

DESCRIPTION

[Title of Invention] COMPOSITION FOR PREPARING CARBON DIOXIDE FORMULATION FOR EXTERNAL USE, METHOD FOR PRODUCING SAME, METHOD FOR EVALUATING SAME, AND CARBON DIOXIDE FORMULATION FOR EXTERNAL USE

TECHNICAL FIELD

[0001]

The present invention relates to a composition to be used for preparing carbon dioxide formulation for external use in which two or more agents are mixed with each other at the time of use.

BACKGROUND ART

[0002]

For achieving aesthetic and medical effects, a technology for generating a carbonic acid gas by mixing a basic composition containing carbonate and an acidic composition such as a water-soluble acid with each other in the presence of water is well-known (see, for example, Patent Document 1).

Furthermore, it is known that it is possible to easily prepare carbon dioxide formulation for external use having enhanced aesthetic and medical effects since a substance that generates an acid by hydrolysis, carbonate, a thickener, water, a gelling agent that is gelled by a calcium ion, and water-insoluble or slightly water-soluble calcium salt are included as essential components, and the carbon dioxide is transdermally or transmucosally absorbed continuously (see, for example, Patent Document 2).

[0003]

A composition for preparing carbon dioxide formulation for external use generates carbon dioxide by mixing and reacting two or more agents with each other at the time of use.

Furthermore, it is known that when a composition for preparing carbon dioxide formulation for external use is used for a cosmetic pack agent, a gelling agent that is gelled by a calcium ion and a water-insoluble or a slightly water-soluble calcium salt are added to the composition for preparing carbon dioxide formulation for external use, thereby enabling the composition for preparing carbon dioxide formulation for external use to be solidified.

[0004]

However, there still remain problems that the gelling speed of a composition for preparing carbon dioxide formulation for external use or hardness of a gel are not moderate

depending on the types or blending ratios of the gelling agent and the water-insoluble or slightly water-soluble calcium salt. That is to say, when the gelling speed is too high, when the composition for preparing carbon dioxide formulation for external use is applied to the skin etc., it is poorly spreadable and carbon dioxide cannot be generated sufficiently. On the contrary, when the gelling speed is too low, the composition for preparing carbon dioxide formulation for external use cannot be easily peeled off from a skin surface by hand, thus making it difficult to use the composition as a pack agent.

PRIOR ART DOCUMENTS

PATENT DOCUMENT

[0005]

Patent Document 1: Japanese Patent No. 4248878

Patent Document 1: Japanese Patent No. 4595058

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0006]

An object of the present invention is to provide a new composition for preparing carbon dioxide formulation for external use which is highly spreadable to the skin etc. at the time of application, that is, immediately after two or more agents are mixed with each other, generates a larger amount of membrane permeable carbon dioxide than membrane permeable carbon dioxide generated from a composition for preparing carbon dioxide formulation for external use consists of conventionally known components, and solidifies until the end of use. Furthermore, an object of the present invention is to provide a carbon dioxide formulation for external use and a cosmetic pack obtained from the new composition for preparing carbon dioxide formulation for external use.

SOLUTION TO PROBLEM

[0007]

The present inventors have intensively studied in view of the above-mentioned circumstances and have found a composition for preparing carbon dioxide formulation for external use including magnesium salt, water-soluble calcium salt, a gelling agent that is gelled by a magnesium ion or a calcium ion, carbonate, a substance that generates an acid by hydrolysis, polyhydric alcohol, and water, as essential components.

ADVANTAGEOUS EFFECTS OF INVENTION

[0008]

The present invention can provide a composition for preparing carbon dioxide formulation for external use containing magnesium salt, water-soluble calcium salt, a gelling agent that is gelled by a magnesium ion or a calcium ion, carbonate, a substance that generates an acid by hydrolysis, polyhydric alcohol, and water, which are divided into two or more agents such that at least the carbonate and the substance that generates an acid by hydrolysis are separately blended, wherein when the two or more agents of composition for preparing carbon dioxide formulation for external use are mixed with each other and then applied to skin, an applied surface does not solidify so as to prevent a state in which the composition for preparing carbon dioxide formulation for external use is not attached to the hand in touching the applied surface after mixing before application, and the composition is gelled so as to be capable of being peeled off without remaining on the skin until the end of use. That is to say, the present invention can provide a composition for preparing carbon dioxide formulation for external use which is highly spreadable at the time of application to the skin etc., and solidifies to such a degree that it can be peeled off by hand at the end of use.

