

AQUEOUS HYDROGEN PEROXIDE SOLUTION FOR DISINFECTION
APPLICATIONS, METHOD FOR PRODUCING SAME, AND DISINFECTION
METHOD USING SAME

TECHNICAL FIELD

[0001]

The present invention relates to an aqueous hydrogen peroxide solution, which is used for heating and evaporating it to obtain the mist and/or gas thereof to be brought into contact with a material to be disinfected to thereby decrease the number of bacteria which attach to the material to be disinfected and/or bacteria floating near the material to be disinfected, and a method for producing the same, and a disinfection method using the same.

BACKGROUND ART

[0002]

Techniques of bringing a high-temperature mist of an aqueous hydrogen peroxide solution or hydrogen peroxide vapor into contact with a material to be disinfected to decrease the number of bacteria which attach to the material are applied to disinfection of clean rooms for electronics industry, disinfection of plastic bottles before being filled with drinks, etc. In particular, recently, a high-performance aqueous hydrogen peroxide solution to be used for aseptic filling has been desired along with widespread use of plastic bottles. Specifically, a product in which the amount of residue generated at the time of evaporating hydrogen peroxide and water is small and a product which has high stability in a high-temperature or metallic storage container have been desired. Regarding the case where an aqueous hydrogen peroxide solution is used for aseptic filling, a method of heating the aqueous hydrogen peroxide solution to its boiling point or higher to be vaporized by an evaporator and spraying gaseous hydrogen peroxide together with air to disinfect a container is known (see Patent Document 1). However, in this case, there is a problem that a portion of a stabilizer added to the aqueous hydrogen peroxide solution attaches to a spray nozzle or an evaporator to block a piping area or the like, resulting in inhibition of stable operation of an aseptic filling apparatus. In addition, there is a problem, which had not been exposed, that when an aqueous hydrogen peroxide solution is stored in an aluminum or stainless tank, the stability is gradually reduced even though the concentration does not change.

[0003]

As means for solving the above-described problem of blocking, reduction in the amount of a stabilizer to be added to an aqueous hydrogen peroxide solution has been proposed. In this case, since the amount of the stabilizer to be added is determined depending on the amount of a decomposition active substance contained in the aqueous hydrogen peroxide solution, it is required to use an aqueous hydrogen peroxide solution containing the decomposition active substance at a low concentration.

For example, in the case where the concentration of the decomposition active substance is at a level of 5 ppb or less, it is known that when sodium pyrophosphate and orthophosphoric acid are used as the stabilizer, the stability of hydrogen peroxide can be ensured even when the total amount the stabilizer to be added is 40 mg/kg or less (see Patent Document 2).

Further, it was reported that when the amount of evaporation (dried) residue was 10 mg/kg or less, the stability of hydrogen peroxide was successfully ensured even when the amount of amino tris(methylene phosphonic acid) to be added was 50 mg/kg or less (see Patent Document 3).

As described above, several means for solving the problem of blocking have been proposed, but regarding the problem of reduction in the stability of hydrogen peroxide during storage in a tank, which had not been exposed, no means for solving the problem had been found. From recent researches made by the present inventors, it has been elucidated that a slight amount of metal is eluted from a metal tank due to a chelating agent such as phosphoric acid which is added to an aqueous hydrogen peroxide solution as a stabilizer, resulting in reduction of the stability of hydrogen peroxide. When a large amount of a stabilizer is used, the reduction of the stability can be avoided, but it is not preferred for the intended use because inhibition of operation such as blocking of a nozzle as described above tends to easily occur.

[0004]

Moreover, even when the amount of a stabilizer to be added to an aqueous hydrogen peroxide solution is decreased for solving the problem of blocking, the problem of an attached matter remaining on a spray nozzle and an evaporator cannot be completely solved, and since a phosphonic acid-based attached matter is poorly soluble, the problem of blocking of a piping area to inhibit stable operation of an aseptic filling apparatus had not been completely solved.

PRIOR ART DOCUMENTS

PATENT DOCUMENTS

[0005]

Patent Document 1: Japanese Laid-Open Patent Publication No. H11-47242

Patent Document 2: Japanese Laid-Open Patent Publication No. 2006-240969

Patent Document 3: Japanese National-phase PCT Laid-Open Patent Publication No. 2009-507887

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0006]

The purpose of the present invention is to solve the above-described problems of the prior art and to provide an aqueous hydrogen peroxide solution to be used in so-called steam sterilization, a method for producing the same, and a disinfection method using the same.

