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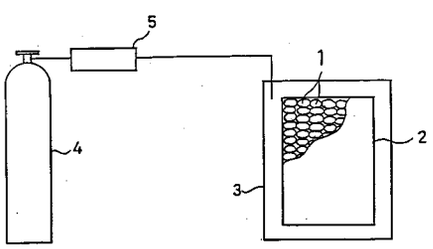
(54) **METHOD OF KILLING PUPA.**

(57) A method of killing a cocoon efficiently for producing raw silk, which comprises placing cocoons as such or in an airpermeable bag in a difficultly gas-permeable bag or container, blowing ethylene oxide gas thereinto, and maintaining the cocoons in such a state for a suitable period of time.

FIG. 1



EP 0 517 915 A1

Field of the Invention

The present invention relates to a method of killing pupa in a production process of raw silk and a method of obtaining raw silk of high quality.

Prior Art

When producing raw silk from raw cocoons, the cocoons before the pupa becomes the moth are collected, and dried and heated to kill pupae and molds. This drying is done in an empirical schedule by, for example, holding for several hours at 110 °C, then lowering the temperature gradually, and holding at 60 °C for a specific time, but it is difficult to dry in the optimum heat treatment schedule at a general farm, and hitherto after collecting cocoons from individual farms, they were treated in batch in a specific organ (cocoon drying station), but improper drying often caused to lower the cocoon opening rate or significantly impair the quality of the obtained raw silk.

In the light of the above circumstances, it is hence a primary object of the invention to present a method of killing pupa easily capable of obtaining raw silk of high quality at high yield in individual farms by eliminating the central cocoon gathering works.

Disclosure of the Invention

The method of killing pupa of the invention is characterized by putting cocoons in a hardly gas-permeable bag or container, and holding by sealing with ethyl oxide gas. More preferably, it is more effective when cocoons are put in a gas- and steam-permeable bag, and this bag is further put in a hardly gas-permeable bag or container and sealed with ethylene oxide gas.

In the invention, ethylene oxide gas is used, but this ethylene oxide gas is not used alone, but is used by diluting with other gas, and preferably a mixed gas of ethylene oxide gas and carbon dioxide gas (hereinafter called Dicide gas) is used. Dicide gas may be composed of 10% of ethylene oxide gas and 90% of carbon dioxide gas (called Dicide H10), 20% of ethylene oxide gas and 80% of carbon dioxide gas (called Dicide H20), 30% of ethylene oxide gas and 70% of carbon oxide gas (called Dicide H30), or the like. Aside from ethylene oxide and carbon dioxide gas, a mixed gas of ethylene oxide gas and chlorofluorocarbons may be used, or other gases may be added. In the method of killing pupa of the invention, cocoons are put in a hardly gas-permeable bag, and the gas is sealed with Dicide gas and held, and in this case, instead of putting the cocoons directly in a gas barrier bag, it is preferable to put cocoons in a gas- and steam-permeable inner bag, and put the inner bag in the hardly gas-permeable outer bag. When the cocoons are directly put in an impermeable outer bag to be sealed with gas, although pupae are killed, the humor of pupae exudes to contaminate the cocoons, and the commercial value may be lowered. Gas-and steam-permeable bags include paper, paper + synthetic resin film, and synthetic resin film, among others. The synthetic resin film may include, for example, polyethylene film. Gas-impermeable outer bags include, for example, an aluminum-coated polyethylene bag. Instead of the outer bag, a sealing container made of metal or the like may be used. The size of the bag may be convenient for handling.

Fig. 1 shows the state of injecting Dicide gas,in which a permeable inner bag 2 filled with cocoons 1, ... is put into an impermeable outer bag 3, and Dicide gas is injected into the outer bag 3 through an injection device 5 from a gas cylinder 4. After injection, the opening of the outer bag is closed by a sealing device not shown.

