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GERMICIDE

Arthur L. Waugh, Chicago, Ill.

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My invention relates to germicides, and more particularly to a detergent germicide.

My invention relates to germicidal solutions, and particularly to such solutions utilizing formaldehyde, in which the killing time for bacteria is reduced considerably below that previously necessary with such germicidal solutions as employ formaldehyde, without increasing excessively the amount of formaldehyde in the solution, and which will not cause rusting of surgical instruments immersed therein. Such surgical instruments ordinarily are metallic or include metallic parts, which are forged from steel, or stamped or cast from soft metal alloys, and are usually electroplated. My improved germicidal solution can be utilized for sterilizing articles of this character that it is necessary to sterilize in the daily use of physicians and nurses, by immersion in the solution, without in any manner damaging the plating thereof or causing rusting or other corrosion of the material from which the same are made.

It is one of the important objects of my invention to provide a germicide that can be utilized for sterilizing of pathogenic organisms and spores in a cold fluid rapidly, without rust, corrosion or loss of temper and edge of fine cutting instruments, even if such instruments are left submerged in the germicidal fluid for an indefinite period of time, and even though there may be articles of varying compositions stored in the same receptacle, immersed in such fluid. One of the difficulties, with the use of solutions that contain unusually high percentages of formaldehyde in order to obtain quick sterilization, is that increasing the amount of formaldehyde increases the possibility of rusting and other damage to the instruments, and there are other objections to the use of excessive percentages of formaldehyde resulting from the volatilization thereof, which gives off undesirable fumes. My invention is not only a means for sterilizing surgical and diagnostic instruments thoroughly and promptly, and detergent means for cleaning the same and for storing the same indefinitely in a safe and handy manner, but also is capable of use for general germicidal purposes. I have found that the use of thymol in very small quantities in a germicidal solution for the purposes above mentioned reduces the killing time for the germicide greatly without any necessity of increasing the amount of formaldehyde, when used in a germicidal solution of the general type described in my application Serial No. 183,647, filed January 6, 1938, patented December 17, 1940, Patent No. 2,224,889, 55

whether used with the standard solution or the concentrated solution described therein. One-fourth of one percent thymol in the concentrated germicidal solution described in said application reduces the killing time to ten minutes, and less than one-tenth of one percent is sufficient for this purpose in the standard solution.

It is impossible to eliminate all water from formaldehyde solutions and obtain any germicidal action, as no germicidal effect would be produced if no water were present, because the protoplasm of the organisms is damaged only when ionization takes place, and there can be no ionization unless some water is present, for although the water ionizes only to a very limited extent, yet the compound thus ionizes slightly. Such ionization would, however, tend to promote rusting, if an excessive amount of water were present. While formaldehyde germicidal solutions using methyl alcohol and acetone as a vehicle are capable of absorbing a large quantity of water and thus tend to prevent such rusting, instruments that have been washed in water, or frequently with soap also, have some of the water or soap remaining in remote places, such as locks, slots, screw-threads, and other places that are difficult to dry. Rusting will occur if any free oxygen is present with iron. While the germicidal solution may be free of such dissociated oxygen, it would be present and usually is present in ordinary tap water, which usually, or at least frequently, contains chlorine, and inasmuch as the instruments would be usually washed in such tap water before being placed in the germicidal solution, it is highly desirable to provide a means in a germicidal solution of the above mentioned character, which will reach the remote places in which water, or soap and water, may be lodged when the instruments are placed in the germicidal solution, which will prevent such rusting due to the presence of this water or dissociated oxygen in the water or other liquid located in these remote places on the instruments. I have found that by utilizing the property of an amine of combining with chlorine and the other halogens, oxygen and many other elements, the free oxygen can be combined with the amine, thus removing the same and preventing the forming of iron hydroxide on the iron or steel of the instruments, particularly in the remote places referred to. The amine does not in any manner injure the detergent and germicidal effect of the formaldehyde solution containing methanol, ethyl alcohol and acetone as solvents and vehicles, such as described in my Patent No. 2,224,889, above referred to, and

my application Serial No. 325,179, filed March 21, 1940, patented December 17, 1940, Patent No. 2,224,890. A very small quantity of an amine is necessary for this purpose.

By utilizing the thymol and the amine in small quantities the killing action of the germicide is speeded up greatly, while any possibility of rusting from any source while the instruments are in the germicidal solution is entirely avoided. While the most satisfactory results are obtained by the use of the small percentages of thymol and an amine in the germicides described in my above mentioned applications, the germicidal action of any formaldehyde germicide solution is speeded up and the tendency of many of these to cause rusting is overcome by the addition of thymol and an amine in small quantity thereto.

Other objects and advantages of my invention will appear as the description thereof proceeds. I desire to have it understood, however, that I do not intend to limit myself to the particular details herein described, except as defined in the claims.

While the addition of the thymol to any previously known formaldehyde germicidal solution will speed up the action thereof as a germicide, it is particularly effective if added to the germicidal solutions described in my above mentioned patent applications. Neither the addition of the thymol nor the amine in any way lessens or interferes with the detergent, germicidal and solvent effects of the solutions described in said applications, but the addition of the thymol does greatly increase the rapidity of action of the germicidal solutions described in said applications, while the addition of the amine prevents the formation of rust from such outside sources as have been previously mentioned, although the solutions described in the above mentioned applications for patent do not of themselves contain any ingredient that would in any manner cause rusting. The amine has mild antiseptic properties also, particularly in the presence of an acid. The germicidal solutions described in my above mentioned applications are slightly acid and contain no alkali.

