

PROCESS FOR PRODUCING EXTINGUISHING AGENT AND THROW-TYPE FIRE EXTINGUISHER

FIELD OF INVENTION

- 5 The present invention relates to a process for producing extinguishing agent and ampoule functions as a throw-type fire extinguisher.

BACKGROUND OF THE INVENTION

- 10 An extinguishing agent is made up of various compositions. For example, Japanese Patent Laid-Open Publication No. 2001-37901 discloses an extinguishing agent comprising urea, sodium chloride, sodium carbonic anhydride, ammonium sulfate and the like.

- 15 However, amongst processes for producing an extinguishing agent, many of them do not disclose the detail of production as know-how of venders. A process for producing an extinguishing agent will be disclosed herein.

- In recent years, in addition to a floor type fire extinguisher, a throw-type fire
20 extinguisher has been commercialized, which is thrown to the origin of a fire. Since it is sometimes difficult to use the floor type fire extinguisher in the course of the actual action of extinguishing a fire, a throw-type fire extinguisher, which can extinguish a fire only by throwing it at the origin of a fire, may be considered to have easiness and convince of application.

- 25 However, not all of components making up the fire extinguishing agent are necessarily safe. There is a possibility to cause a problem when a child or an aged person drinks or consumes the agent by mistake.

- 30 Accordingly, there is a need for a process for producing a safe extinguishing agent, which has no or little adverse influence on the human body.

Furthermore, there is a need for providing a process for producing a safe

extinguishing agent, which effectively conducts a treatment so that components incorporated therein may exhibit their action, to thereby produce an extinguishing agent having a high fire-extinguishing performance.

5

10

15

20

25

30

SUMMARY OF THE INVENTION

According to the present invention, a process for producing an extinguishing agent is provided. Sodium chloride, ammonium dihydrogen phosphate and ammonium hydrogen carbonate are dissolved in water at a temperature of 30°C to 40°C to form a solution. The ammonium dihydrogen phosphate and ammonium hydrogen carbonate as dissolved, are allowed to undergo a reaction. The sodium chloride is present in the extinguishing agent in a ratio 5g to 15g per 500ml of water, the ammonium dihydrogen phosphate is present in the extinguishing agent in a ratio 50g to 70g per 500ml of water, and the ammonium hydrogen carbonate is present in the extinguishing agent in a ratio 50g to 70g per 500ml of water.

The process of the above first aspect of the invention may further comprise a step of incorporating a surfactant in the extinguishing agent.

15

According to a second aspect of the present invention, there is provided a process for producing an extinguishing agent. Sodium chloride, ammonium dihydrogen phosphate and ammonium hydrogen carbonate, urea and ammonium sulfate are dissolved in water at a temperature of 30°C to 40°C to form a solution. The ammonium dihydrogen phosphate and ammonium hydrogen carbonate, as dissolved, are allowed to undergo a reaction. The sodium chloride is present in the extinguishing agent in a ratio 5g to 15g per 500ml of water, the ammonium dihydrogen phosphate is present in the extinguishing agent in a ratio 50g to 70g per 500ml of water, the ammonium hydrogen carbonate is present in the extinguishing agent in a ratio 50g to 70g per 500ml of water, the urea is present in a ratio of 20g to 40g per 500ml of water, and the ammonium sulfate is present in the extinguishing agent in a ratio of 35g to 55g per 500ml of water.

The process according to the second aspect of the invention may further comprise a step of incorporating a surfactant in the extinguishing agent.

30

Additional aspects of the invention involve processes of producing a throw-type fire extinguisher, and processes of extinguishing a fire with a throw-type fire extinguisher.

Still additional aspects of the invention involve processes of producing a throw-type fire extinguisher containing extinguishing agents such as those described herein.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

5

First Embodiment

First embodiment of the present invention will now be described.