The injection volume of Dicide gas into the bag is preferably 10 to 20 ml per cocoon, for example, in the case of Dicide H20, but the type and volume of gas may be properly adjusted depending on the situation. The quantity of cocoons to be put in the inner bag 2 is generally 10 to 15 kg, but it is not limitative. When Dicide H20 is injected by 15 ml per cocoon, pupae are dead in about an hour, but to prevent molds it is preferable to keep the same state for 2 to 24 hours. After keeping the gas sealed state for a specified time, when the impermeable outer bag 8 is opened, the pupae are dried naturally,and the cocoons are not contaminated by the humor. Besides, fungi and other germs are also destroyed, and the cocoons may be maintained for a long period without contamination of cocoons by molds In this method of killing pupa, since high temperature is not applied to the cocoons, the cocoon opening rate is high, and the touch of the cocoon yarns is outstandingly excellent. Besides, as compared with the conventional heating method, the color of the cocoons is white, and raw silk of high quality is obtained. Besides, for example, pupa killing and mold preventive treatment may be easily done at individual sericultural farms, and it is not necessary to collect cocoons centrally at a specified time, and there is no risk of moth growth during transportation, and sericulture at a remote distance is possible, which is expected to contribute greatly to

the raw silk production system.

As clear from the description herein, according to the method of killing pupa of the invention, since high temperature is not applied unlike the prior art, the cocoon opening rate is high, and the touch is excellent, and the color is white, and raw silk of high quality is produced. Another advantage of this method of killing pupa is that it can be easily executed at individual farms.

Brief Description of the Drawing

Fig. 1 is an explanatory diagram of gas sealing method.

Preferred Embodiments of the Invention

Some of the embodiments of the invention are described in detail below.

[Embodiment 1]

In a gas-impermeable bag with external dimensions of 165 x 230 mm, 20 live silkworm pupae were put and the bag was sealed, and 300 ml of Dicide H20 was injected by using a syringe, and the bag was held in a thermostatic oven at 37°C. Thereafter, at specified time intervals, 1.0 ml of gas in the bag and cocoons was sampled by a syringe, and the concentrations of ethylene oxide gas (EO) and carbon dioxide gas (CO_2) were measured by gas chromatograph, and the results were as shown in Table 1. In the cocoons held for 2 hours or more, the pupae were confirmed to be dead.

Table 1

	EO%		CO_2%	
	In bag	In cocoon	In bag	In cocoon
Right after sealing	7.7	5.5	36.8	36.5
30 minutes later	4.6	3.1	37.1	37.9
2 hours later	2.1	2.0	40.4	40.5
3 hours later	1.8	1.7	42.1	42.0
4 hours later	1.7	1.7	43.4	43.5
5 hours later	1.6	1.6	45.1	45.1
6 hours later	1.5	1.5	46.0	46.3
7 hours later	1.4	1.4	46.7	46.9
22 hours later	1.0	1.0	49.8	49.8

[Embodiment 2]

In an aluminum-coated polyethylene film (dimensions 600 x 500 mm), 700 cocoons were put, and 10.5 ml of Dicide H20 was injected, and held in sealed state for 14 hours, and the bag was opened, and the cocoons were transferred into a cocoon net bag and stored. The remains of pupae were clean, the cocoons were white, and molds were not observed after long storage. Incidentally, at least in an hour after gas sealing, no moth was found.

[Embodiment 3]

In a gas-impermeable bag measuring 165 x 230 mm, 20 living silkworms were put, and Dicide H20 (600 ml, 300 ml, 150 ml) and Dicide L (a mixed gas of 27% of EO, 41% of Freon 11, and 32% of Freon 12; 600 ml) were injected, and storing at 37°C, the gas in bag was sampled by syringe and analyzed by chromatograph, of which results were as shown in Table 2. In this embodiment, too, pupae were dead in 2

hours.

