Patented Sept. 14, 1948 2,449,274

UNITED STATES PATENT OFFICE

2,449,274

SELF-INDICATING QUATERNARY AMMONIUM BACTERIOCIDAL COMPOSITION

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No Drawing. Application May 27, 1946, Serial No. 672,688

10 Claims. (Cl. 167—33)

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This invention relates to self-indicating bacteriocidal agents and to methods of preparing such agents.

Heretofore it has been proposed to test the bacteriocidal strength of various solutions and compositions by withdrawing a sample, adding certain dyes and reagents and observing the color effects with respect to a standard. Such procedures are exemplified by the disclosures of U. S. patents to: Lehmkuhl, 1,986,403, dated January 1, 1935; and Scharer, 2,385,471, dated September 25, 1945. It has also been proposed in the U. S. patent to Englund, 1,584,022, dated May 11, 1926 to add fluorescent dyes of the diresorcinolphthalein type to inorganic cleaning compositions to progressively indicate their relative strengths in aqueous solutions.

In the washing and rinsing of tableware, especially in public places such as restaurants and soda fountains, State and Federal requirements have been promulgated in an effort to limit bacteria counts of the articles processed to such low values as to prevent transmission of disease. Even though the proprietors of such public places may be cooperative in their efforts to conform with such regulations, they have never heretofore been provided with a simple means for determining when the bacteriocidal potency of their rinse solutions has become spent or reduced to an unsafe value. The age and frequency of renewing the solutions cannot be relied upon to assure the required bacteriocidal strength of such compositions, since elapsed time and extent of use are not the sole criteria; some contaminants reduce the effectiveness of these solutions much more rapidly than others.

Quaternary ammonium compounds have now been accepted rather generally by various Federal and local agencies as inhibitors of bacterial growth and transmission, and it is with respect to the use of such quaternary ammonium compounds that the present invention is primarily concerned.

It has been found in accordance with this invention, that when various dyes of characteristic color and fluorescence are admixed with certain types of quaternary ammonium compounds possessing particular phenol coefficients, the characteristics of color and fluorescence are sharply modified. Then when the phenol coefficient of the composition has become reduced to a predetermined value by contamination, a marked and rather abrupt change in color and fluorescence occurs, thus providing a user or inspector with an unmistakable visual indication of that condition.

Fluorescent dyes of the phthalein class have now been found to produce highly satisfactory results in conjunction with quaternary ammo-

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nium compounds as self-indicating bacteriocidal compositions which in aqueous solutions undergo a sharp and distinct change in color and fluorescence characteristics upon reduction in potency to certain predetermined values.

When these dyes are added to the quaternary ammonium compounds under consideration, the resulting color and fluorescence are entirely different from these characteristics of the dye itself, but when the bacteriocidal potency of the composition becomes reduced to the predetermined value below which it is undesirable to rely upon it, the rather sudden change in color and fluorescence will directly indicate the existence of such condition. This sudden change is in sharp contrast to gradual changes of the types known in the prior art for use in such colorometric comparisons as pH determinations. By virtue of the present invention, a mere glance at the bath will suffice to indicate whether or not it is satisfactory for further use.

Laboratory and operating tests have been conducted with various dyes and quaternary ammonium compounds and with various contaminants, and thus far the tests have verified the results herein proposed.

Among the materials with which highly satisfactory results have been obtained, in that the fluorescence of the dye is quenched upon its addition to the bacteriocide, and restored when a predetermined degree of contamination has been produced in an aqueous bath together with the color changes as previously referred to, are the following:

a. Lauryl pyridinium chloride (12%) ..... 1 gal.
Uranine ..... ½ gm.
pH 7.55
Phenol coefficient 28+

b. Lauryl pyridinium chloride (12%) ..... 1 gal.
Fluorescein ..... ½ gm.
pH 7.55
Phenol coefficient 28+

c. N-pyridinium chloride (10%) ..... 1 gal.
Uranine ..... ½ gm.
pH 4.91

d. N-pyridinium chloride (10%) ..... 1 gal.
Fluorescein ..... ½ gm.
pH 4.91

e. Cetyl pyridinium iodide (1%) ..... 1 gal.
Fluorescein ..... ½ gm.
pH 7.80

f. Cetyl pyridinium bromide (1%) ..... 1 gal.
Uranine ..... ½ gm.
pH 7.78

g. Cetyl pyridinium bromide (1%) ..... 1 gal.
Fluorescein ..... ½ gm.
pH 7.78

h. Cetyl pyridinium chloride (2½%) ..... 1 gal.
Uranine ..... ½ gm.
pH 6.00

t. Cetyl pyridinium chloride (2½%)---- 1 gal.
Fluorescein ---------- ½ gm.
pH 6.00

The pH values of these aqueous baths are noted as being variously in the acid and alkaline ranges, a condition which would thus far appear to be not of a critical nature. Certain of these compositions have been subjected to the effects of various atmospheric temperatures, natural light, ultra violet light and reducing agents without adversely affecting their performance for the purposes intended.