MEANS FOR SOLVING THE PROBLEMS

[0007]

The present inventors diligently made researches on the amount of a stabilizer to be added to an aqueous hydrogen peroxide solution, components of the stabilizer, evaporation residue and water washability thereof, impurities contained, storage stability, safety for use, etc., and found that when an aqueous hydrogen peroxide solution containing hydrogen peroxide, a phosphate salt and an aluminum salt as essential components is used, it is possible to provide an aqueous hydrogen peroxide solution, wherein an attached matter derived from a stabilizer of an aqueous hydrogen peroxide solution which attaches to and remains on a spray nozzle and an evaporator is reduced, wherein a residue can be easily removed by water washing, and wherein an aseptic filling apparatus can be stably operated, and thus arrived at the present invention.

Specifically, the present invention is as follows:

<1> An aqueous hydrogen peroxide solution, which is used for decreasing the number of bacteria, wherein said solution comprises hydrogen peroxide, a phosphate salt and an aluminum salt as essential components.

<2> The aqueous hydrogen peroxide solution according to item <1>, wherein the phosphate salt is at least one selected from the group consisting of tripotassium phosphate, trimagnesium phosphate, diammonium hydrogen phosphate, ammonium dihydrogen phosphate, dipotassium hydrogen phosphate, potassium dihydrogen

phosphate, disodium hydrogen phosphate, sodium dihydrogen phosphate, trisodium phosphate and calcium bis(hydrogen phosphate).

<3> The aqueous hydrogen peroxide solution according to item <1>, wherein the phosphate salt is a hydrogenphosphate.

<4> The aqueous hydrogen peroxide solution according to any one of items <1> to <3>, wherein the additive concentration of the phosphate salt is 1 to 18 mg/kg.

<5> The aqueous hydrogen peroxide solution according to any one of items <1> to <4>, wherein the aluminum salt is aluminum potassium sulfate.

<6> The aqueous hydrogen peroxide solution according to any one of items <1> to <5>, wherein the additive concentration of the aluminum salt is 1 to 4 mg/kg.

<7> The aqueous hydrogen peroxide solution according to any one of items <1> to <6>, which comprises at least one acid and/or salt selected from the group consisting of L-ascorbic acid and a salt thereof, ethylenediamine tetraacetate, citric acid and a salt thereof, gluconic acid and a salt thereof, L-glutamic acid and a salt thereof, a silicate, a nitrate, a carbonate, a pyrophosphate, and a sulfate.

<8> The aqueous hydrogen peroxide solution according to item <7>, wherein the additive concentration of the acid and/or salt is 2 to 12 mg/kg.

<9> The aqueous hydrogen peroxide solution according to any one of items <1> to <8>, wherein the concentration of the hydrogen peroxide is 30 wt% to 40 wt%.

<10> A disinfectant obtained by using the aqueous hydrogen peroxide solution according to any one of items <1> to <9>.

<11> A method for producing the aqueous hydrogen peroxide solution according to any one of items <1> to <9>, comprising a phosphate salt and an aluminum salt to an aqueous hydrogen peroxide solution as a raw material.

<12> A disinfection method, comprising mixing air with a mist and/or gas of the aqueous hydrogen peroxide solution according to any one of items <1> to <9> and then bringing the resultant mixture into contact with a material to be disinfected.

<13> The disinfection method according to item <12>, wherein air is heated to be accompanied by the mist and/or gas of the aqueous hydrogen peroxide solution when the aqueous hydrogen peroxide solution is brought into contact with the material to be disinfected.

<14> The disinfection method according to item <12> or <13>, wherein the aqueous hydrogen peroxide solution is heated to 100 to 150°C to be brought into contact with the material to be disinfected.

<15> The disinfection method according to any one of items <12> to <14>, wherein the material to be disinfected is a packaging container, a food machinery, a plastic bottle or

a plastic bottle preform.

<16> The disinfection method according to any one of items <12> to <14>, wherein the material to be disinfected is a closed space.

<17> The disinfection method according to item <16>, wherein the closed space is an automobile, a clean room for electronics industry, a living space, a medical space, a kitchen, a cooking place, a vehicle or an aircraft.