Furthermore, according to the composition for preparing carbon dioxide formulation for external use of the present invention, by containing magnesium salt, water-soluble calcium salt, a gelling agent that is gelled by magnesium ion or a calcium ion, carbonate, a substance that generates an acid by hydrolysis, polyhydric alcohol and water, it is possible to generate membrane permeable carbon dioxide in an amount exceeding an amount of membrane permeable carbon dioxide generated from a composition for preparing carbon dioxide formulation for external use consists of components known in, for example, Patent Document 2.

BRIEF DESCRIPTION OF DRAWINGS

[0009]

FIG. 1 is a graph showing a change over time of a generation amount of membrane permeable carbon dioxide in Example 1 and Comparative Example 3.

FIG. 2 is a graph showing a change over time of a pH value in Example 1 and Comparative Example 3.

DESCRIPTION OF EMBODIMENTS

[0010]

The composition for preparing carbon dioxide formulation for external use of the present invention is a preparation of carbon dioxide formulation for external use in which two or more agents are mixed with each other at the time of use, and contains at least magnesium salt, water-soluble calcium salt, a gelling agent that is gelled by a magnesium ion or a calcium ion,

carbonate, a substance that generates an acid by hydrolysis, polyhydric alcohol, and water, and may further contain other components as needed.

[0011]

The magnesium salt is not particularly limited and can be appropriately selected depending on the purposes as long as it includes magnesium in its chemical structural formula and generates a magnesium ion in water. Examples of the magnesium salt include magnesium oxide, magnesium carbonate, magnesium sulfate, magnesium aluminosilicate, magnesium L-ascorbic acid-2-phosphoric acid ester, magnesium silicate, magnesium stearate, magnesium hydroxide, magnesium acetate, magnesium malate, magnesium citrate, and the like. One of these examples may be used singly or two or more of these examples may be used in combination, and may combine with other essential components such as carbonate. Among them, magnesium carbonate, magnesium oxide, and the like, are preferable, and magnesium carbonate also working as carbonate that is essential as the components for a composition for preparing carbon dioxide formulation for external use is more preferable.

[0012]

The content of the magnesium salt to the total amount of the composition for preparing carbon dioxide formulation for external use is not particularly limited and can be appropriately selected depending on the purposes. When the content is more than 12 mass %, it may take too short time for the applied surface to start to solidify and to solidify to such a degree that the entire gel can be peeled off from the skin without remaining on the skin. On the other hand, when the content is less than 0.3 mass %, it takes too long time for the applied surface to start to solidify and to solidify to such a degree that the entire gel can be peeled off from the skin without remaining on the skin. Therefore, the content is preferably 0.3 mass % or more and less than 12 mass %, and more preferably 0.5 mass % or more and 11 mass % or less.

[0013]

The water-soluble calcium salt is not particularly limited and can be appropriately selected depending on the purposes as long as it includes calcium in its chemical structural formula, has water-soluble property and generates a calcium ion in water. Examples of the water-soluble calcium salt include calcium chloride, calcium lactate, and the like. One of these examples may be used singly or two or more of these examples may be used in combination, and may combine with other essential components. Among them, calcium salt is preferable because it is gelled until the end of use such that the composition for preparing carbon dioxide formulation for external use is capable of being peeled off by the hand, and calcium chloride is more preferable in view of solubility to water.

[0014]

The content of the water-soluble calcium salt (excluding water in the water-soluble calcium salt) to the total amount of the composition for preparing carbon dioxide formulation for external use is not particularly limited, and can be appropriately selected depending on the purposes. When the content is less than 0.003 mass %, the composition for preparing carbon dioxide formulation for external use is not sufficiently gelled by the end of use, thus making peeling difficult. On the other hand, when the content is more than 0.05 mass %, the applied surface easily solidifies after mixing before application. Therefore, the content is preferably 0.003 mass % or more and 0.05 mass % or less, and more preferably 0.003 mass % or more and 0.03 mass % or less.

[0015]

The gelling agent that is gelled by a magnesium ion or a calcium ion is not particularly limited, and can be appropriately selected depending on the purposes as long as it is gelled by a magnesium ion generated from the magnesium salt or a calcium ion generated from the water-soluble calcium salt. Examples of the gelling agent include carageenan, xanthan gum, tara gum, sodium alginate, and the like. One of these examples may be used singly or two or more of these examples may be used in combination. Among them, sodium alginate and xanthan gum are preferable in view of smoothness of an applied state and ease of use.

