



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 158(3) EPC

(43) Date of publication:
15.06.2005 Bulletin 2005/24

(51) Int Cl.7: **A24D 3/14**

(21) Application number: **03797591.9**

(86) International application number:
PCT/JP2003/011724

(22) Date of filing: **12.09.2003**

(87) International publication number:
WO 2004/026053 (01.04.2004 Gazette 2004/14)

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PT RO SE SI SK TR**
Designated Extension States:
AL LT LV MK

(72) Inventors:
• **SASAKI, Takashi, JAPAN TOBACCO INC.**
Tokyo 130-8603 (JP)
• **TARORA, Masafumi, JAPAN TOBACCO INC.**
Tokyo 130-8603 (JP)
• **HASEGAWA, Takashi, JAPAN TOBACCO INC.**
Tokyo 130-8603 (JP)

(30) Priority: **19.09.2002 JP 2002273287**

(71) Applicant: **Japan Tobacco Inc.**
Tokyo 105-8422 (JP)

(74) Representative: **Behnisch, Werner, Dr.**
Reinhard-Skuhra-Weise & Partner GbR,
Friedrichstrasse 31
80801 München (DE)

(54) **FILTER FOR CIGARETTE**

(57) A cigarette filter has a filter medium containing a basic amino acid or a basic amino acid salt and a moisturizing agent selected from the group consisting of glycerin, sodium propionate and sodium lactate.

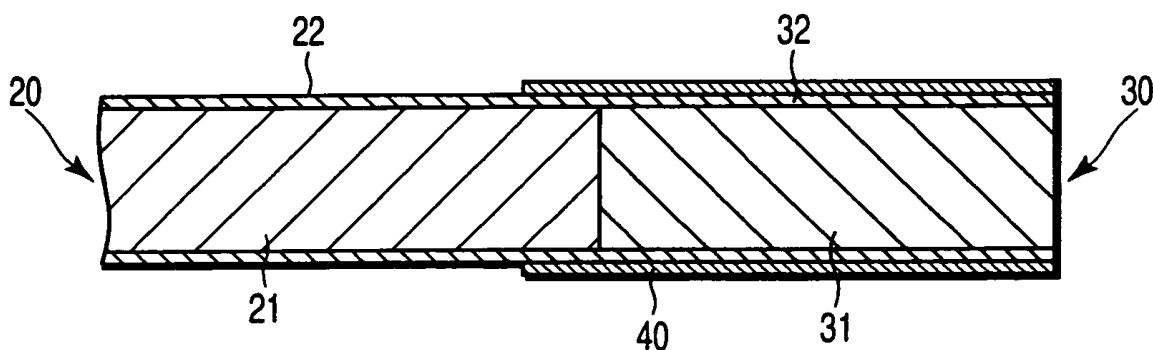


FIG. 2

Description

Technical Field

[0001] The present invention relates to a cigarette filter capable of lowering the amount of aldehydes contained in the mainstream smoke of a cigarette.

Background Art

[0002] Various chemical components are contained in the mainstream smoke puffed by a smoker in smoking a cigarette. It is difficult to adsorb and remove aldehydes represented by formaldehyde among these chemical components with an ordinary cigarette filter. Therefore, it is desired to remove the aldehydes from the mainstream smoke of the cigarette.

[0003] It is attempted in the past to use various additives in the cigarette filter in order to adsorb and remove the aldehydes contained in the mainstream smoke of the cigarette. However, the use of the conventional additives gives rise to a problem of impairing tobacco taste.

Disclosure of Invention

[0004] An object of the present invention is to provide a cigarette filter, which permits effectively lowering the amount of aldehydes in the mainstream smoke of a cigarette while suppressing the detrimental effects such as degradation of tobacco taste.

[0005] A cigarette filter according to an aspect of the present invention is characterized by comprising a filter medium containing a basic amino acid or a basic amino acid salt and a moisturizing agent.

[0006] The basic amino acid or the basic amino acid salt used in the present invention is selected from the group consisting of arginine, arginine salt, lysine, lysine salt, histidine, histidine salt, ornithine, ornithine salt, citrulline, citrulline salt, hydroxyzine and hydroxyzine salt. The moisturizing agent used in the present invention is selected from the group consisting of glycerin, sodium propionate and sodium lactate.

[0007] In the cigarette filter of the present invention, it is desirable for the basic amino acid or the basic amino acid salt to be contained in an amount of 3.5 mg or more.

[0008] In the cigarette filter of the present invention, it is desirable for the ratio of the basic amino acid or the basic amino acid salt to the moisturizing agent to fall within a range of between 1:1 and 1:2.