<18> The disinfection method according to any one of items <12> to <14>, wherein an apparatus for generating the mist of the aqueous hydrogen peroxide solution and/or hydrogen peroxide vapor is brought into a facility to generate the mist of the aqueous hydrogen peroxide solution and/or hydrogen peroxide vapor, thereby decreasing the number of bacteria in the facility.

<19> The disinfection method according to item <18>, wherein the facility is a toilet facility, a waste processing facility or a livestock barn.

ADVANTAGEOUS EFFECT OF THE INVENTION

[0008]

According to the present invention, the stability of hydrogen peroxide is improved, an attached matter derived from a stabilizer of an aqueous hydrogen peroxide solution which attaches to and remains on a spray nozzle, an evaporator or the like is reduced, and a residue can be easily removed by water washing.

EMBODIMENTS FOR CARRYING OUT THE INVENTION

[0009]

Hereinafter, the present invention will be described in detail.

The aqueous hydrogen peroxide solution of the present invention comprises a phosphate salt and an aluminum salt as active components for stabilizing hydrogen peroxide. It may further comprise another acid and/or salt as an additive for facilitating water washing of an evaporation residue which attaches to a nozzle, an evaporator or the like.

Conventionally, there is a problem that a slight amount of metal is eluted from a metal tank due to a chelating agent such as phosphoric acid which is added to an aqueous hydrogen peroxide solution as a stabilizer, resulting in reduction of the stability of hydrogen peroxide. This problem can be solved by using a phosphate salt.

[0010]

Specifically, preferred examples of the phosphate salt to be used in the present invention include tripotassium phosphate, trimagnesium phosphate, diammonium

hydrogen phosphate, ammonium dihydrogen phosphate, dipotassium hydrogen phosphate, potassium dihydrogen phosphate, disodium hydrogen phosphate, sodium dihydrogen phosphate, trisodium phosphate and calcium bis(hydrogen phosphate), and disodium hydrogen phosphate is particularly preferred. Further, the phosphate salt to be used in the present invention is preferably a hydrogenphosphate.

[0011]

As the aluminum salt to be used in the present invention, an aluminum-containing food additive can be used without any particular problem, and for example, aluminum potassium sulfate is preferred.

[0012]

In the present invention, the acid and/or salt for obtaining good water washability of an evaporation residue which attaches to a nozzle, an evaporator or the like can also be selected from additives designated by the Food Sanitation Act. Specifically, L-ascorbic acid and/or a salt thereof, ethylenediamine tetraacetate, citric acid and/or a salt thereof, gluconic acid and/or a salt thereof, L-glutamic acid and/or a salt thereof, a silicate, a nitrate, a carbonate, a pyrophosphate and a sulfate are preferred, and a sulfate is particularly preferred.

[0013]

In the aqueous hydrogen peroxide solution of the present invention, the additive concentration of the phosphate salt is preferably 1 to 18 mg/kg, and more preferably 1 to 12 mg/kg. When the additive concentration of the phosphate salt is 1 to 18 mg/kg, the stabilization effect is obtained, and the amount of an evaporation residue which attaches to an evaporator, a nozzle or the like is suppressed.

In the aqueous hydrogen peroxide solution of the present invention, the additive concentration of the aluminum salt is preferably 1 to 4 mg/kg, and more preferably 1 to 3 mg/kg. When the additive concentration of the aluminum salt is 1 to 4 mg/kg, the stabilization effect is obtained, and the amount of an evaporation residue which attaches to an evaporator, a nozzle or the like is suppressed.

In the aqueous hydrogen peroxide solution of the present invention, the concentration of the hydrogen peroxide is preferably 30 to 40 wt%, and more preferably 33 to 37 wt%. When the concentration of the hydrogen peroxide is 30 to 40 wt%, suitable disinfecting power is obtained and it is preferred.

In the aqueous hydrogen peroxide solution of the present invention, the additive concentration of another acid and/or salt to be preferably used is preferably 2 to 12 mg/kg, and more preferably 3 to 10 mg/kg. When the additive concentration of another acid and/or salt is 2 to 12 mg/kg, the washability of the evaporation residue is

improved and it is preferred.

