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PROCESSES FOR DISINFECTING NON-PERISHABLE ARTICLES

Hermann Genth and Otto Pauli, Krefeld-Bockum, Germany, assignors to Farbenfabriken Bayer Aktiengesellschaft, Leverkusen, Germany, a corporation of Germany

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The present invention pertains to processes for disinfecting non-perishable articles and to bactericidal and disinfecting agents and compositions for use therein.

It is known to use pyrocabonic acid esters, preferably the diethyl ester, as preserving agents for perishable materials that are easily spoiled. If the materials to be preserved contain water, then this has the advantage that the esters decompose hydrolytically within a short time to carbon dioxide and the corresponding alcohol. Particularly in the case of the diethyl ester, no undesired decomposition products are formed and thus no undesired side effects occur.

We have now found, surprisingly, that pyrocarbonic acid esters are not only effective as preservatives, i.e., as agents which inhibit bacterial growth, but that they are also fungicidal and have a disinfecting effect. The principal object of the present invention is to provide a process for disinfecting articles of all kinds, such as textiles, packing materials and containers, in which process the articles are treated with pyrocarbonic acid esters.

As a rule, a comparatively short period of time is necessary for the pyrocarbonic esters completely to destroy the bacteria on the articles to be disinfected or, at the very least, to reduce the bacterial count to a value which is, in practice, of no significance.

Examples of pyrocarbonic acid esters which may be used in the processes of the present invention are the dimethyl, diethyl, dipropyl, diisopropyl, dibutyl, diisobutyl, diamyl, dissoamyl, dicyclohexyl, diphenyl, dibenzyl and difurfuryl esters, as well as mixed esters, such as the 2,3-dichlorophenyl ethyl ester and the 3.5-dichlorophenyl benzyl ester.

If personal linen, bed linen, containers or packing materials are to be treated, then the use of the diethyl ester is again of advantage since it decomposes into carbon dioxide and the harmless ethanol.

The articles to be treated can, for example, be sprayed with a pyrocarbonic acid ester of the kind mentioned, dipped into the ester or brought into contact with compositions which contain the pyrocarbonic acid esters, for example, aqueous alcoholic solutions or aqueous dispersions, or with gaseous mixtures of the vapors of the esters and other gases, such as carbon dioxide, nitrogen or air, Aqueous dispersions can be easily and quickly produced in a short time, for example, with the help of a rapid stirrer and, possibly, with the addition of a wetting or dispersing agent.

Thus, for example, blankets, linen materials, bed linen, packing foils, bags, containers, such as flasks and bottles, metal caps or closures, and cork, rubber or synthetic plastic stoppers for bottles and other containers, can readily be freed from bacteria and/or disinfected. Articles which can be disinfected in the process of the present invention may be formed of metals, such as aluminum, zinc, tin and galvanized or tinned iron, wood and also of synthetic plastics, such as polyethylene, polyamides or polyesters.

The following examples in which the parts mentioned

are parts by weight, are given for the purpose of illustrating the present invention:

Example 1

Aluminum casks which are intended for the storage and shipment of beverages and are to be disinfected before being re-used, are filled with a cleaning solution consisting of 90 parts water and 10 parts ethanol. 0.5% pyrocarbonic acid diethyl ester is added and is mixed with the ethanol. After allowing the cask and the solution to stand for about 30 seconds, the initial bacterial count of 8×10^5 to 10×10^5 drops to a bacterial count of 1×10^2 per milliliter of the cleaning solution which is, in practice, insignificant. After rinsing out with clear water, bacterial spores which previously were present were no longer detectable in the beverage with which the cask was filled.

Example 2

Swatches of a blanket (4 x 4 cm.) are infected with a culture of each of two test bacteria (*Staphylococcus aureus* and *Escherichia coli*). After drying at 37° C. a solution of 90 parts water, 9.5 parts ethanol and 0.5 part pyrocarbonic acid diethyl ester are brought into and maintained in contact with the swatches for various different periods of time. The addition of a trace of a wetting agent (alkylaryl sulphonate) has an advantageous effect. In the case of a period of 10 or 20 minutes' contact time of the solution with the infected swatches, a definite killing of the test bacteria can be observed. (For testing purposes, the swatches were placed and incubated at a temperature of 37° C. on the surface of a nutrient medium, the swatches were turned over after 24 hours and placed on a fresh surface of the nutrient medium, in accordance with the method of H. Ostertag that was published in Melliand Textilberichte, vol. 41, pages 763 to 768 (1960).)

