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(71) Applicant and
(72) Inventor: **GIRVAN, Don, H.** [US/US]; 5417 Riverwood Road, St. Augustine, FL 32092 (US).

(74) Agents: **MERCHANT, Mary, Anthony** et al.; Jones & Askew, LLP, 2400 Monarch Tower, 3424 Peachtree Road, N.E., Atlanta, GA 30326 (US).

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(54) Title: METHOD FOR CONTROLLING MICROORGANISMS IN STANDING WATER USING SODIUM CARBONATE PEROXYHYDRATE COMPOSITIONS

(57) Abstract: A method for controlling the growth of microorganisms in a standing water system comprises adding a sodium carbonate peroxyhydrate composition. The method is particularly useful in treating polybiguanide-treated standing water systems and when converting a standing water system from chlorine- or bromine-based treatment to biguanide-based treatment.

METHOD FOR CONTROLLING MICROORGANISMS IN STANDING WATER USING SODIUM CARBONATE PEROXYHYDRATE COMPOSITIONS

Technical Field

This invention comprises compositions, methods and devices for treating standing water. Such treatment of water includes treatment of swimming pools, spas, cooling towers and the like.

Background

Water is a primary transmission vector for the spread of microorganisms. It is also an excellent growth medium for certain kinds of molds and algae causing unwanted discoloration and turbidity in the water. Some of the microorganisms that will grow in standing water include Chlorococcum, Chlorella, Cledaphora, Microcystis, Osciliatoris, Spirogyra, Ulaothrix, Vanetteria, and the fungus Aspergillus flavus. Accordingly, the prevention or inhibition of growth of microorganisms in water has been a longstanding problem for standing water systems. This is especially true where there is extensive human contact with

the water as in bathing or in recreational areas such as swimming pools.

There are many methods available for controlling the growth of microorganisms in standing water. Traditionally, halogens such as chlorine have been used to treat water; however, use of chlorine has several inherent problems. One of the major problems involved with the use of chlorine is that it is difficult to maintain an effective concentration of chlorine in the water. This loss of effective concentrations of chlorine is due to the escape of chlorine from the water in a gaseous form and is accelrated in direct sunlight. Another disadvantage of using elemental chlorine in water systems is that hydrochloric acid (HCl) is formed as the chlorine dissolves in the water. The formation of HCl causes a drop in the pH of the water, making acid-base balancing difficult. To maintain the proper pH of the water it is necessary to add a buffer system to the water. Additionally, chlorine-based treatment is known to be destructive to structures in constant contact with the chlorine-treated water and to cause eye and tissue irritation in swimmers.

Sodium tetraborate has also been known to be effective as an algaecide and a fungicide in standing water systems such as swimming pools, drinking water reservoirs and cooling towers. Use of tetraborates has been disclosed in U.S. Patents Nos. 4,594,091; 5,131,938; and 5,676,844; all to Girvan, all incorporated by reference herein in their entirety. It has been shown that the alkaline metal, tetraborate, by itself improves the treatment of standing water systems in several ways. The tetraborate solutions plus dissolved carbon dioxide

will produce sodium carbonate plus sodium bicarbonate which will lower the CO_2 concentration in the water and make it difficult for algae to grow in the water. The tetraborates have also be shown to react with dissolved halides in the water to give off free halogens. Finally, the tetraborates increase the solubility of most other salts that may be added to the standing water system.

Another sanitizing system for treatment of standing water systems is based upon the use of polymeric biguanides. Polymeric biguanides are known to possess powerful antibacterial properties and to inhibit the growth of fungi. Water systems treated with polymeric biguanides do not cause the eye irritation that is common with chlorine-based systems.

A drawback to use of polymeric biguanides is that microorganisms become resistant to the sanitizing effects of polymeric biguanide-based systems. When this occurs, polymeric biguanide-based water systems are typically treated with products that contain hydrogen peroxide. One method of use of hydrogen peroxide is that the hydrogen peroxide is applied to the water between the second and fourth week of each month, whereupon it oxidizes organic material and quickly restores clarity and sparkle to the water, indicating that the problem with microorganisms has been brought under control.