10 First, 5g to 15g, e.g. 10g of sodium chloride is incorporated in 300ml of water at a temperature ranging from 30°C to 40°C, for example, approximately, 40°C, and then the mixture is stirred to dissolve sodium chloride into water. Sodium chloride is utilized as a catalyst.

15 Subsequently, 50g to 70g, for example, 60g of ammonium dihydrogen phosphate is incorporated and dissolved therein, and 50g to 70g, for example, 60g of ammonium hydrogen carbonate is incorporated to cause a reaction to be dissolved.

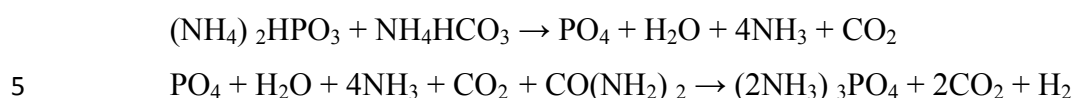
Ammonium dihydrogen phosphate and ammonium hydrogen carbonate are thermally
20 decomposed into carbon dioxide gas (CO₂) and ammonia gas (NH₃) during the course of fire extinguishing through combustion. Carbon dioxide gas has a function of shielding the supply of oxygen to burning products and a function of neutralizing and suppressing oxidation of burning products. Ammonia gas, which possesses a neutralization function and a cooling function, prevents re-ignition of burning
25 products to avoid fire from spreading to surroundings.

Subsequently, 200ml of boiling water is added to the solution to make the total amount of extinguishing agent to 500ml, and the temperature to about 60°C-70°C. The agent is allowed to cool at room temperature.

30

Finally, as occasion may demand, effective amount, e.g. approximately 20ml of a surfactant (e.g. alpha foam: surfactant for forming aqueous membrane foam) is added to 500ml of the extinguishing agent.

Reactions brought about by combustion in the course of extinguishing fire are as follows:



The extinguishing agent thus produced is incorporated into a container to be ready for use. The container in which the extinguishing agent of the present invention is incorporated may be various kinds of breakable plastic containers made of non-phthalic acid, polyvinyl chloride (PVC), polypropylene (PP), polystyrene (PS),
10 polyethylene (PE), polyethylene terephthalate (PET) or the like. The container can store the extinguishing agent of the present invention without deterioration of quality of the extinguishing agent of the present invention in a stable manner and does not react with the extinguishing agent of the present invention.

15

Second Embodiment

Next, a second embodiment of the present invention will be described.

20

First, 5g to 15g, for example, 10g of sodium chloride is incorporated in 300ml of water at 30°C, and then the mixture is stirred to dissolve sodium chloride into water. Sodium chloride is utilized as a catalyst.

25 Subsequently, 50g to 70g, for example, 50g of ammonium dihydrogen phosphate is incorporated and dissolved therein, and 50g to 70g, for example, 50g of ammonium hydrogen carbonate is incorporated to cause a reaction to be dissolved.

Subsequently, 20g to 40g, for example, 50g of urea is incorporated and dissolved in
30 the solution. Thereafter, 35g to 55g, for example, 45g of ammonium sulfate is incorporated and dissolved in the solution.

Ammonium dihydrogen phosphate and ammonium hydrogen carbonate, urea and

ammonium sulfate are thermally decomposed into carbon dioxide gas and ammonia gas during the course of fire extinguishing through combustion. Carbon dioxide gas has a function of shielding the supply of oxygen to burning products and neutralizing and suppressing oxidation of burning products. Ammonia gas, which possesses a neutralization function and a cooling function, prevents re-ignition of burning products to avoid fire from spreading to the surroundings.

Subsequently, 200ml of boiling water is added to the solution to bring to a total amount of extinguishing agent to 500ml, and to bring the temperature to a range between 60°C-70°C. The solution is allowed to cool at room temperature.

Finally, as occasion may demand, 20ml of a surfactant (e.g., alpha foam) is added to 500ml of the extinguishing agent.