Table 2

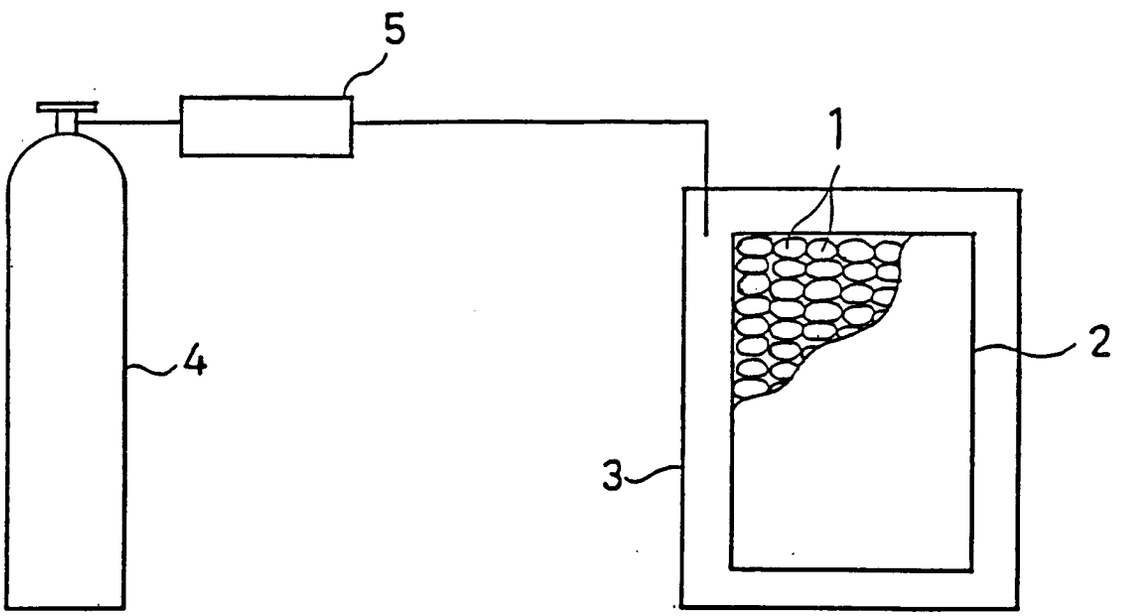
Gas	H2O 600 ml	H2O 300 ml	H2O 150 ml	L 600 ml	Sealed without gas
Start	13.7	12.3	8.6	14.8	Analysis of CO_2
2.0 hours later	4.8	2.5	1.7	6.4	15.0
4.0 hours later	4.6	2.5	1.6	5.4	20.5
6.0 hours later	4.1	2.2	1.5	-	21.6
23 hours later	2.5	1.0	0.6	2.7	28.3
30 hours later	2.0	0.8	0.5	2.4	28.8
46 hours later	1.1	0.4	0.2	1.4	28.0
70 hours later	0.4	0	0	0.6	31.0

Claims

1. A method of killing pupa characterized by putting cocoons in a gas-impermeable bag or container, and storing by sealing with ethylene oxide gas.

2. A method of killing pupa characterized by putting cocoons in a gas- and steam-permeable bag, putting this bag in a gas-impermeable bag or container, and storing by sealing with ethylene oxide gas.

FIG. 1



INTERNATIONAL SEARCH REPORT

International Application No PCT/JP90/01668

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl[5] D01B7/00

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	D01B7/00

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

Jitsuyo Shinan Koho 1926 - 1990
Kokai Jitsuyo Shinan Koho 1971 - 1990

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	JP, A, 56-63003 (Institut Tekhnicheskoi Teplofiziki Akademii Nauk Ukrainskoi SSR), May 29, 1981 (29. 05. 81), Line 4, lower right column, page 2 to line 10, upper left column, page 3 (Family: none)	1, 2
A	JP, A, 54-120715 (Barubison K.K.), September 19, 1979 (19. 09. 79), Lines 5 to 7, lower left column, lines 7 to 17, lower right column, page 1 (Family: none)	1, 2

* Special categories of cited documents: [10]

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
January 9, 1991 (09. 01. 91)	January 21, 1991 (21. 01. 91)
International Searching Authority	**Signature of Authorized Officer**
Japanese Patent Office	