Although liquid hydrogen peroxide is commonly used to restore clarity and sparkle in polymeric biguanide-based systems, there are several drawbacks to using hydrogen peroxide. First, water quality tends to decline soon after

treatment, requiring frequent applications of hydrogen peroxide to the water and resulting in cycles of dull or cloudy water. In some cases, hydrogen peroxide is also unable to eradicate persistent microorganisms, especially water molds and blooms of bacteria having a reddish-pink appearance.

Another problem with use of hydrogen peroxide as it is currently sold is that hydrogen peroxide is a hazardous material that requires special handling. Hydrogen peroxide is usually sold in liquid form at a 27% to 36% solution and poses serious environmental and safety hazard considerations. Products containing liquid hydrogen peroxide are considered hazardous by the Department of Transportation, and have to be transported in heavy-wall plastic jugs with safety seals and placed in an outer plastic bag. Additionally, safety warnings must be extensive, and childproof caps are required. These safety precautions inevitably increase the costs associated with transport of products containing liquid hydrogen peroxide, and require careful use and storage procedures. This type of material is dangerous to persons who cannot read the warnings or those who do not follow the specialized handling procedures. Use in a family pool poses hazards to children who may try to treat the pool without the necessary precautions. What is currently needed are compositions methods and devices that provide a safe, less costly, more effective, and more environmentally sensitive treatment for standing water systems. These compositions, methods and devices can be used to control growth or microorganisms in a standing water system. The treatment needs to be able to be used with polymeric biguanide systems.

Summary of the Invention

The present invention comprises compositions, methods and devices for treating standing water. In particular, the compositions comprise a sodium carbonate peroxyhydrate composition that can be used to inhibit growth of microorganisms in standing water. The methods of treating water of the present invention comprise the addition of sodium carbonate peroxyhydrate to standing water. Additionally, the present invention comprises devices for storing and dispensing the compositions of the present invention.

A preferred embodiment of the present invention comprises a composition comprising sodium carbonate peroxyhydrate. Another preferred embodiment of the present invention comprises compositions and methods of use of compositions comprising an admixture of sodium carbonate peroxyhydrate and an alkaline metal borate salt, preferably, sodium tetraborate compositions. The methods of treating water of the present invention comprise applications of the compositions to standing water.

The addition of the borate salt composition to the sodium carbonate peroxyhydrate composition further enhances water quality, reduces eye and skin irritation, and buffers alkalinity. The present invention comprises devices for storing and dispensing the compositions of the present invention.

Accordingly, it is an object of the present invention to provide methods and compositions for the treatment of standing water.

It is further an object of the present invention to provide methods and compositions for the prevention of growth of microorganisms in standing water.

It is still a further an object of the present invention to provide methods and compositions for the treatment of standing water treated with polymeric biguanides.

It is yet another object of the present invention to provide methods and compositions for the prevention of growth of microorganisms in standing water treated with polymeric biguanides.

It is an object of the present invention to provide methods and compositions for the treatment of standing water comprising compositions comprising sodium carbonate peroxyhydrate.

It is yet another object of the present invention to provide methods for the treatment of standing water by administering an admixture comprising sodium carbonate peroxyhydrate and sodium tetraborate compositions.

It is further an object of the present invention to provide methods and compositions for polymeric biguanide-treated water wherein the dull then cloudy cycles of the water are reduced.

It is an object of the present invention to provide methods and compositions for eliminating residue formation

when converting standing water from chlorine or bromine treatment conditions to biguanide treatment conditions.

It is yet another object of the present invention to provide methods and compositions for the treatment of polymeric biguanide-treated water in a more environmentally sensitive and cost effective manner.