The extinguishing agent thus produced is incorporated into a container to be ready for use. The container in which the extinguishing agent of the present invention is incorporated may be various kinds of breakable plastic containers made of non-phthalic acid, polyvinyl chloride (PVC), polypropylene (PP), polystyrene (PS), polyethylene (PE), polyethylene terephthalate (PET) or the like. The container can store the extinguishing agent of the present invention without deterioration of quality of the extinguishing agent of the present invention in a stable manner and does not react with the extinguishing agent of the present invention.

In the practice of embodiments of the present invention, when fire occurs, a person throws the ampoule (the throw-type fire extinguisher) at the fire. When the ampoule hits a burning object, the ampoule breaks easily and the extinguishing agent is expelled. Ammonium dihydrogen phosphate, ammonium hydrogen carbonate, urea and ammonium sulfate generate ammonia and carbon dioxide cause the fire to be extinguished.

According to the first and second embodiments of the process for producing an extinguishing agent of the present invention, a safe extinguishing agent having no or little harmful effects upon human body can be provided. The use of ammonium

hydrogen carbonate increases extinguishing rate.

The extinguishing rate when the conventional ammonium carbonate is used and that when ammonium hydrogen carbonate is used are shown below.

5

Table 1

		Rate
	Ammonium carbonate	45 seconds
10	Ammonium hydrogen carbonate	25 seconds

When being incorporated into an appropriate container, the extinguishing agent produced according to the present invention can be used for a fire extinguisher that is thrown at the origin of a fire when fire occurs. A safe extinguishing agent having no or little influence upon human body can be provided. The use of ammonium hydrogen carbonate increases extinguishing rate.

15

Third Embodiment

20

A throw-type fire extinguisher must consist of extinguishing agent and a container that serves a function to throw the fire extinguisher at the origin of fire.

25

The extinguishing agent (2) is loaded into a thin-walled synthetic resin container (1) (an ampoule/ bottle) having such a size that one can hold and throw. The container is filled with the extinguishing agent and sealed with a silicon or plastic cap (3). The design of the thin-walled breakable bottle is shown in FIG. 1. The material of the breakable plastic container is made of non-phthalic acid, polyvinyl chloride (PVC), polypropylene (PP), polystyrene (PS), polyethylene (PE), polyethylene terephthalate (PET) or the like.

30

The ampoule/ bottle to store the extinguishing agent shall not deteriorate the quality of the extinguishing agent of the present invention to maintain the agent in a stable

manner, and does not react with the extinguishing agent of the present invention.

The breakable ampoule/ bottle has a minimum wall thickness of 0.3mm to 0.9mm (e.g., 0.5mm) and is resistant to cracking at an internal pressure up to at least 0.06MPa. The internal pressure capacity of an ampoule may be measured by inserting a pipe to the container, and gradually increasing pressure in the container until a fail point at which the container cracks. The ampoule preferably is capable of sustaining an internal pressure of 0.06MPa or greater before cracking, meaning the container does not crack at 0 to 0.06MPa, and possibly higher.

The sealed ampoule/ bottle shall also withstand an external pressure up to 75kg for at least 10 seconds according to the 740N JIS Standard. And it would break if the ampoule is thrown from a height of about 20 to 80cm on to concrete surface. The bottle of the throw-type fire extinguisher can withstand a temperature as low as -25°C and/ or as high as 80°C, or any temperature falls between -25°C to 80°C.

The ampoule/ bottle is designed to provide a hassle-free extinguishing environment to children, senior citizens, the disabled and women in particular. In the practice of embodiments of the present invention, when fire occurs, a person throws the ampoule/ bottle at the fire. When the ampoule/ bottle hits a burning object, the ampoule/ bottle breaks easily and the extinguishing agent expels and generates chemical reaction to put out the fire.