Particularly preferably, the additive concentration of the phosphate salt is 2 to 4 mg/kg, the additive concentration of the aluminum salt is 2 to 3 mg/kg, and the additive concentration of another acid and/or salt is 3 to 5 mg/kg.

[0014]

As decomposition components of hydrogen peroxide, heavy metals are known. However, decomposition components contained in the industrially-manufactured aqueous hydrogen peroxide solution are mostly limited to Fe, Cr, Ni and Pd. In the present invention, it is desirable to use an aqueous hydrogen peroxide solution in which each of the Ni concentration and the Pd concentration is set to 0.1 ppb or less and each of the Fe concentration and the Cr concentration is set to 5 ppb or less.

[0015]

The aqueous hydrogen peroxide solution of the present invention can be produced by directly adding the phosphate salt, the aluminum salt, and optional another acid and/or salt to an aqueous hydrogen peroxide solution as a raw material.

[0016]

The method for producing the mist-type and/or gaseous hydrogen peroxide is not particularly limited. Examples of the method include a method using ultrasonic waves and a method using heating. It is preferred that the aqueous hydrogen peroxide solution is heated to its boiling point or higher to be vaporized by an evaporator and that the gaseous hydrogen peroxide is sprayed together with air.

[0017]

The apparatus for heating and evaporating the aqueous hydrogen peroxide solution of the present invention is not particularly limited, and a publicly-known apparatus can be used.

[0018]

The temperature for heating and vaporization is more desirably 100°C to 150°C.

[0019]

It is more desirable that air is also heated to be accompanied by the mist and/or gas of the aqueous hydrogen peroxide solution when the aqueous hydrogen peroxide solution is brought into contact with the material to be disinfected.

[0020]

Examples of the material to be disinfected include a packaging container, a food machinery, a plastic bottle and/or plastic bottle preform, and a closed space.

[0021]

Examples of the closed space include an automobile, a clean room for electronics industry, a living space, a medical space, a kitchen, a cooking place, a vehicle and an aircraft.

[0022]

In the present invention, it is possible to bring an apparatus for generating the mist of the aqueous hydrogen peroxide solution and/or hydrogen peroxide vapor into a facility to generate the mist of the aqueous hydrogen peroxide solution and/or hydrogen peroxide vapor, thereby decreasing the number of bacteria in the facility.

[0023]

Examples of the facility include a toilet facility, a waste processing facility and a livestock barn.

EXAMPLES

[0024]

Next, the present invention will be more specifically described by way of examples and comparative examples. However, the present invention is not limited to the below-described examples.

[0025]

<Method for preparing a sample>

The stability of hydrogen peroxide was examined (1) immediately after preparation, (2) at the stage which was simulated to be after stored in an aluminum tank, and (3) at the stage in which it was simulated that the product was stored in a stainless tank after stored in the aluminum tank.

A desired amount of an additive was added to a predetermined aqueous hydrogen peroxide solution, and after that, the hydrogen peroxide concentration was adjusted to 35 wt%. The amounts of the additives are as shown in Tables 1 to 3.

Explanation of (2): 2 test pieces made of aluminum (30 mm×30 mm×2 mm) were put into 300 ml of the aqueous hydrogen peroxide solution of the present invention, and it was allowed to stand at 45°C for 24 hours.

Explanation of (3): After (2), the test pieces made of aluminum were taken out from the solution, and instead of them, 2 test pieces made of SUS304 (30 mm×30 mm×2 mm) were put into the solution, and it was allowed to stand at 45°C for 24 hours.

Note that citric acid 3Na means trisodium citrate, and similarly, gluconic acid Na means sodium gluconate. Further, potash alum means aluminum potassium sulfate ($\text{AlK}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$).

[0026]

<Method for measuring a sample>

The stability of hydrogen peroxide was evaluated based on the JIS stability, and the physical property of an evaporation residue was evaluated based on the water washability of an attached matter. The JIS stability was examined according to the method defined by JIS-1463. Further, the water washability of the attached matter was evaluated as follows: a test piece made of SUS304 (30 mm×30 mm×2 mm) was placed on a hot plate heated to 150°C; 3 ml of the aqueous hydrogen peroxide solution was added dropwise to the test piece; the moisture was evaporated to precipitate the attached matter; the test piece was washed with running water; the state of residue of the attached matter before and after washing with water was observed by SEM; and the evaluation was carried out based on the amount of the remaining area.

