invention relates to soaps and has particular reference to soaps which possess germicidal properties.

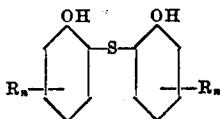
An object of this invention is to provide a germicidal soap by incorporating certain substances, hereinafter mentioned, into washing, toilet or so-called liquid soaps.

A further object of this invention is the provision of new compositions of matter.

Other objects will be apparent to persons skilled in the art from a reading of the following description.

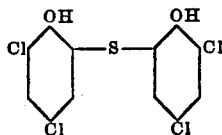
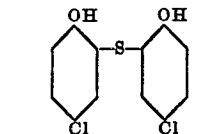
According to the present invention, washing soaps, toilet soaps and liquid soaps may be rendered germicidal by incorporating therein a 2,2'-dihydroxy halogenated diphenyl sulfide.

The 2,2'-dihydroxy halogenated diphenyl sulfides of this invention may be represented according to their chemical structure as follows:

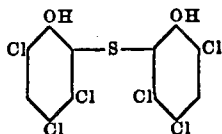


where R is halogen and n is an integer from 1 to 4 inclusive.

As examples of specific members of the foregoing class of compounds in the chlorine series may be mentioned:



and



Compounds having other halogen substituents, e. g. bromine, iodine and fluorine are encompassed by this invention. Also falling under the class of compounds disclosed herein are those which have more than one halogen substituent, such as, for example, chlorine and bromine, in one or both nuclei.

The 2,2'-dihydroxy halogenated diphenyl sulfides are white, crystalline solids. The melting points and solubility characteristics of certain of these compounds follow:

	Melting point °C.	Solubility (room temperature)
2,2'-dihydroxy - 5,5' - dichloro diphenyl sulfide.	175	Quite insoluble in water. Easily soluble in alcohol, ether, acetic acid, acetone and alkalies.
2,2'-dihydroxy - 3,5 - 3',5' - tetrachloro diphenyl sulfide.	188	Do.
2,2'-dihydroxy - 3,5,6 - 3',5',6' - hexachloro diphenyl sulfide.	183	Do.

For purposes of this application, the 2,2'-dihydroxy halogenated diphenyl sulfides are termed germicidal agents, and are hereinafter sometimes referred to as such, and sometimes referred to merely as agents.

Relatively small amounts of the germicidal agents of the invention are sufficient to render soap germicidal. Amounts as low as $\frac{1}{2}$ of 1% of the germicidal agent, based on the weight of the soap content of the final soap product, have proved satisfactory in some cases. However, it is preferred to use amounts of the order of 1 to 3% on the same basis. The upper limit of the amount of agent which may be used is determined by practical considerations. As a general rule, increasing the concentration of agent in the soap increases the germicidal activity of the resulting soap. However, the cost of the agent relative to the cost of the soap itself mitigates against the use of too large an amount of the agent in soap. Moreover, large amounts of the agent in soap are to be avoided if it is desired to obtain a resulting soap product with satisfactory detergent properties. Soaps containing as much

as 10% of the agents of this invention were found to be satisfactory in this regard.

The invention may be practiced by adding the agents to the soap in any suitable manner during the crutching or milling or similar operation. Care should be taken to obtain a uniform distribution of the agents throughout the soap. They may be dissolved in a small amount of a suitable solvent, for example, acetone or alcohol. If desired, however, the agents may be added directly to the soap without dissolving them previously. In the case of "frame" soaps, it is preferred to add the agents to the soap during the crutching operation. With milled soaps, it is preferred to make the addition during the milling operation. In the case of liquid soaps, it is preferred to effect the addition while the agent is in solution. In general, any method which results in the agent being uniformly incorporated into the final soap product is satisfactory.

The method employed to test the germicidal properties of the soaps of this invention is a modification of the U. S. Food and Drug Administration method (Circular 198, December 1931). A standard 24 hour broth culture of *Staphylococcus aureus*, contact time of 5 minutes, and temperature of 37° C. were used in the tests. Instead of transferring the loopful of material containing the test sample and culture to the broth at the end of the contact time as in the official F. D. A. test method, the loopful was transferred to a tube of liquid agar, maintained at approximately 42° C. The contents were thoroughly mixed and then poured into a petri dish and allowed to solidify at room temperature, followed by an incubation period of 40-48 hours at 37° C.

The number of colonies present after this treatment were counted. It is this "plate count" which the numbers given in the accompanying table represent. The number zero (0) represents absence of colonies and hence indicates that the sample tested destroyed all of the bacteria. In other words, germicidal power is inversely related to the number given as the "plate count."

In order to check the organisms, *Staphylococcus aureus*, for proper resistance, a "plate count" was run on phenol of dilution of 1:80 and 1:90 and only those cultures having proper resistance were employed in the test.

The following table gives data obtained by testing a neutral milled soap alone and by testing the same soap containing 2% of certain of the germicidal agents. The data given in the table are intended as illustrative of specific em-

bodiments of the invention and are not to be considered as limiting the scope of the invention.

A ¹	Plate count		
	A/1.5 ²	A/4 ³	A/9 ⁴
1 2,2'-dihydroxy-5,5'-dichloro diphenyl sulfide.....	0	50	200
2 2,2'-dihydroxy-3,5,6-3',5',6'-hexachloro diphenyl sulfide.....	0	0	0
3 2,2'-dihydroxy-3,5,6-3',5',6'-hexachloro diphenyl sulfide.....	0	0	0
4 Soap blank (no agent added).....	(4)	(4)	10,000

¹ A, refers to the neutral soap plus the added agent, except in the case of the soap blank where A refers to the soap itself.

² A/1.5, means that 1 part by weight of material A was diluted with 1.5 parts of water. Similarly, A/4 refers to a mixture of 1 part of A and 4 parts of water, etc. The figures under the designations A/1.5, etc., refer to the "plate counts" obtained at the dilution indicated.

³ Number 3 was found to give a zero count even at concentrations as low as A/29 under the test conditions.

⁴ Not tested.

The term "soap" as used herein is employed in its popular or ordinary meaning. The term refers to cleansing agents, made usually by the action of alkali on fat or fatty acids and consisting essentially of sodium or potassium salts of fatty acids.

The term "germicidal soap" for the purposes of this patent application refers to those soaps which are effective against *Staphylococcus aureus* of standard resistance. For example, if a soap is not effective against *Staphylococcus aureus*, it is not considered to be germicidal, whether or not it is effective against other types of bacteria. On the other hand, if a soap is effective against *Staphylococcus aureus*, the soap is considered to be germicidal, whether or not it is effective against any other types of bacteria.

The foregoing illustrates the practice of our invention which, however, is not to be limited thereby but is to be construed as broadly as permissible in view of the prior art and limited solely by the appended claims.

What is claimed is:

1. A germicidal soap consisting of a detergent soap and 2,2'-dihydroxy-3,5,6-3',5',6'-hexachloro diphenyl sulfide.

2. A germicidal soap comprising a detergent soap and not more than 5% by weight of 2,2'-dihydroxy-3,5,6-3',5',6'-hexachloro diphenyl sulfide.

3. A germicidal soap comprising a detergent soap and from 1% to 3% by weight of 2,2'-dihydroxy-3,5,6-3',5',6'-hexachloro diphenyl sulfide.

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