With this breakable ampoule/ bottle, anybody can hold and throw it without complicated operation when confront with an unexpected fire. This design is especially practical and effective in the case of emergency and most importantly, the breakable ampoule/ bottle does not hurt human skin, and it is safe to be used by everybody to control an initial fire.

EXPERIMENTAL EXAMPLES

In order to determine an appropriate temperature of the solution to be generated by

adding the boiling/hot/lukewarm water to the container containing the ammonium dihydrogen phosphate, ammonium hydrogen carbonate, urea and ammonium sulfate, the following experiments were conducted.

5 Experiment 1

1. Prepare containers made of thin polyvinylchloride (PVC) plastic (530ml, 0.5mm thick).
2. Add 300ml of 30°C water and 10g of sodium chloride into each container.
3. Add 60g of ammonium dihydrogen phosphate into each container.
- 10 4. Add 60g of ammonium hydrogen carbonate into each container.
5. Add boiling water, hot water or lukewarm water to bring the temperature of the solution to 30°C (four containers), 40°C (four containers), 50°C (four containers), 60°C (four containers), and 70°C (four containers). Total amount of the solution in each container is 510ml.
- 15 6. Leave the containers to sit in an open state and allow ammonia and carbon dioxide to be generated.
7. Close the containers.
8. Allow the solution in the containers to reach room temperature.
9. To test the stability of the different agents, two samples of each containers
- 20 (prepared at 30, 40, 50, 60, and 70°C, respectively) were maintained at 40°C in a water tank. Observations as to whether the containers crack or not were recorded.

Experiment 2

1. Prepare containers made of thin polyvinylchloride (PVC) plastic (530ml, 0.5mm
- 25 thick).
2. Add 300ml of 30°C water and 10g of sodium chloride into each container.
3. Add 60g of ammonium dihydrogen phosphate into each container.
4. Add 60g of ammonium hydrogen carbonate into each container.
5. Add 30g of urea into each container.
- 30 6. Add 45g of ammonium sulfate into each container.
7. Add boiling water, hot water, lukewarm water to bring the temperature of the solution to 30°C (four containers), 40°C (four containers), 50°C (four containers),

60°C (four containers), and 70°C (four containers). Total amount of the solution in each container is 510ml.

8. Leave the containers to sit in an open state and allow ammonia and carbon dioxide to be generated.

5 9. Close the containers.

10. Allow the solution in the containers to reach room temperature.

11. To test the stability of the different agents, two samples of each containers (prepared at 30, 40, 50, 60, and 70°C., respectively) were maintained at 40°C in a water tank. Observations as to whether the containers crack or not were recorded.

10 12. To test the extinguishing capability of each container, a pan (length 73cm) was set directly below a crib (height 1 meter, width 73cm; depth 73cm). 1.5 liters of heptane were placed in the pan and a fire was generated. The height of pillar of fire was about five meters.

15 13. Throw five containers of each container (30, 40, 50, 60, and 70°C) at the fire, one by one to confirm whether the extinguishing agent can put out fire.

Experiment 1 Results

	Container	Lapse time	Result
20	30°C	5 minute 16 second	Crack, leak of the extinguishing agent
		5 minute 26 second	Crack, leak of the extinguishing agent
	40°C	32 minute 02 second	Crack, leak of the extinguishing agent
		32 minute 44 second	Crack, leak of the extinguishing agent
25	50°C	1 hour 13 minute 27 second	Crack, leak of the extinguishing agent
		1 hour 15 minute 54 seconds	Crack, leak of the extinguishing agent
	60°C	2 hour	No cracks.
		2 hour	No cracks.
30	70°C	2 hour	No cracks.
		2 hour	No cracks.