It is further an object of the present invention to provide methods and devices for storing and dispensing compositions comprising sodium carbonate peroxyhydrate.

It is an object of the present invention to provide methods and compositions for treating standing water systems comprising compositions comprising sodium carbonate peroxyhydrate and a borate salt.

These and other objects, features and advantages of the present invention will become apparent after a review of the following detailed description of the disclosed embodiments.

Detailed Description

The present invention comprises methods and compositions for the treatment of standing water systems. Standing water systems as used herein include, but are not limited to, swimming pools, spas, hot tubs, cooling tower systems, foot baths, drinking water reservoirs, and the like. The methods and compositions of the present invention may be used with known water treatments for standing water systems such as halogen-based treatments or biguanide-based systems. Biguanide-based systems include such treatments as Baquacil (sold by (Avecia Pool Products) a polymeric

biguanide-based product and additional polymeric products such as Softswim (manufactured by Biolab, Inc., Decatur, Ga.). It is contemplated that the present invention can be used in any standing water system wherein pH is desirably maintained at a stable value, the growth of microorganisms is desirably inhibited and the clarity of the standing water system is desirably maintained.

Currently, the most frequently used shocking agent for polymeric biguanide-treated waters, including pools and spas, is hydrogen peroxide. This is because there is generally a chemical incompatability between chlorine or potassium monopersulfate and the biguanide sanitizer. Through experimentation, it has been found that sodium carbonate peroxyhydrate can be used to shock or oxidize organic material in the pool or spa. This treatment also restores water clarity, improves the odor of the water and helps to maintain adequate pH conditions following acid rain showers by buffering the water system.

Sodium carbonate peroxyhydrate compositions, in powder form, offer safety advantages over the use of liquid hydrogen peroxide. This is especially important during all handling stages including shipping, storage and application to water systems. The compositions offer safety to pool users and maintenance personnel, including reducing the chances of skin exposure to dangerous chemicals, and the compositions are easier to apply to the water system. The compositions of the present invention also have a longer shelf life than hydrogen peroxide and does not lose strength during storage.

The present invention can be used in the treatment of standing water systems by application of the compositions in approximately 0.1 to 10 pounds per 10,000 gallons of water, preferably 0.5 to 5 pounds, and most preferably 1 pound per 10,000 gallons of water, for normal routine shock treatment. This will keep the water system clear, clean and maintain high water quality. Current methods with hydrogen peroxide are to treat every 2 to 4 weeks which allows water quality to deteriorate between treatments.

If the water system becomes heavily contaminated, such as an algal growth or bloom, the compositions of the present invention can be easily added in increased amounts. Such increased amounts include use of two to ten times the above amounts. This will destroy the organic growth and allow the filter to remove the remains.

An advantage of the present invention is that the oxidizing treatment of the standing water, using the compositions of the present invention, can occur without interfering with the biguanide polymer. Currently, there are no solid or powdered oxidizers that do not destroy the biguanide polymer during oxidation treatments.

The preferred compositions of the present invention comprise sodium carbonate peroxyhydrate compositions. A preferred embodiment of the present invention comprises the addition to a standing water system of a composition of sodium carbonate peroxyhydrate, $2Na_2CO_3 \cdot 3H_2O_2$. A preferred composition comprises range of 100% sodium carbonate peroxyhydrate, $2Na_2CO_3 \cdot 3H_2O_2$ to