○=the amount of the remaining area was 40% or less of the area in the photograph;
 Δ=the amount of the remaining area was more than 40% and less than 70% of the area in the photograph;
 ×=the amount of the remaining area was 70% or more of the area in the photograph

[0027]

Table 1

	Additive-1		Additive-2		Additive-3		JIS stability [%]			Washability of residue
	[mg/kg]		[mg/kg]		[mg/kg]		(1)	(2)	(3)	
Comparative Example 1	—	—	NaH ₂ PO ₄	12	—	—	98.8	-	-	—
Comparative Example 2	—	—	NaH ₂ PO ₄	9	—	—	98.6	-	-	—
Comparative Example 3	—	—	NaH ₂ PO ₄	6	—	—	98.4	-	-	—
Comparative Example 4	—	—	NaH ₂ PO ₄	3	—	—	98.4	-	-	—
Comparative Example 5	—	—	—	—	—	—	96	-	-	—
Comparative Example 6	—	—	Na ₃ PO ₄	9	—	—	96.4	-	-	×
Comparative Example 7	—	—	—	—	Na ₂ SO ₄	4	96.6	-	-	—
Comparative Example 8	—	—	NaH ₂ PO ₄	12	Na ₂ SO ₄	4	97.2	-	-	—
Comparative Example 9	—	—	NaH ₂ PO ₄	9	Na ₂ SO ₄	4	97.8	-	-	—
Comparative Example 10	—	—	NaH ₂ PO ₄	6	Na ₂ SO ₄	4	97.3	-	-	—
Comparative Example 11	—	—	NaH ₂ PO ₄	3	Na ₂ SO ₄	4	97	-	-	—
Comparative Example 12	potash alum	3	—	—	—	—	98.6	98.4	42.6	—
Comparative Example 13	potash alum	2	H ₃ PO ₄	9	Na ₂ SO ₄	6	99.6	99.6	95.2	×

[0028]

The results obtained in the cases which lacked the essential components of the present invention are shown in Table 1.

It is understood that when the aluminum salt (potash alum) was not added as in

the case of Comparative Examples 1-11, or when the phosphate salt was not added as in the case of Comparative Examples 5, 7 and 12, or when phosphoric acid was added instead of the phosphate salt as in the case of Comparative Example 13, the JIS stability was not satisfactory, and the washability of residue was not satisfactory.

[0029]

Table 2

	Additive-1		Additive-2		Additive-3		JIS stability [%]			Washability of residue
	[mg/kg]		[mg/kg]		[mg/kg]		(1)	(2)	(3)	
Example 1	potash alum	2	Na ₂ HPO ₄	9	Na ₂ SO ₄	6	99.4	99.2	90.4	△
Example 2	potash alum	2	(NH ₄) ₂ HPO ₄	9	Na ₂ SO ₄	6	99.6	99.3	91.9	△
Example 3	potash alum	2	Ca(H ₂ PO ₄) ₂	9	Na ₂ SO ₄	6	99.6	99.6	90.3	—
Example 4	potash alum	2	K ₂ HPO ₄	9	Na ₂ SO ₄	6	99.4	99.4	92.4	△
Example 5	potash alum	2	KH ₂ PO ₄	9	Na ₂ SO ₄	6	99.7	99.2	88.1	—
Example 6	potash alum	2	Na ₃ PO ₄	9	Na ₂ SO ₄	6	99.3	99.1	88.3	△
Example 7	potash alum	2	NH ₄ H ₂ PO ₄	9	Na ₂ SO ₄	6	99.6	99.4	90.9	△
Example 8	potash alum	2	NaH ₂ PO ₄	9	(NH ₄) ₂ CO ₃	6	99.3	98.9	92.5	△
Example 9	potash alum	2	NaH ₂ PO ₄	9	MgSO ₄	6	99.6	99	92.6	△
Example 10	potash alum	2	NaH ₂ PO ₄	9	NaHCO ₃	6	99.4	99.1	92	△
Example 11	potash alum	2	NaH ₂ PO ₄	9	Na ₂ CO ₃	6	99.4	99.3	91	△
Example 12	potash alum	2	NaH ₂ PO ₄	9	NaNO ₃	6	99.5	99.5	95.4	△
Example 13	potash alum	2	NaH ₂ PO ₄	9	ascorbic acid	6	99.3	99	86.7	△
Example 14	potash alum	2	NaH ₂ PO ₄	9	citric acid 3Na	6	98.8	98.8	87	○
Example 15	potash alum	2	NaH ₂ PO ₄	9	citric acid 3Na	4	99	98.9	88.9	△
Example 16	potash alum	2	NaH ₂ PO ₄	9	citric acid 3Na	2	98.9	99	90.3	△
Example 17	potash alum	2	NaH ₂ PO ₄	9	gluconic acid Na	6	99.2	99.2	89.4	△

[0030]

The results obtained in the cases which satisfied the essential components of the present invention are shown in Table 2.

