

**PROCESS FOR PRODUCING EXTINGUISHING AGENT AND THROW-TYPE FIRE
EXTINGUISHER**

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FIELD OF INVENTION

The present invention relates to a process for producing extinguishing agent and ampoule that is similar to a throw-type or a handy fire extinguisher.

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DESCRIPTION

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.

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

In recent years, in addition to a floor type fire extinguisher, a throw-type fire 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.

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

Accordingly, there is a need for a process for producing a safe extinguishing agent, which has no or little adverse influence on 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
5 incorporated therein may exhibit their action, to thereby produce an extinguishing
agent having a high fire-extinguishing performance.

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SUMMARY OF THE INVENTION

5 According to the present invention, there is provided a process for producing an extinguishing agent (2) comprising

- a step of incorporating sodium chloride in an amount of 5g to 15g and ammonium dihydrogen phosphate in an amount of 50g to 70g both relative to 500ml of water at a temperature of 30°C to 40°C to solve them into the hot water, and
- 10 • a step of incorporating sodium hydrogen carbonate in an amount of 50g to 70g relative to 500ml of water into the solution to be dissolved therein.

The process of the invention may further comprise a step of incorporating a surfactant.

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According to another aspect of the present invention, there is a process for producing an extinguishing agent comprising

- a step of incorporating sodium chloride in an amount of 5g to 15g and ammonium dihydrogen phosphate in an amount of 50g to 70g both relative to 500ml of water at a temperature of 30°C to 40°C to solve them into the hot water,
- 20 • a step of incorporating sodium hydrogen carbonate in an amount of 45g to 70g relative to 500ml of water into the solution to be dissolved therein,
- a step of incorporating urea in an amount of 20g to 40g relative to 500ml of water into the solution to be dissolved therein, and
- 25 • a step of incorporating ammonium sulfate in an amount of 35g to 55g relative to 500ml of water to be dissolved therein.

The process according to another of the invention may further comprise a step of incorporating a surfactant.

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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 an appropriate amount 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.

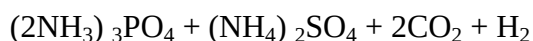
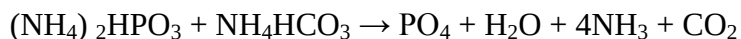
20 Ammonium dihydrogen phosphate and ammonium hydrogen carbonate are thermally decomposed into carbon dioxide gas (CO_2) and ammonia gas (NH_3) during the course of fire extinguishing through combustion. Carbon dioxide gas has a function of shielding the supply of oxygen to burning products and a function of neutralizing and suppressing oxidation of burning products. Ammonia gas, which possesses a neutralization function and a cooling function, prevents re-ignition of burning products to avoid spreading fire to surroundings.

25 Subsequently, an appropriate amount 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:

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- 10 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 kind of containers which 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 which are not collided with the
- 15 extinguishing agent of the present invention.

Second Embodiment

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

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First, 5g to 15g, for example, 10g of sodium chloride is incorporated in 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 to 70g, for example, of ammonium hydrogen carbonate is incorporated to cause a reaction to be dissolved.

Subsequently, boiling water is added to the resulting solution.

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Ammonium dihydrogen phosphate and ammonium hydrogen carbonate 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 shutting 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 reignition of burning products to avoid spreading fire to circumferences.

Subsequently, 20g to 40g, for example, 20g of urea is incorporated and dissolved in the solution. Thereafter, 35g to 55g, for example, 45g of ammonium sulfate and an appropriate amount of boiling water are incorporated to dissolve ammonium sulfate.

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

15 Urea is also thermally decomposed into carbon dioxide gas and ammonia gas by combustion in the course of extinguishing a fire. Due to a function of oxygen-shielding to the burning products possessed by carbon dioxide gas and functions of neutralization and cooling possessed by ammonia gas, burning products can be extinguished and spreading of fire to circumferences can be prevented.

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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 in a container to be ready for use. The container in which the extinguishing agent of the present invention is incorporated may be various kind of containers which 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 which are not collided with the extinguishing agent of the present invention. Examples of the containers which can be used, include but are not restricted to metal-made containers, resin-made containers having a light weight.

According to the first and second embodiments of the process for producing an extinguishing agent of the present invention, a safety extinguishing agent having no

or little influence upon human body can be provided. The use of ammonium hydrogen sulfate increases extinguishing rate.

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

Table 1

10		Rate
	Ammonium carbonate	45 seconds
	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 which is thrown at the origin of a fire when fire occurs. A safety extinguishing agent having no or little influence upon human body can be provided. The use of ammonium hydrogen sulfate increases extinguishing rate.

20 **Description of the Ampoule**

The extinguishing agent (2) is packed in a thin-walled synthetic resin container (1) (an ampoule) having such a size that one can hold and throw. The container is filled with the above-described extinguishing agent and sealed with a silicon or rubber cap (3). The temperature range of the use of the resin container is from -15°C~80°C and it could be kept for more than 7 years in a safe-keeping environment or in room temperature (-10°C~45°C).