My improved germicidal solution in its preferred form contains formaldehyde, water and solvents, thymol and an amine. The solvents are, preferably, acetone and methanol and the solution is, preferably, made up in a concentrated form containing approximately 16% formaldehyde and 24% water, and approximately 60% solvents, the solvents, preferably, comprising acetone and methanol and the proportion of acetone to methanol may vary from twice as much acetone as methanol, to twice as much methanol as acetone. To this is added from one-fourth of one percent to two percent thymol, and from one-fourth of one percent to two percent of an amine, preferably, hexamethylenamine or methenamine U. S. P.

From this concentrated solution a standard solution for sterilizing surgical instruments and similar apparatus by immersion in the cold solution may be prepared by adding to the above mentioned solution ethyl (U. S. P.) alcohol in the proportions of one part of the solution above mentioned to three parts of ethyl alcohol. The ethyl alcohol used being, preferably, U. S. P. contains absolute alcohol 95.57% and water 4.43%.

This will produce a solution containing approximately 71% absolute alcohol (ethyl), approximately 3.7% formaldehyde, approximately 10% water, and approximately 15% solvents

made up of acetone (U. S. P.) and methanol in the proportion of half as much to twice as much methanol as acetone, and very small percentages of thymol and either of the amines mentioned. Of course, if up to 2% thymol or an amine is added, then the percentages of the total of the other ingredients will be very slightly decreased, but the approximate percentages will be substantially as stated.

As far as the action of the thymol and the amine is concerned, the exact percentages of ethyl alcohol, methanol, acetone and formaldehyde are not of such great importance, for these may vary slightly and the results, as far as the action of the amine and the thymol is concerned, will be the same.

In fact, the addition of such small percentages of the amines mentioned and the thymol to formaldehyde solutions containing solvents other than those mentioned, such as alcohols, or mixtures of alcohols, will have the killing time thereof decreased by the addition of the thymol thereto in such very small percentage as here mentioned, and will have any tendency that such formaldehyde solutions might have to cause rusting, decreased, if not entirely prevented, by the addition of an amine such as those mentioned, thereto.

The particular solutions here described are highly effective germicidal liquids because these contain a very high percentage of formaldehyde and contain nothing that will in any manner impede the action of the formaldehyde, or cause rusting of instruments that are immersed in the solution. In addition to this, the thymol adds to the effectiveness of the germicidal solution very materially, because it speeds up the action of the solution in its killing action. Furthermore, by the use of either of the amines mentioned, any difficulties that previously existed in connection with formaldehyde solutions using solvents that would prevent rusting in general, but might not reach the remote crevices or spaces in instruments that might contain water, is also entirely avoided. While the thymol could be used alone in a germicide that was not used for the immersion of instruments therein, my invention is primarily for the purpose of providing a germicide that can be used for the immersion of surgical instruments therein for sterilizing purposes, and can also be used for other general germicidal purposes, and therefore the amine is, preferably, used in the solution, although if a solution is prepared in accordance with my invention, that is intended for other germicidal uses than that of sterilizing instruments by immersion, the amine could be omitted. Also, of course, the amine added to the germicidal solution above described, whether the concentrated or diluted solution containing acetone and methanol as solvents, will prevent the rusting whether the thymol is used or not, but inasmuch as both speed of action and prevention of rust in remote crevices of surgical instruments is desired of a germicide for the purpose of immersing instruments therein, preferably, both the thymol and the amine are utilized. While the omission of the thymol would still leave the solution thoroughly effective, it would be relatively slow in action as compared with that containing the very small percentage of thymol described above. While as much as two percent thymol can be used, it has been found that even one-fourth of one percent is thoroughly effective to greatly speed up the action of the germicidal solution.

It has been found that the most desirable

practical way to produce the solution is in the concentrated form, as this reduces the cost of packaging and shipping, and inasmuch as the alcohol used for diluting the concentrated solution to produce the standard solution can be purchased by hospitals at a low price, it is most convenient to furnish the solution in concentrated form to such institutions. However, in case anyone having the concentrated germicidal solution for dilution fails to dilute the same, it still operates perfectly satisfactory as a germicide for immersion of instruments therein for sterilization purposes, due to the type of solvents used.

The concentrated solution is made up with the percentage of thymol therein not under one-fourth of one percent and not over two percent, and the percentage of the amine therein not under one-fourth of one percent and not over two percent. Of course, when this solution is so made up and is diluted with ethyl alcohol, as above described, using one part of the concentrated solution to three parts ethyl alcohol, the percentage of thymol and of the amine in the final solution is further reduced, the percentage of thymol in the standard solution when the concentrated solution has been so diluted, being between .063% and .5%, and the percentage of amine used in the standard solution being between .063% and .5% due to such dilution with the alcohol.

What I claim is:

1. A germicidal liquid containing substantially one part formalin to two parts solvents including methanol and acetone, there being from one-half as much to twice as much acetone as methanol in said liquid, and containing approximately 16% formaldehyde, not more than 24% water, and from .25% to 2% hexamethylenamine.

2. A germicidal liquid containing substantially one part formalin to two parts solvents including methanol and acetone, there being from one-half as much to twice as much acetone as methanol in said liquid, and not over 24% water from .25% to 2% of thymol and from .25% to 2% of hexamethylenamine.

3. A germicidal liquid containing approximately 4% formaldehyde, approximately 70% ethyl alcohol, approximately 10% water, between .063% and .5% thymol, between .063% and .5% of hexamethylenamine, and approximately 15% solvents including methanol and acetone, there being from one-half as much to twice as much acetone as methanol in said liquid.

4. A germicidal liquid containing approximately 4% formaldehyde, approximately 70% ethyl alcohol, approximately 10% water, between .063% and .5% of hexamethylenamine, and approximately 15% solvents, including methanol and acetone, there being from one-half as much to twice as much acetone as methanol in said liquid.

ARTHUR L. WAUGH.