It is also possible to kill the mentioned test bacteria on textile materials by diluting vapors of diethylpyrocarbonate with pressurized air in a volume ratio of 12:88 and introducing the gaseous mixture, with the help of a spray device, into a closed chamber in which are contained the infected textiles. In this manner, a contact time of 5–10 hours suffices for the killing, i.e., for complete disinfection. Any diethyl pyrocarbonate which has not reacted hydrolytically with the water already contained in the textile can easily be decomposed into carbon dioxide and ethanol by blowing water vapor into the disinfection chamber. The drying of the textile takes place in the usual manner.

Example 3

Polyethylene tubes are rinsed with a solution of 90 parts water, 9.4 parts ethanol, 0.5 part pyrocarbonic acid diethyl ester and 0.1 part of an emulsifier (an alkylaryl sulphonate). Subsequently, a cosmetic having an egg yoke base was stored for 28–34 days in these rinsed tubes without any sign of fermentation and decomposition.

Example 4

Cork stoppers which are intended for use as closures for fruit juice bottles are sprayed shortly before use in a polyethylene container with diethyl pyrocarbonate or with a solution of diethyl pyrocarbonate in pure ethanol. A pressure container provided with a valve serves for the evaporation of the diethyl pyrocarbonate or ethanol solution of diethyl pyrocarbonate. By shaking up the cork stoppers in the container, all the stoppers are brought into intimate contact with the vapors of the diethyl pyrocarbonate or ethanol solution of diethyl pyrocarbonate. Growth or cultivation of bacteria or fungi in bottles closed with stoppers treated in this manner

does not occur. In a control series of bottles which were closed with untreated stoppers between 5 and 18% of the bottles containing a beverage were cloudy and the growth of surface bacteria and bacterial growth on the cork were definitely observed.

We claim:

1. A process for the disinfection of non-perishable articles which comprises bringing said non-perishable articles that are to be disinfected into contact with an ester of pyrocarbonic acid of the group consisting of the dimethyl, diethyl, dipropyl, diisopropyl, dibutyl, diisobutyl, diamyl, diisoamyl, dicyclohexyl, diphenyl, dibenzyl, difurfuryl, 2,3-dichlorophenyl ethyl, and 2,5-dichlorophenyl benzyl pyrocarbonate.

2. A process as defined in claim 1 in which the article to be disinfected is brought into contact with a solution in aqueous ethanol of an ester of pyrocarbonic acid as defined in claim 1.

3. A process as defined in claim 1 in which the article to be disinfected is brought into contact with an aqueous dispersion of an ester of pyrocarbonic acid as defined in claim 1 containing an emulsifying agent.

4. A process as defined in claim 3 in which the emulsifying agent is an alkyl aryl sulfonate.

5. A process as defined in claim 1 in which the article to be disinfected is brought into contact with a vapor consisting of an ester of pyrocarbonic acid as defined in claim 1 and a gas of the group consisting of carbon dioxide, nitrogen, and air.

6. A process as defined in claim 1 in which the article to be disinfected is brought into contact with diethyl pyrocarbonate.

7. A process for the disinfection of the surfaces of non-perishable articles which comprises bringing said non-perishable articles that are to be disinfected into contact with an aqueous solution containing 10% by weight of ethanol and 0.5% by weight of diethyl pyrocarbonate for a period of at least 30 seconds.

8. A process for the disinfection of the surfaces of non-perishable articles which comprises rinsing said non-perishable articles to be disinfected with an aqueous solution containing 9.4% by weight of ethanol, 0.5% by weight of diethyl pyrocarbonate and 0.1% by weight of an alkylaryl sulfonate emulsifying agent.

9. The process of claim 1 wherein the non-perishable articles are textiles.

10. The process of claim 1 wherein the non-perishable articles are packing materials.

11. The process of claim 1 wherein the non-perishable articles are containers.

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LEWIS GOTTS, *Primary Examiner.*

JULIAN S. LEVITT, *Examiner.*