After diluting these compositions to the minimum strengths at which their use conforms with F. D. A. standards (F. D. A. Circular 198), they were contaminated with a 35% soap solution (which if added in sufficient quantity would inactivate them as bacteriocides) and at the first indication of the restored fluorescence and color, they were found to retain a substantial proportion of their original bacteriocidal activity, thus providing a definite safety factor.

An example of a practical application of the invention is as follows:

Used drinking glasses were cleansed with warm water and washing compound, rinsed in clear water, and then immersed in a bath containing one ounce of the following composition to four gallons of water:

12% lauryl pyridinium chloride having a phenol coefficient of 28+ (F. D. A. Circular 198)
88% water
½ gm. fluorescein per gal.

The glasses were then placed in a rack to drain.

So long as the aqueous composition retained its original light straw color it was found to possess satisfactory bacteriocidal properties. This color, accompanied by no apparent fluorescence under any conditions observed, remained substantially unchanged throughout many washing and rinsing operations. Then, suddenly, when the contamination reached a critical predetermined point, the bath assumed a definite green color accompanied by a marked fluorescence. A determination of the phenol coefficient at this point showed that the value had dropped to a point substantially below its original strength, and at which renewal would be desired, yet it retained definite bacteriocidal activity sufficient to constitute a safety factor.

The quaternary ammonium compounds successfully employed to produce these desired results have included quaternary ammonium salts, wherein the ammonium nitrogen is incorporated in an aromatic ring or resonating system, which compounds can be characterized as cationic or invert soaps, detergents, wetting agents, disinfectants, germicides or bacteriocides.

The effect of the apparent loss or reduction of fluorescence of the dyes upon admixture with the quaternary ammonium compounds may be referred to as quenching. Whether or not fluorescence could be detected under special lighting or photographically is of no practical importance where the impression upon the human eye is involved, and for the effects here under consideration, the expression "apparent fluorescence" may be employed to advantage.

Many and valuable applications of this invention will suggest themselves to those skilled in the art, among which are uses in swimming pools, foot baths, dish washing, and various other places where contamination should be readily detectable.

The examples outlined herein will adequately serve to illustrate the invention without restricting it beyond the scope of the appended claims.

I claim:

1. A bacteriocidal composition comprising a bacteriocidal quaternary ammonium compound and a fluorescent indicating agent quenched therein and responsive at a predetermined reduced bacteriocidal strength to change the visual aspect of the composition, said indicating agent being selected from the group consisting of fluorescein and uranine.

2. A bacteriocidal composition comprising a bacteriocidal alkyl pyridinium halide and a fluorescent phthalein dye selected from the group consisting of fluorescein and uranine quenched therein.

3. A bacteriocidal composition comprising a bacteriocidal alkyl pyridinium halide and a fluorescein indicator quenched therein.

4. A bacteriocidal composition comprising lauryl pyridinium chloride and a fluorescein indicator quenched therein.

5. A bacteriocidal composition comprising an aqueous vehicle, a quaternary ammonium bacteriocide and a fluorescent indicator selected from the group consisting of fluorescein and uranine quenched therein responsive at a predetermined bacteriocidal strength to change the visual aspect of the composition.

6. A bacteriocidal composition comprising an aqueous vehicle, a quaternary ammonium bacteriocide having a relatively high initial phenol coefficient and a fluorescent indicator selected from the group consisting of fluorescein and uranine quenched therein responsive at a predetermined reduced phenol coefficient to change the visual aspect of the composition.

7. A method for rendering reduced potency of a quaternary ammonium bacteriocide composition self indicating comprising incorporating therein a fluorescence agent selected from the group consisting of fluorescein and uranine which changes the visual aspect of the composition at a predetermined bacteriocidal strength.

8. A method for rendering reduced strength of an alkyl pyridinium halide bacteriocidal composition self indicating comprising incorporating therein a fluorescein indicator which changes the visual aspect of the composition at a predetermined bacteriocidal strength.

9. A method for rendering reduced strength of an alkyl pyridinium halide bacteriocidal composition self indicating comprising incorporating therein a uranine indicator which changes the visual aspect of the composition at a predetermined bacteriocidal strength.

10. A bacteriocidal composition comprising a bacteriocidal alkyl pyridinium halide and a uranine indicator quenched therein.

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REFERENCES CITED

The following references are of record in the file of this patent:

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