[0016]

The content of the gelling agent that is gelled by a magnesium ion or a calcium ion to the total amount of the composition for preparing carbon dioxide formulation for external use is not particularly limited and can be appropriately selected depending on the purposes. When the content is less than 1.0 mass %, gelling of the composition for preparing carbon dioxide formulation for external use is not sufficient, so that an effect as an agent for external use on skin cannot be obtained easily. On the other hand, the content is more than 7 mass %, the applied surface easily solidifies after mixing before application in such a state that the composition for preparing carbon dioxide formulation for external use is not attached to the hand in touching the applied surface. Therefore, the content is preferably 1.0 mass % or more and 7 mass % or less, and more preferably 2 mass % or more and 5 mass % or less.

[0017]

The carbonate is not particularly limited, and can be appropriately selected depending on the purposes as long as it is carbonate that reacts with the substance that generates an acid by hydrolysis, which is included in the composition for preparing carbon dioxide formulation for external use, to generate carbon dioxide. Examples of the carbonate include ammonium carbonate, ammonium hydrogencarbonate, potassium carbonate, potassium hydrogencarbonate, sodium carbonate, sodium hydrogencarbonate, magnesium carbonate, magnesium hydrogencarbonate, calcium carbonate, calcium hydrogencarbonate, barium carbonate, and the

like. One of these examples may be used singly or two or more of these examples may be used in combination, and may also combine with other essential components such as magnesium salt and calcium salt. Among them, magnesium carbonate that also generates a magnesium ion is more preferable.

[0018]

The content of the carbonate to the total amount of the composition for preparing carbon dioxide formulation for external use is not particularly limited and can be appropriately selected depending on the purposes. When the content is less than 0.3 mass %, the generation amount of carbon dioxide decreases, so that it become difficult to sufficiently exhibit the effect as the agent for external use obtained by the generation of the carbon dioxide. On the other hand, when the content is more than 12 mass %, pH of the composition for preparing carbon dioxide formulation for external use becomes higher, the generated carbon dioxide tends to exist as a carbonate ion, and the generation amount of membrane permeable carbon dioxide decreases. Therefore, the content is preferably 0.3 mass % or more and 12 mass % or less, and more preferably 0.5 mass % or more and 11 mass % or less.

[0019]

The substance that generates an acid by hydrolysis is not particularly limited, and can be appropriately selected depending on the purposes as long as it has one or more cyclic ester bonds in its molecular structure. Examples of the substance include glucono delta lactone, pantolactone, D, L- or L-lactide (3,6-dimethyl-1,4-dioxane-2,5-dione), D, L- or L-glycolide, phthalic anhydride, maleic anhydride, succinic anhydride, and the like. One of these examples may be used singly or two or more of these examples may be used in combination. Among them, glucono delta lactone and D, L-lactide and the like are preferable, and glucono delta lactone is more preferable in view of hydrolysis speed and generation speed of an acid that is to be reacted with carbonate and easy availability of compounds.

[0020]

The content of the substance that generates an acid by hydrolysis to the total amount of the composition for preparing carbon dioxide formulation for external use is not particularly limited and can be appropriately selected depending on the purposes. When the content is less than 10 mass %, the generation amount of carbon dioxide by reaction between the hydrolyzed acid and carbonate is decreased, and it is difficult to sufficiently exhibit the effect as the agent for external use obtained by generation of carbon dioxide. On the other hand, the content is more than 20 mass %, the substance is not easily stirred and mixed with the other components. Thereafter, the content is preferably 10 mass % or more and 20 mass % or less, and more preferably 13 mass % or more and 18 mass %.

[0021]

The polyhydric alcohol is not particularly limited, and can be appropriately selected depending on the purposes as long as it is alcohol having two or more hydroxyl groups in its molecular structure. Examples of the polyhydric alcohol include ethylene glycol, propylene glycol, 1,3-butylene glycol, polyethylene glycol, glycerin, 1,8-octanediol, sugar alcohol such as glycerin and sorbitol, sugar such as trehalose, and the like. One of these examples may be used singly or two or more of these examples may be used in combination. Among them, in view of the effect of shortening of the gelling time and moisture retention, 1,3-butylene glycol is preferable.