Experiment 2 Results

	Container	Lapse time	Result
5	30°C	4 minute 56 second	Crack, leak of the extinguishing agent
		5 minute 27 second	Crack, leak of the extinguishing agent
	40°C	28 minute 12 second	Crack, leak of the extinguishing agent
		29 minute 36 second	Crack, leak of the extinguishing agent
	50°C	1 hour 12 minute 38 second	Crack, leak of the extinguishing agent
10		1 hour 16 minute 14 seconds	Crack, leak of the extinguishing agent
	60°C	2 hour	No cracks.
		2 hour	No cracks.
	70°C	2 hour	No cracks.
		2 hour	No cracks.

15

Both in the experiment 1 and in the experiment 2, all of the containers including solutions made at 30°C, 40°C and 50°C by adding hot water or lukewarm water cracked. On the other hand, in the experiment 1 and in the experiment 2, all of the containers including solutions made at 60°C and 70°C by adding boiling water did not crack.

20

From these experiments, it is revealed that the temperature of the solution is preferably raised to approximately 60°C to 70°C by adding boiling water into the containers after the ingredients have been added into the containers. Before closing the containers, a relatively large amount of ammonia and carbon dioxide were generated. As a result, after closing the containers, the containers did not crack, even when subject to temperatures (e.g., 40°C) comparable to those of a hot summer day.

25

Samples of each of the five containers with solutions made at 30°C-70°C were found to extinguish fire. The solutions/ extinguishing agents made at 70°C were expected to contain relatively smaller amounts of ammonium dihydrogen phosphate, ammonium hydrogen carbonate, and ammonium sulfate than the other containers having agents prepared at lower temperatures, thus it was predicted that the 70°C extinguishing

30

agent would have little or no fire extinguishing capabilities. However, it was found that the extinguishing agent was able to put out fires.

5

10

15

20

25

30

CLAIMS:

- [1] A process for producing an extinguishing agent (2) comprising:
- Dissolving sodium chloride, ammonium dihydrogen phosphate and ammonium hydrogen carbonate at temperature of 30 to 40°C to form a solution;
 - allowing the ammonium dihydrogen phosphate and the ammonium hydrogen carbonate, as dissolved, to undergo a reaction; and
 - adding water to raise the temperature of the solution to a range between 60°C to 70°C.,
 - adding 20ml of surfactant;
 - wherein the sodium chloride is present in the extinguishing agent in a ratio of 5 to 15g per 500ml of water, the ammonium dihydrogen phosphate is present in the extinguishing agent in a ratio of 50 to 70g per 500ml of water, and the ammonium hydrogen carbonate is present in the extinguishing agent in a ratio of 50 to 70g per 500ml of water.
- [2] A process for producing an extinguishing agent (2) comprising:
- Dissolving sodium chloride, ammonium dihydrogen phosphate, ammonium hydrogen carbonate, urea and ammonium sulfate at a temperature of 30 to 40°C to form a solution;
 - allowing the ammonium dihydrogen phosphate and the ammonium hydrogen carbonate as dissolved, to undergo a reaction; and
 - adding a water to raise the temperature of the solution to a range between 60°C to 70°C.,
 - adding 20ml of surfactant;
 - wherein the sodium chloride is present in the extinguishing agent in a ratio of 5 to 15g per 500ml of water, the ammonium dihydrogen phosphate is present in the extinguishing agent in a ratio of 50 to 70g per 500ml of water, the ammonium hydrogen carbonate is present in the extinguishing agent in a ratio of 50 to 70g per 500ml of water, the urea is present in the extinguishing agent in a ratio of 20 to 40g per 500ml of water, and the ammonium sulfate is present in the extinguishing agent in

a ratio of 35 to 55g per 500ml of water.