When compared to the results in Table 1, the JIS stability was improved, and the washability of residue was also improved.

In particular, Example 14 showed significant effects on the washability of residue.

[0031]

Table 3

	Additive-1		Additive-2		Additive-3		JIS stability [%]			Washability of residue
	[mg/kg]		[mg/kg]		[mg/kg]		(1)	(2)	(3)	
Example 18	potash alum	3	NaH ₂ PO ₄	12	Na ₂ SO ₄	4	99.8	99.7	96.7	—
Example 19	potash alum	3	NaH ₂ PO ₄	9	Na ₂ SO ₄	4	99.7	99.8	95.4	—
Example 20	potash alum	3	NaH ₂ PO ₄	6	Na ₂ SO ₄	4	99.5	99.7	93.8	○
Example 21	potash alum	3	NaH ₂ PO ₄	3	Na ₂ SO ₄	4	99.6	99.5	89.9	○
Example 22	potash alum	3	NaH ₂ PO ₄	12	Na ₂ SO ₄	2	99.5	99.1	91	△
Example 23	potash alum	3	NaH ₂ PO ₄	9	Na ₂ SO ₄	2	99.7	99.3	92.6	△
Example 24	potash alum	3	NaH ₂ PO ₄	6	Na ₂ SO ₄	2	99.6	98.3	75.8	—
Example 25	potash alum	3	NaH ₂ PO ₄	3	Na ₂ SO ₄	2	99.5	99	69.9	—
Example 26	potash alum	2	NaH ₂ PO ₄	9	Na ₂ SO ₄	12	99.6	99.4	90.1	△
Example 27	potash alum	2	NaH ₂ PO ₄	9	Na ₂ SO ₄	10	99.4	99.5	91	△
Example 28	potash alum	2	NaH ₂ PO ₄	9	Na ₂ SO ₄	8	99.6	99.5	91.5	△
Example 29	potash alum	2	Na ₂ HPO ₄	9	Na ₂ SO ₄	6	99.4	99.2	90.4	△
Example 4	potash alum	2	K ₂ HPO ₄	9	Na ₂ SO ₄	6	99.4	99.4	92.4	△
Example 30	potash alum	2	NaH ₂ PO ₄	18	Na ₂ SO ₄	4	99.5	99	89.3	—
Example 31	potash alum	2	NaH ₂ PO ₄	12	Na ₂ SO ₄	4	99.6	99.1	94.3	△
Example 32	potash alum	2	NaH ₂ PO ₄	9	Na ₂ SO ₄	4	99.4	99.4	90.4	—
Example 33	potash alum	2	NaH ₂ PO ₄	6	Na ₂ SO ₄	4	99.4	99.4	86	—
Example 34	potash alum	2	NaH ₂ PO ₄	3	Na ₂ SO ₄	4	98.9	99.2	76.1	—
Example 35	potash alum	2	NaH ₂ PO ₄	18	Na ₂ SO ₄	2	99.3	97.2	86.5	—
Example 36	potash alum	2	NaH ₂ PO ₄	12	Na ₂ SO ₄	2	99.3	97.7	87.9	—
Example 37	potash alum	2	NaH ₂ PO ₄	9	Na ₂ SO ₄	2	98.9	99.2	91	△
Example 38	potash alum	2	NaH ₂ PO ₄	6	Na ₂ SO ₄	2	98.8	98	83.3	—
Example 39	potash alum	2	NaH ₂ PO ₄	3	Na ₂ SO ₄	2	98.9	99.1	77.7	—
Example 40	potash alum	1.7	NaH ₂ PO ₄	7.5	Na ₂ SO ₄	5	99.5	99.3	88.5	△
Example 41	potash alum	1	NaH ₂ PO ₄	18	Na ₂ SO ₄	2	98.6	88.6	60.6	—
Example 42	potash alum	1	NaH ₂ PO ₄	12	Na ₂ SO ₄	2	98.9	92.9	69.2	—
Example 43	potash alum	1	NaH ₂ PO ₄	6	Na ₂ SO ₄	2	98.1	95.9	75.3	—

[0032]

The results obtained in the cases where the addition amount of each of potash alum, sodium dihydrogen phosphate and sodium sulfate was changed are shown in Table 3.