[0022]

The content of the polyhydric alcohol to the total amount of the composition for preparing carbon dioxide formulation for external use is not particularly limited and can be appropriately selected depending on the purposes. When the content is less than 5 mass %, it takes long time to gel the composition for preparing carbon dioxide formulation for external use after mixing two or more agents, thus making it impossible to gel the composition for preparing carbon dioxide formulation for external use to such a degree that it can be peeled off by hand until the end of use. On the other hand, when the content is more than 25 mass %, the applied surface solidifies in a state in which the composition for preparing carbon dioxide formulation for external use is not attached to the hand in touching the applied surface after mixing before application. Therefore, the content is preferably 5 mass % or more and 25 mass % or less, and more preferably 5 mass % or more and 20 mass % or less.

[0023]

The water included in the composition for preparing carbon dioxide formulation for external use is not particularly limited, and can be appropriately selected depending on the purposes as long as it is water to be used for usual cosmetics, pharmaceuticals, and the like. Examples of the water include distilled water, membrane permeated water, and ion exchanged water. One of these examples may be used singly or two or more of these examples may be used in combination, and the water may be included as aqueous solutions of the other components, for example, an aqueous solution of calcium chloride.

[0024]

The content of the water to the total amount of the composition for preparing carbon dioxide formulation for external use is not particularly limited and can be appropriately selected depending on the purposes. Furthermore, the content is a total of the water and water included in the other components such as water-soluble calcium salt, and the content is prepared such that the total amount of the composition for preparing carbon dioxide formulation for external use becomes 100 mass %. Furthermore, when the content is less than 55 mass %, since the water has high viscosity and lacks in fluidity, flexibility, and solubility with respect to the other

components, the content is preferably 55 mass % or more.

[0025]

The other components of the composition for preparing carbon dioxide formulation for external use are not particularly limited, and can be appropriately selected depending on the purposes as long as they are components to be used for cosmetics or agents for external use on skin. Examples of the other components include a surface active agent, a pH adjustment agent, a moisturizing agent, a preservative, an antioxidant, a perfume, a dispersing agent, an ultraviolet absorber, a coloring agent, and the like. One of these examples may be used singly or two or more of these examples may be used in combination.

[0026]

Use mode of the carbon dioxide formulation for external use is not particularly limited, and can be appropriately selected depending on the purposes. Examples of the use mode include a mode in which two or more gel-type agents are mixed with each other at the time of application to the skin etc., a mode in which two or more of gel-like and granular agents are mixed with each other at the time of application to the skin etc., a mode in which a granular agent dissolved in water and a gel-like agent are mixed with each other at the time of application to the skin etc.

[0027]

The method for evaluating the spreadability at the time of application of the composition for preparing carbon dioxide formulation for external use to the skin etc. is not particularly limited and can be appropriately selected depending on the purposes as long as the method can show the spreadability of the applied gel. Examples of the method include a method for evaluating the spreadability based on the length of "time until the applied surface starts to solidify" wherein the "time until the applied surface starts to solidify" is defined as time from time when two or more agents are mixed with each other and then applied to the skin etc. until "time at which a gel is not attached to the hand and fingers in touching the applied surface."

[0028]

The method for evaluating the ease of peeling at the end of use after the composition for preparing carbon dioxide formulation for external use is applied to the skin etc. is not particularly limited and can be appropriately selected depending on the purposes as long as the method can show the ease of peeling and the ease of solidifying the applied gel. Examples of the method include a method for evaluating the length of "peelable time" in comparison with the use time, wherein the "peelable time" is defined as time from time when two or more agents are mixed with each other and then applied to the skin etc. until time when "a gel does not remain on the skin when the gel is peeled off."

[0029]

The method for evaluating the generation amount of membrane permeable carbon dioxide of the composition for preparing carbon dioxide formulation for external use is not particularly limited, and can be appropriately selected depending on the purposes as long as it can measure the amount of membrane permeable carbon dioxide that permeates through a membrane mimicking the human skin environment. Examples of the method include a method of soaking a porous polymer membrane into fat and oil and measuring the amount of carbon dioxide permeating the membrane. In order to bring the porous material close to the human skin environment, a method using a microporous film (3M microporous film having a pore diameter of 0.3 μm or less manufactured by Sumitomo 3M Limited) for the porous polymer membrane, olive squalane (Plant Squalane manufactured by Kishimoto Special Liver Oil Co., Ltd.) for the fat and oil, and a carbon dioxide concentration meter (type No. CGP-31 manufactured by DKK-TOA Corporation) for measurement of the membrane permeable carbon dioxide is particularly preferable.