- [3] A process of producing a throw-type fire extinguisher (FIG 1) containing an extinguishing agent comprising:
- 5 • Dissolving sodium chloride, ammonium dihydrogen phosphate and ammonium hydrogen carbonate at a temperature of 30 to 40°C to form a solution;
 - allowing the ammonium dihydrogen phosphate and the ammonium hydrogen carbonate as dissolved, to undergo a reaction;
 - 10 • loading the solution in a breakable plastic container made of non-phthalic acid, polyvinyl chloride (PVC), polypropylene (PP), polystyrene (PS), polyethylene (PE), polyethylene terephthalate (PET) or the like;
 - adding water to the container to raise the temperature of the solution to a range between 60°C to 70°C;
 - 15 • adding 20ml of surfactant, closing the container;
 - wherein the sodium chloride is present in the extinguishing agent in a ratio of 5 to 15g per 500ml of water, the ammonium dihydrogen phosphate is present in the extinguishing agent in a ratio of 50 to 70g per 500ml of water, and the ammonium hydrogen carbonate is present in the
 - 20 extinguishing agent in a ratio of 50 to 70g per 500ml of water.
- [4] A process of producing a throw-type fire extinguisher (FIG 1) containing an extinguishing agent comprising:
- 25 • Dissolving sodium chloride, ammonium dihydrogen phosphate, ammonium hydrogen carbonate, urea and ammonium sulfate at a temperature of 30 to 40°C to form a solution;
 - allowing the ammonium dihydrogen phosphate and the ammonium hydrogen carbonate as dissolved, to undergo a reaction;
 - loading the solution in a breakable plastic container made of non-phthalic acid, polyvinyl chloride (PVC), polypropylene (PP), polystyrene (PS),
 - 30 polyethylene (PE), polyethylene terephthalate (PET) or the like;
 - adding water to the container to raise the temperature of the solution to a

range between 60°C to 70°C;

- adding 20ml of surfactant, and closing the container;
- wherein the sodium chloride is present in the extinguishing agent in a ratio of 5 to 15g per 500ml of water, the ammonium dihydrogen phosphate is present in the extinguishing agent in a ratio of 50 to 70g per 500ml of water, the ammonium hydrogen carbonate is present in the extinguishing agent in a ratio of 50 to 70g per 500ml of water, the urea is present in the extinguishing agent in a ratio of 20 to 40g per 500ml water, and the ammonium sulfate is present in the extinguishing agent in a ratio 35 to 55g per 500ml water.

[5] The ampoule/ bottle of the throw-type fire extinguisher is made of non-phthalic acid, polyvinyl chloride (PVC), polypropylene (PP), polystyrene (PS), polyethylene (PE), polyethylene terephthalate (PET) or the like that breaks when it is thrown from a height of 20 to 80cm on to a concrete surface.

[6] The ampoule/ bottle of the throw-type fire extinguisher has a minimum wall thickness of 0.3 to 0.9mm, able to withstand a temperature as low as -25°C and/or as high as 80°C, or any temperature falls between -25°C to 80°C.

[7] The ampoule/ bottle of the throw-type fire extinguisher is resistant to crack at an internal pressure up to at least 0.06MPa.

[8] The ampoule/ bottle of the throw-type fire extinguisher can withstand an external pressure up to 75kg or more for 10 seconds according to 740N JIS standard.

ABSTRACT

A process is provided for producing an extinguishing agent (2). Sodium chloride and ammonium dihydrogen phosphate are dissolved in water at a temperature of 30 to 40°C to form a solution. Ammonium hydrogen carbonate is dissolved into the solution, and allowed to undergo a reaction with the ammonium dihydrogen phosphate, as dissolved. The sodium chloride is present in the extinguishing agent in a ratio of 5 to 15g per 500ml of water, the ammonium dihydrogen phosphate is present in the extinguishing agent in a ratio of 50 to 70g per 500ml of water, and ammonium hydrogen carbonate is present in the extinguishing agent in a ratio of 50 to 70g per 500ml of water. Also provided is a process of producing a throw-type fire extinguisher. The extinguishing agent (2) is loaded in to a breakable synthetic resin container (1) that serves to throw at the fire. When the ampoule hits a burning object, the ampoule breaks and the extinguishing agent expels to generate chemical reaction to put out the fire.