approximately 15%. Additives that effect consistency or add to commercial aspects such as colorings, perfumes, etc., can be included in such compositions. A preferred embodiment comprises 100% sodium carbonate peroxyhydrate, $2Na_2CO_3 \cdot 3H_2O_2$. Additional preferred compositions are mixtures or admixtures comprising sodium carbonate peroxyhydrate and borate salts. As used herein, sodium carbonate peroxyhydrate compositions include both the sodium carbonate peroxyhydrate compositions and the compositions of the admixture of sodium carbonate peroxyhydrate and the borate salts. Preferably the borate salts are alkaline metal borate salts. More preferably, the alkaline metal borate salts are an alkaline metal tetraborate pentahydrate, or an alkaline metal tetraborate decahydrate. The hydration state of the borate salt is not critical to the present invention. The alkaline metal can be any alkaline metal that is compatible with the borate ion. These alkaline metals include sodium, potassium and lithium. It is contemplated by the term borate molecule, as used herein, the borate molecule can be any of the borate ions or boric acid or it can be a combination of borate ions and boric acid. The borate salts and sodium carbonate peroxyhydrate compositions enhance the water quality, helps to reduce eye and skin irritation, and buffers alkalinity.

The present invention has advantages over the prior art in that application of sodium carbonate peroxyhydrate compositions to the water avoids the clear then dull-cloudy cycles experienced when treating standing water systems with liquid hydrogen peroxide. Further, when

converting a pool or spa from chlorine- or bromine-based treatments to biguanide-based treatments, the addition of sodium carbonate peroxyhydrate compositions will eliminate residual interference with the biguanide system and prevent cloudy water. Replacing liquid hydrogen peroxide with sodium carbonate peroxyhydrate in either of the above applications not only increases the efficacy of a water treatment system, but it also provides a more environmentally sensitive and cost effective means of treatment. Additionally, use of the compositions of the present invention avoids the hazards associated with use of liquid hydrogen peroxide. The methods and compositions of the present invention provide water treatments that have more constant control of water conditions than other currently used treatments. For example, application of hydrogen peroxide provides a spike of oxidation and then a drop. The percarbonate compositions of the present invention provide more uniform and constant oxidation conditions, without the spike and drop fluctuations. The standing water system remains clean and free of organisms without fluctuations in appearance or other water conditions.

The compositions of the present invention are preferably made in a power or granular form, though other forms, such as tablets, are also contemplated by the present invention. The compositions are prepared by mixing the particular ingredients uniformly in a powder blender. A preferred composition comprises approximately 80% sodium carbonate peroxyhydrate and 20% borate or boric acid or a combination thereof of borate salt and boric acid. Another

preferred composition comprises blending a borate salt such as sodium tetraborate into sodium carbonate peroxyhydrate. The percentage of the sodium tetraborate in the mixture or admixture is between approximately 0.5 to 60%, preferably between approximately 2 to 55%, and most preferably between 5 to 50% of the total weight.

Methods of treating water of the present invention comprise the addition of the sodium carbonate peroxyhydrate compositions to standing water. In a preferred embodiment of the present invention, the sodium carbonate peroxyhydrate composition is added to a standing water system treated with polymeric biguanides. The compositions are added to the water system at an application rate of between approximately 0.1 to 10 pounds/week/10,000 gallons of water, preferably between approximately 0.3 to 7 pounds/week/10,000 gallons of water, and most preferably between approximately 0.5 to 3 pounds/week/ 10,000 gallons of water. A preferred method of application to the standing water systems includes broadcasting the sodium carbonate peroxyhydrate compositions in powder form on the water surface on a weekly basis. Other methods of introducing powered materials into standing water systems are also included in the methods of the present invention. Tablets or other compressed forms of the compositions of the present invention can be added to devices that automatically add the compositions to the water system. Automatic dispensers of powered products can also be used with the compositions.

Such weekly applications avoid the clear then dull-cloudy cycles experienced when treating with liquid hydrogen

peroxide. Avoidance of the dull-cloudy cycles decreases the possibility of an algae problem, eradication of which could be costly. Treatment with sodium carbonate peroxyhydrate compositions would therefore reduce the costs associated with sanitation because good maintenance costs less than correcting an established algae problem.