[0030]

The evaluation of the generation amount of membrane permeable carbon dioxide of the composition for preparing carbon dioxide formulation for external use is specifically carried out as follows: 1 g of gel obtained by stirring and mixing two or more agents is placed into a special-purposed container for a carbon dioxide concentration meter, a microporous film coated with 0.1 g of olive squalane is put thereon, and a detector of a carbon dioxide concentration meter is attached to the special-purposed container. A predetermined amount of water is added so as to fill between the container and the detector by using an injection syringe, and immediately thereafter, the generation amount of membrane permeable carbon dioxide is measured, and the measurement amount is recorded every one minute for 60 min.

[0031]

As the method for evaluating the composition for preparing carbon dioxide formulation for external use, it is possible to confirm the state of carbon dioxide generated from the composition for preparing carbon dioxide formulation for external use by further measuring pH of the composition for preparing carbon dioxide formulation for external use at the time when membrane permeable carbon dioxide is generated.

The method for measuring pH is not particularly limited, and can be appropriately selected depending on the purposes as long as it can measure a change over time of pH of the composition for preparing carbon dioxide formulation for external use.

Examples of the method include a method for stirring and mixing two or more agents with each other, and measuring the pH of the composition for preparing carbon dioxide

formulation for external use over time by using a pH meter having waterproof property under ordinary conditions (pHep4 HI98127 manufactured by HANNA Instruments).

EXAMPLE

[0032]

Hereinafter, the present invention will be specifically described with reference to Examples and Comparative Examples, but the present invention is not necessarily limited to these Examples.

[0033]

Examples 1 to 9 and Comparative Examples 1 to 3

Compositions for preparing carbon dioxide formulation for external use were prepared according to the composition described in Table 1. Note here that in Examples in which magnesium carbonate working as magnesium salt and carbonate was blended, the compositions for preparing carbon dioxide formulation for external use were prepared in blending amounts of magnesium carbonate described in the Table, but in the blending conditions for the essential components in Claim 4 and paragraphs 0034, 0035, and the like, magnesium salt and carbonate were regarded to be blended in the same amount, respectively.

Two divided agents according to the blending amounts described in Table 2 were stirred and mixed with each other so that they became uniform in visual observation immediately before use.

[0034]

[Table 1] Blending amount in Examples and Comparative Examples (unit: mass %)

[illegible]

[0035]

[Table 2] Blending amount of each agent in Examples and Comparative Examples (unit: g)

[illegible]

[0036]

Compositions for preparing carbon dioxide formulation for external use prepared in Examples 1 to 9 and Comparative Examples 1 to 3 were evaluated according to the below-mentioned evaluation method, in terms of spreadability at the time of application to the skin etc. after mixing and ease of peeling at the end of use of the composition for preparing carbon dioxide formulation for external use.

Time from time at which two or more agents are mixed with each other and then applied to the skin etc. to “time at which gel is not attached to the hand and fingers in touching the applied surface” is referred to as “time until the applied surface starts to solidify.” The “time until the applied surface starts to solidify” was measured. Next, time from time at which two or more agents are mixed with each other and then applied to the skin etc. to “time at which the gel does not remain on the skin when the agent is peeled off” is referred to as “peelable time.” The “peelable time” was measured. Then, appropriate “time until the applied surface starts to solidify” was specified based on the time at which two or more agents were mixed with each other and applied to the skin etc., and appropriate “peelable time” was specified based on the use time. Both the “time until the applied surface starts to solidify” and the “peelable time” were within the specified time, the composition was evaluated as “excellent (◎)”; both were not within the specified time, the composition was evaluated as “not good (△)”; one was within the specified time and the other was not within the specified time, the composition was evaluated as “good (○)”; the case where the composition does not solidify or is not able to be peeled off even after 60 minutes have passed after mixing, the composition is evaluated as “not usable (×)”.

In the described Examples and Comparative Examples, since time in which the two or more agents of the composition for preparing carbon dioxide formulation for external use were mixed with each other and applied to the skin etc. was within 5 min, the appropriate time until the applied surface starts to solidify was specified to be 5 to 10 minutes. Furthermore, in the described Examples and Comparative Examples, since the use time of the composition for preparing carbon dioxide formulation for external use was 10 to 15 minutes, the appropriate peelable time was specified to be 10 to 15 minutes.