Note that the results of Example 4 are identical to those in Table 2.

In Examples 20 and 21, the JIS stability was high, and the washability of residue was significantly good.

INDUSTRIAL APPLICABILITY

[0033]

According to the present invention, the stability of hydrogen peroxide is improved, an attached matter derived from a stabilizer of an aqueous hydrogen peroxide solution which attaches to and remains on a spray nozzle, an evaporator or the like is reduced, and a residue can be easily removed by water washing. Therefore, an aseptic filling apparatus can be stably operated without blocking a narrow piping area such as a nozzle.

CLAIMS

1. An aqueous hydrogen peroxide bactericidal solution, wherein said solution comprises:
 - a) hydrogen peroxide;
 - b) a phosphate salt;
 - c) an aluminum salt; and
 - d) at least one acid and/or salt selected from the group consisting of L-ascorbic acid and a salt thereof, ethylenediamine tetraacetate, citric acid and a salt thereof, gluconic acid and a salt thereof, L-glutamic acid and a salt thereof, a silicate, a nitrate, a carbonate, a pyrophosphate, and a sulfate;wherein the additive concentration of the acid and/or salt is 2 to 12 mg/kg.
2. The solution according to claim 1, wherein the phosphate salt is at least one selected from the group consisting of tripotassium phosphate, trimagnesium phosphate, diammonium hydrogen phosphate, ammonium dihydrogen phosphate, dipotassium hydrogen phosphate, potassium dihydrogen phosphate, disodium hydrogen phosphate, sodium dihydrogen phosphate, trisodium phosphate and calcium bis(hydrogen phosphate).
3. The solution according to claim 1, wherein the phosphate salt is a hydrogenphosphate.
4. The solution according to any one of claims 1 to 3, wherein the additive concentration of the phosphate salt is 1 to 18 mg/kg.
5. The solution according to any one of claims 1 to 4, wherein the aluminum salt is aluminum potassium sulfate.
6. The solution according to any one of claims 1 to 5, wherein the additive concentration of the aluminum salt is 1 to 4 mg/kg.
7. The solution according to any one of claims 1 to 6, wherein the concentration of the hydrogen peroxide is 30 wt% to 40 wt%.
8. A method for producing the solution according to any one of claims 1 to 7, comprising adding a phosphate salt, an aluminum salt and at least one acid and/or salt to an aqueous

hydrogen peroxide solution as a raw material.

9. A disinfection method, comprising mixing air with a mist and/or gas of the solution according to any one of claims 1 to 7, and then bringing the resultant mixture into contact with a material to be disinfected.

10. The disinfection method according to claim 9, wherein air is heated to be accompanied by the mist and/or gas of the solution when the solution is brought into contact with the material to be disinfected.

11. The disinfection method according to claim 9 or claim 10, wherein the solution is heated to 100 to 150°C to be brought into contact with the material to be disinfected.

12. The disinfection method according to any one of claims 9 to 11, wherein the material to be disinfected is a packaging container, a food machinery, a plastic bottle or a plastic bottle preform.

13. The disinfection method according to any one of claims 9 to 11, wherein the material to be disinfected is a closed space.

14. The disinfection method according to claim 13, wherein the closed space is an automobile, a clean room for electronics industry, a living space, a medical space, a kitchen, a cooking place, a vehicle or an aircraft.

15. The disinfection method according to any one of claims 9 to 11, wherein an apparatus for generating the mist of the aqueous hydrogen peroxide solution and/or hydrogen peroxide vapor is brought into a facility to generate the mist of the aqueous hydrogen peroxide solution and/or hydrogen peroxide vapor, thereby decreasing the number of bacteria in the facility.

16. The disinfection method according to claim 15, wherein the facility is a toilet facility, a waste processing facility or a livestock barn.