Other advantages of using sodium carbonate peroxyhydrate compositions rather than liquid hydrogen peroxide are that sodium carbonate peroxyhydrate is environmentally safe, has low toxicity to humans and animals, and is highly soluble. Hydrogen peroxide can cause fires, can be caustic to the skin, and can cause decomposition of other substances resulting in unwanted reactions such as release of harmful gases. Unlike hydrogen peroxide, the sodium carbonate peroxyhydrate composition will not bleach or discolor vinyl. The economic advantages associated with the increase in safety and environmental sensitivity include much lower costs per month, transportation cost savings, and easy storage.

The present invention can also be of benefit during the conversion of a standing water system from a chlorine- or bromine-based system to a biguanide-based system. The sodium carbonate peroxyhydrate compositions are applied to the standing water system one to three days prior to addition of the polymeric biguanides. Addition of the sodium carbonate peroxyhydrate compositions to the standing water system eliminate residual interference with the biguanide system and prevents cloudy water. Treatment is

continued on a weekly basis after the biguanide-based system is established.

The present invention also comprises methods and devices for storing and dispensing the sodium carbonate peroxyhydrate compositions of the present invention.

The compositions and methods of the present invention act as powerful cleaners and oxidizers when added to standing water systems, and can be used as highly effective nonchlorine dry bleach and stain removers. Though not wishing to be bound by any particular theory, it is believed that the sodium percarbonate transforms into 27% hydrogen peroxide and 13% oxygen with a pH of 9.5, and a final decomposition form would include carbonate, oxygen and water. The present invention can be used to cleanse a standing water system of organics and the compositions are safe to transport in the dry form and are listed as nonhazardous by the Department of Transportation. A most preferred utility of the present invention is the use in oxidizing biguanide pools on a routine basis.

This invention is further illustrated by the following examples, which are not to be construed in any way as imposing limitations upon the scope thereof. On the contrary, it is to be clearly understood that resort may be had to various other embodiments, modifications, and equivalents thereof which, after reading the description herein, may suggest themselves to those skilled in the art without departing from the spirit of the present invention and/or the scope of the appended claims.

EXAMPLES

Example 1

An example of the use of a composition of the present invention comprising 100% sodium carbonate peroxyhydrate was done with thirty test pools that were sanitized with biguanide, in Florida and Louisiana during the hot summer months. Using 1 pound per 10,000 gallons of treated water, the composition was applied weekly, and all thirty pools remained clear without algae. In previous years, during the hot summer months, these pools had experienced algae clouds and had required an algaecide treatment of hydrogen peroxide every seven to ten days to retain clarity.

Another thirty test pools, using biguanide-based sanitization, received a composition comprising a blend of 75% sodium carbonate peroxyhydrate and 25% sodium tetraborate pentahydrate per 10,000 gallons of treated water. All thirty pools remained clear and algae free with greater sparkle and brilliance and used 10-20% less biguanide sanitizer. The pH was more stable and swimmers reported less eye and skin irritation.

Example 2

The present invention was used to convert a water system in Florida that was using chlorine sanitization to a biguanide-based system. In converting a 20,000 gallon chlorine treated pool to a biguanide-based system, the chlorine was first removed by adding 20 pounds of sodium carbonate peroxyhydrate to the water with the pump and filter running. After twenty-four hours, no chlorine residue was found by

testing and biguanide treatment was begun without interference from chlorine. This conversion was repeated with bromine pools with similar satisfactory results. Had there been any chlorine or bromine residual in any test pool, the water would have appeared cloudy and biguanide consumption would have been increased.

Example 3

A set of 20 test pools in Texas, Louisiana and Florida were treated using the present invention. The pools each held 10,000 gallons of water, were located out-of-doors, and were biguanide-treated pools with vinyl wall and sand filters. The oxidizing treatment was changed from 1 gallon of 27% hydrogen peroxide to 1 pound per week of a compositions of a peroxyborate/borate blend, 50/50%, with fair results. Some light mustard algae developed after heavy rain during a three month operation period during the hot months.