Evaluation results of the spreadability at the time of application to the skin etc., and ease of peeling at the end of use are shown in Table 3.

[0037]

[Table 3] Evaluation results in Examples and Comparative Examples

	Example 1	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7	Example 8	Example 9	Comparative Example 1	Comparative Example 2	Comparative Example 3
Time until surface starts to solidify (min)	5	5	2	1.5	10	5	4	2.5	0	(does not solidify)	25	20
Peeleable time (min)	10	10	7	5	20	10	5	3	5	-	(not able to be peeled off)	35
Evaluation	◎	◎	△	△	○	◎	△	△	△	×	×	△

[0038]

From Table 3, it was found that as compared with Examples 1, 2 and 6 with excellent (◎) evaluation, in Comparative Example 2 which does not include water-soluble calcium salt, the composition was not able to be peeled off at the end of use, and in Examples 3 and 4 which includes a larger blending amount of calcium chloride as water-soluble calcium salt, the time until the applied surface starts to solidify was short, and thus the spreadability at the time of application was not good. Furthermore, it was found that in Comparative Example 1 in which magnesium carbonate was changed to sodium hydrogencarbonate, neither applied surface nor inside solidifies, and in Examples 7 and 8 in which the blending amount of magnesium carbonate was increased, the time until the applied surface starts to solidify and peelable time became short.

[0039]

Compositions for preparing carbon dioxide formulation for external use prepared in Example 1 and Comparative Example 3 were evaluated according to the below-mentioned evaluation method, in terms of the generation amount of membrane permeable carbon dioxide.

In Examples and Comparative Examples, 1 g of gel obtained by mixing the two agents described in Table 2 with each other was placed into a special-purposed container for a carbon dioxide concentration meter, a microporous film coated with 0.1 g of olive squalane was put thereon, and a detector of a carbon dioxide concentration meter was attached to the special-purposed container. A predetermined amount of water was added so as to fill between the container and the detector by using an injection syringe, and immediately thereafter, the generation amount of membrane permeable carbon dioxide was measured, and the measurement amount was recorded every one minute for 60 min.

Test results of the generation amount of membrane permeable carbon dioxide are shown in Table 4.

[0040]

[Table 4] Generation amount of membrane permeable carbon dioxide (mg/L)

Time after mixing (min)	Example 1	Comparative Example 3
0	0	0
1	0	0
2	10	10
3	20	20
4	40	30
5	80	40
6	110	100
7	150	140
8	180	200
9	260	280
10	370	360
11	520	460
12	680	560
13	810	650
14	930	770
15	1050	860
16	1190	960
17	1330	1060
18	1420	1140
19	1570	1230
20	1670	1310
21	1740	1380
22	1800	1450
23	1830	1510
24	1870	1560
25	1900	1610
26	1910	1650
27	1940	1680
28	1970	1710
29	2000	1740
30	2020	1770
31		1790
32		1820
33		1840
34		1860
35		1880
36		1900
37		1920
38		1940
39		1960
40		1980
41		2000
42		2020

[0041]

Based on Table 4, the change over time of the generation amount of membrane permeable carbon dioxide in Example 1 and Comparative Example 3 is shown in FIG. 1.

From Table 4 and FIG. 1, when Example 1 is compared with Comparative Example 3 which does not include a magnesium ion and water-soluble calcium salt, it is found that the generation amount of membrane permeable carbon dioxide until the assumed use time after mixing in Example 1, that is, 15 minutes is about 1.2 times as large as the generation amount of membrane permeable carbon dioxide in Comparative Example 3.

[0042]

The pH was measured by the following method. The two agents described in Example 1 and Comparative Example 3 were stirred and mixed, and pH of the composition for preparing carbon dioxide formulation for external use was measured over time using a pH meter having waterproof property under ordinary conditions (pHep4 HI98127 manufactured by HANNA Instruments).

The measurement results of pH are shown in Table 5 and FIG. 2.