The container, particularly polyvinylchloride (PVC) containers, may have a minimum wall thickness of about 0.3mm to about 0.7mm (e.g., 0.5mm) and could

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bear external pressure up to 75kg, but it would break if it is thrown from a height of about 30cm. The container is also resistant to cracking at internal pressure up to at least 0.06MPa for 5 minutes. The internal pressure capacity of a container 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 container preferably is capable of sustaining an internal pressure of at least 0.06MPa or greater before cracking, meaning the container does not crack at 0 to 0.06MPa, and possibly higher.

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

The design of the thin-walled round cylinder (ampoule) is shown in FIG. 1. The material of the resin container is made of non-phthalic acid, high-pressure polyvinyl chloride (PVC), low-pressure polyvinyl chloride, polypropylene, or the like.

The container is designed to provide a barrier-free extinguishing environment to children, senior citizens, the disabled and women in particular. With this ampoule, 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 resin does not hurt our skin, so it is safe to use by everybody to put out fire.

EXPERIMENTAL EXAMPLES

In order to determine an appropriate temperature of the solution to be generated by adding the boiling/hot/luke-warm water to the container containing the ammonium dihydrogen phosphate, ammonium hydrogen carbonate, urea and ammonium sulfate, the following experiments were conducted.

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.
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.
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 (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 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.
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.

9. Close the containers.

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

5 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.

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
10 heptane were placed in the pan and a fire was generated. The height of pillar of fire was about five meters.

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.

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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
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
25	60°C 2 hour	No cracks.
	2 hour	No cracks.
70°C	2 hour	No cracks.
	2 hour	No cracks.

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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
10	50°C	1 hour 12 minute 38 second	Crack, leak of the extinguishing agent
		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.
15		2 hour	No cracks.

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.

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.

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

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CLAIMS:

- [1] A process for producing an extinguishing agent (2) comprising
- a step of incorporating sodium chloride in an amount of 5g to 15g and ammonium dihydrogen phosphate in an amount of 50g to 70g both relative to 500ml of water into hot water at a temperature of 30°C to 40°C to solve them into the hot water, and
 - a step of incorporating sodium hydrogen carbonate in an amount of 50g to 70g relative to 500ml of water into the solution to be dissolved therein.
- [2] The process according to Claim 1, which further comprises a step of incorporating an effective amount of a surfactant into the extinguishing agent.
- [3] The process according to Claim 2, wherein said surfactant containing a fluorine-type surfactant for forming an aqueous membrane foam.
- [4] The process according to Claim 1, further comprising adding water to raise the temperature of the solution to about 60°C to about 70°C
- [5] The process according to Claim 1, wherein said extinguishing agent (2) is incorporated in a resin container (1) to be ready for use as a throw-type fire extinguisher.
- [6] A process for producing an extinguishing agent (2) comprising
- a step of incorporating sodium chloride in an amount of 5 to 15g and ammonium dihydrogen phosphate in an amount of 50g to 70g both relative to 500ml of water into hot water at a temperature of 30°C to 40°C to solve them into the hot water,
 - a step of incorporating sodium hydrogen carbonate in an amount of 45g to 70g relative to 500ml of water into the solution to be dissolved therein,

- a step of incorporating urea in an amount of 20g to 40g relative to 500ml of water into the solution to be dissolved therein, and
- a step of incorporating ammonium sulfate in an amount of 35g to 55g relative to 500ml of water to be dissolved therein.

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[7] The process according to Claim 6, which further comprises a step of incorporating a surfactant.

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[8] The process according to Claim 7, wherein said surfactant containing a fluorine-type surfactant for forming an aqueous membrane foam.

[9] The process according to Claim 6, further comprising adding water to raise the temperature of the solution to about 60°C to about 70°C

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[10] The process according to Claim 6, wherein said extinguishing agent (2) is incorporated in a resin container (1) to be ready for use as a throw-type fire extinguisher.

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[11] The extinguishing agent is packed in a thin-walled synthetic resin container (1) (an ampoule) having such a size that one can hold and throw easily. Such container with a thickness of about 0.3mm to about 0.7mm is filled with the above-described extinguishing agent and sealed with a silicon or rubber cap (3). The temperature range of the use is from -15°C~80°C and it could be kept for more than 7 years in a safe-keeping environment or in room temperature (-10°C~45°C). The resin container (1) would bear external pressure up to 75kg, but it would break if it is thrown from a height of about 30cm. The ampoule also withstands an internal pressure of at least 0.06MPa for 5 minutes. When the ampoule is thrown into the origin of a fire, the ampoule would break, and the diffused extinguishing agent (2) would cause a chemical reaction by the heat of the burnt material and thus put out fire simultaneously.

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[12] The device of claim 11 characterised in that the design of the thin-walled round cylinder (ampoule) is shown in FIG. 1. The material of the resin
5 container (1) is made of non-phthalic acid, high-pressure polyvinyl chloride (PVC), low-pressure polyvinyl chloride, polypropylene, or the like.