Example 4

Using the same pools and conditions as described for Example 3, the oxidizing treatment was changed from 1 gallon of 27% hydrogen peroxide to 1 pound per week peroxycarbonate/borate blend 75/25% with excellent results. No algae appeared and biguanide use was reduced to 10-20% during the hot months.

Example 5

Using the same pools and conditions as described for Example 3, the oxidizing treatment was changed from 1 gallon of 27% hydrogen peroxide to 1 pound per week 100% sodium peroxycarbonate with excellent results. No algae appeared and biguanide use was reduced to 10-20% during the hot months. Water quality was good however, Proteam-Supreme-sodium tetraborate was added manually to maintain sparkling blue appearance.

It should be understood, of course, that the foregoing relates only to preferred embodiments of the present invention and that numerous modifications or alterations may be made therein without departing from the spirit and the scope of the invention as set forth in the appended claims.

CLAIMS

What is claimed:

1. A method of controlling the growth of microorganisms in standing water comprising the administration of an effective amount of a sodium carbonate peroxyhydrate composition to the standing water system.

2. The method of claim 1 wherein the sodium carbonate peroxyhydrate composition is administered to the standing water system so that the final concentration of the composition is between approximately 0.5 and 3 pounds per 10,000 gallons of water.

3. A method of controlling the growth of microorganisms in standing water comprising the administration of an admixture comprising an effective amount of a mixture of a sodium carbonate peroxyhydrate composition and a borate salt composition.

4. The method of claim 3 wherein the admixture is administered to the standing water system so that the final concentration of the admixture is between approximately 0.5 and 3 pounds per 10,000 gallons of water.

5. The method of claim 3 wherein the borate salt in the admixture is between approximately 5% and 50% by weight.

6. A method of controlling the growth of microorganisms in standing water treated with polymeric biguanides comprising the administration of an effective amount of a sodium carbonate peroxyhydrate composition to the standing water system.

7. The method of claim 6 wherein the sodium carbonate peroxyhydrate composition is administered to the standing water system so that the final concentration of the composition is between approximately 0.5 and 3 pounds per 10,000 gallons of water.

8. A method of controlling the growth of microorganisms in standing water treated with polymeric biguanides comprising the administration of an admixture comprising an effective amount of a sodium carbonate peroxyhydrate composition and an effective amount of a sodium tetraborate composition.

9. The method of claim 8 wherein the admixture is administered to the standing water system so that the final concentration of the admixture is between approximately 0.5 and 3 pounds per 10,000 gallons of water.

10. The method of claim 8 wherein the sodium tetraborate composition in the admixture is between approximately 5% and 50% by weight.

11. A method of converting a standing water system from chlorine or bromine to polymeric biguanides comprising the administration of an effective amount of a sodium carbonate peroxyhydrate composition.

12. The method of claim 11 wherein the sodium carbonate peroxyhydrate composition is administered to the standing water system so that the final concentration of the composition is between approximately 0.5 and 3 pounds per 10,000 gallons of water.

13. A method of converting a standing water system from chlorine or bromine to polymeric biguanides comprising the administration of an admixture comprising an effective amount of a sodium carbonate peroxyhydrate composition and an effective amount of a sodium tetraborate composition.

14. The method of claim 13 wherein the admixture is administered to the standing water system so that the final concentration of the admixture is between approximately 0.5 and 3 pounds per 10,000 gallons of water.

15. The method of claim 13 wherein the sodium tetraborate composition in the admixture is between approximately 5% and 50% by weight.

INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

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US CL :210/758, 759, 764, 169

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 210/758, 759, 764, 169

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WEST 2.0

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4,975,109 A (FRIEDMAN, JR. et al.) 04 December 1990, abstract, col. 3, lines 33-66.	1-5
X	US 5,256,182 A (FRIEDMAN, JR. et al.) 26 October 1993, col. 3, lines 33-50, col. 4, lines 5-10.	1-5
X, P	US 6,045,708 A (ERIKSSON) 04 April 2000, abstract, column 8, lines 44-47.	1-2

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

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