[0043]

[Table 5] Measurement result of pH (pH)

Time after mixing (min)	Example 1	Comparative Example 3
0	10.2	9.3
1	4.9	7.1
2	5.5	7.9
3	6.0	6.8
4	6.4	6.6
5	6.5	6.4
6	6.5	6.4
7	6.4	6.3
8	6.4	6.2
9	6.3	6.2
10	6.2	6.1
11	6.2	6.1
12	6.1	6.0
13	6.0	6.0
14	6.0	6.0
15	5.9	5.9
16	5.9	5.9
17	5.8	5.9
18	5.8	5.8
19	5.7	5.8
20	5.6	5.8
21	5.5	5.8
22	5.4	5.8
23	5.3	5.7
24	5.3	5.7
25	5.2	5.7
26	5.1	5.7
27	5.0	5.7
28	5.0	5.6
29	4.9	5.6
30	4.8	5.6
31	4.8	5.6
32	4.8	5.6
33	4.7	5.5
34	4.7	5.5
35	4.6	5.5
36	4.6	5.5
37	4.6	5.5
38	4.5	5.4
39	4.5	5.4
40	4.5	5.4
41	4.5	5.4
42	4.5	5.4
43	4.4	5.4
44	4.4	5.4
45	4.4	5.4
46	4.4	5.4
47	4.4	5.3
48	4.4	5.3
49	4.3	5.3
50	4.3	5.3
51	4.3	5.3
52	4.3	5.3
53	4.3	5.2
54	4.3	5.2
55	4.3	5.2
56	4.2	5.2
57	4.2	5.2
58	4.2	5.2
59	4.2	5.1
60	4.2	5.1

[0044]

From Table 5 and FIG. 2, it was found that in Example 1, pH decreased immediately after two agents had been mixed with each other, and the pH was kept at pH 4.0 to 6.5 at which the membrane permeable carbon dioxide was easily generated before 60 min had passed.

[0045]

From Tables 3 to 5 and FIGs. 1 to 2, it was found that it was possible to provide a composition for preparing carbon dioxide formulation for external use, in which when the composition was divided into two or more agents and the divided agents were mixed with each other and then applied to the skin, the composition did not solidify so as to prevent a state in which the composition for preparing carbon dioxide formulation for external use was not attached to the hand in touching the applied surface after mixing before application, and the composition was gelled so as to be capable of being peeled off from the skin by hand until the end of use. That is to say, it was found that the composition for preparing carbon dioxide formulation for external use had high spreadability at the time of application to the skin etc., and solidified to such a degree that it was able to be peeled off by hand at the end of use.

Furthermore, since the composition for preparing carbon dioxide formulation for external use of the present invention contains magnesium salt, water-soluble calcium salt, a gelling agent that is gelled by a calcium ion or a magnesium ion, carbonate, a substance that generates an acid by hydrolysis, polyhydric alcohol and water, it was found that, from immediately after the start of use before the end of use, pH was maintained at 4 to 6.5, and generated membrane permeable carbon dioxide in an amount exceeding the amount of membrane permeable carbon dioxide generated from the composition for preparing carbon dioxide formulation for external use consist of components known in, for example, Patent Document 2.

[0046]

The above-mentioned advantageous effects are based on some factors. Firstly, the above-mentioned advantageous effects are based on that blending of the component such as magnesium carbonate that generates a magnesium ion makes ion cross-linking of gelling agents such as sodium alginate and xanthan gum gentler than the case of blending a component that generates a calcium ion. Blending of a magnesium ion improves the spreadability of the composition for preparing carbon dioxide formulation for external use immediately after mixing, and contributes to solidification of the entire gel. Furthermore, the above-mentioned advantageous effects are based on that blending of calcium chloride that is water-soluble calcium salt as the component that generates a calcium ion hastens ion cross-linking of gelling agents such as sodium alginate and xanthan gum as compared with the case where water-insoluble or slightly water-soluble calcium carbonate is blended. Blending of the

water-soluble calcium ion contributes to solidification of the applied surface of the composition for preparing carbon dioxide formulation for external use immediately after mixing. Furthermore, the above-mentioned advantageous effects are based on that increasing the blending amount of butylene glycol that is polyhydric alcohol can hasten the ion cross-linking of the gelling agent. Blending of butylene glycol contributes to adjustment of the spreadability or peelable time of the composition for preparing carbon dioxide formulation for external use immediately after mixing.

Furthermore, the above-mentioned advantageous effects are based on that blending of appropriate amounts of a component such as magnesium carbonate that generates a magnesium ion and water-soluble calcium salt can adjust the time until the applied surface starts to solidify or the peelable time, and can release the membrane permeable carbon dioxide generated from the composition for preparing carbon dioxide formulation for external use to the outside of the composition for preparing carbon dioxide formulation for external use. Blending of appropriate amounts of the component that generates a magnesium ion and water-soluble calcium salt enables a larger amount of membrane permeable carbon dioxide to be generated than that generated from a composition for preparing carbon dioxide formulation for external use consists of conventionally known components in which an appropriate amount of water-insoluble or slightly water-soluble calcium salt are blended but a component that generates a magnesium ion is not blended.

INDUSTRIAL APPLICABILITY

[0047]

According to a composition for preparing carbon dioxide formulation for external use of the present invention, two or more agents are mixed and prepared easily, the applied surface does not solidify so as to provide high spreadability immediately after mixing before application to the skin, and the composition can be peeled off until the end of use without remaining on the skin, as well as generation of a sufficient amount of membrane permeable carbon dioxide can be sustained during use. Therefore, in cosmetic packs that can continue to provide skin with an appropriate stimulation, the composition for preparing carbon dioxide formulation for external use of the present invention can provide high spreadability at the time of application, can be peeled off cleanly at the end of use, and has an effect of a so-called carbonic acid gas pack. However, the composition can be used for not only cosmetic packs, but also for any of cosmetics such as a peeling agent, agents for external use on skin, agents for hair and other quasi drugs, pharmaceuticals, and products for pets.

[0048]

The composition for preparing carbon dioxide formulation for external use of the present invention has features of, in particular, good spreadability at the time of application and

peelability at the end of use, which have not been able to be achieved simultaneously in a gel-like pack, that is, a so-called carbonic acid gas pack in beauty business. Therefore, so far, it has been necessary to wipe off solidifying gels, which were not sufficiently peeled off at the end time of use, by towel, and there has been a secondary problem in washing of the towel used for wiping off the solidifying gel. The present invention can solve also such a secondary problem.

CLAIMS

1. A composition for preparing carbon dioxide formulation for external use comprising at least magnesium salt, water-soluble calcium salt, a gelling agent that is gelled by a magnesium ion or a calcium ion, carbonate, a substance that generates an acid by hydrolysis, polyhydric alcohol, and water, as essential components.
2. The composition for preparing carbon dioxide formulation for external use according to claim 1, wherein when the composition for preparing carbon dioxide formulation for external use is divided into two or more such that at least the carbonate and the substance that generates an acid by hydrolysis are separately blended, and the divided compositions are mixed with each other and then applied to skin, an applied surface does not solidify after mixing before application, and the composition is gelled so as to be capable of being peeled off from the skin until end of use.
3. The composition for preparing carbon dioxide formulation for external use according to claim 1 or 2, wherein magnesium salt and water-soluble calcium salt are blended so as to have a period during which a generation amount of membrane permeable carbon dioxide exceeds a generation amount of membrane permeable carbon dioxide in a case of mixing the composition for preparing carbon dioxide formulation for external use in which magnesium salt is excluded and water-soluble calcium salt is changed to water-insoluble calcium salt or slightly water-soluble calcium salt.
4. The composition for preparing carbon dioxide formulation for external use according to any one of claims 1 to 3, wherein a content of the magnesium salt to a total amount of the composition for preparing carbon dioxide formulation for external use is 0.3 mass % or more and 12 mass % or less; a content of the water-soluble calcium salt to the total amount of the composition for preparing carbon dioxide formulation for external use is 0.003 mass % or more and 0.05 mass % or less; a content of the gelling agent that is gelled by a magnesium ion or a calcium ion to the total amount of the composition for preparing carbon dioxide formulation for external use is 1.0 mass % or more and 7 mass % or less; a content of the carbonate to the total amount of the composition for preparing carbon dioxide formulation for external use is 0.3 mass % or more and 12 mass % or less; a content of the substance that generates an acid by hydrolysis to the total amount of the composition for preparing carbon dioxide formulation for external use is 10 mass % or more and 20 mass % or less; and a content of the polyhydric alcohol to the total amount of the composition for preparing carbon dioxide formulation for external use is 5 mass % or more and 25 mass % or less.

5. A method for producing a composition for preparing carbon dioxide formulation for external use according to any one of claims 1 to 4, wherein the composition comprises at least magnesium salt, water-soluble calcium salt, a gelling agent that is gelled by a magnesium ion or a calcium ion, carbonate, a substance that generates an acid by hydrolysis, polyhydric alcohol, and water, as essential components.
6. A carbon dioxide formulation for external use using the composition for preparing carbon dioxide formulation for external use according to any one of claims 1 to 4.
7. A cosmetic pack using the composition for preparing carbon dioxide formulation for external use according to any one of claims 1 to 4.