Brief Description of Drawings

[0009]

FIG. 1 schematically shows the construction of an apparatus for measuring formaldehyde contained in the mainstream smoke of a cigarette in the Examples of the present invention;

FIG. 2 is a cross-sectional view showing the construction of a cigarette used in the Examples of the present invention;

FIG. 3 is a graph showing the delivery of formaldehyde depending on the type of a basic substance added to a cigarette filter;

FIG. 4 is a graph showing the relationship between the amount of water added to a cigarette filter together with L-arginine and the delivery of formaldehyde;

FIG. 5 is a graph showing the relationship between the amount of glycerin added to a cigarette filter together with L-arginine and the increased amount of water in the cigarette filter;

FIG. 6 is a graph showing the delivery of formaldehyde depending on the type of a moisturizing agent added to a cigarette filter together with L-arginine; and

FIG. 7 is a graph showing the relationship between the ratio of L-arginine to glycerin added to a cigarette filter and the delivery of formaldehyde.

Best Mode for Carrying Out the Invention

[0010] As a result of extensive research conducted from various viewpoints on additives in an attempt to lower aldehydes contained in the mainstream smoke of a cigarette, the present inventors have found that a basic amino acid or a basic amino acid salt is an effective additive. The basic amino acid or the basic amino acid salt used in the present invention is selected from the group consisting of, for example, arginine, arginine salt, lysine, lysine salt, histidine, histidine salt, ornithine, ornithine salt, citrulline, citrulline salt, hydroxyzine and hydroxyzine salt. Among these compounds, arginine and a salt thereof are admitted as food additives.

[0011] The present inventors have also found that the aldehydes contained in the mainstream smoke of a cigarette can be more effectively removed if the basic amino acid or the basic amino acid salt is used in combination with a moisturizing agent. The moisturizing agent used in the present invention is selected from the group consisting of glycerin, sodium propionate and sodium lactate.

[0012] It is possible to use an ordinary filter medium such as acetate tow, a paper filter material, or a pulp unwoven fabric as the carrier (filter raw material) for the basic amino acid or the basic amino acid salt and the moisturizing agent.

[0013] It is believed that, in the cigarette filter of the present invention, the aldehydes in the mainstream smoke of a cigarette are lowered by the mechanism given below. In the first step, the aldehydes contained in the mainstream smoke of a cigarette are dissolved in water held by the moisturizing agent carried by the filter. Further, the aldehydes dissolved in the water are allowed to react with the basic amino acid or the basic amino acid salt carried by the filter so as to be trapped

within the filter. It should be noted that the moisturizing agent functions to stably hold the water serving to dissolve the aldehydes.

[0014] In the cigarette filter of the present invention, the basic amino acid or the basic amino acid salt should be contained in an amount of 3.5 mg or more, because it is difficult to obtain a sufficient effect of lowering the aldehydes where its amount is smaller than 3.5 mg.

[0015] Also, in the cigarette filter of the present invention, the ratio of the basic amino acid or the basic amino acid salt to the moisturizing agent is specified to fall within a range of between 1:1 and 1:2. If the ratio noted above fails to fall within the range noted above, it is difficult to obtain a sufficient effect of lowering the aldehydes.

[0016] For allowing the filter medium to contain the basic amino acid or the basic amino acid salt and the moisturizing agent, it is possible to employ such a method as spraying, dipping and roller transfer.

[0017] It is also possible to allow the filter medium to contain activated charcoal in addition to the basic amino acid or the basic amino acid salt and the moisturizing agent.

[0018] The configuration of the filter tip may be a plain type, a dual type, a multi-segment type having triple or more segments, or a plug-space-plug type. It is possible for the basic amino acid or the basic amino acid salt and the moisturizing agent to be contained in a part or all the segments of the filter tip.

[0019] The cigarette filter of the present invention may be a filter connected to the tobacco section of a cigarette as a mouth end component or a filter in the form of a cigarette holder.

Examples:

[0020] In the method of measuring the aldehydes contained in the mainstream smoke of a cigarette, which is used in the following Examples, the derivative of 2,4-dinitrophenyl hydrazine (DNPH), a trapping substance, is measured by high-speed liquid chromatography (HPLC). The substances that can be measured simultaneously by this method are eight components consisting of formaldehyde, acetaldehyde, acetone, acrolein, propionaldehyde, crotonaldehyde, methyl ethyl ketone and n-butylaldehyde. In the following Examples, the description is directed to formaldehyde among the aldehydes (carbonyl compounds) that are to be measured.

[0021] In the first step, a trapping solution is prepared by dissolving 9.51 g of 2,4-dinitrophenyl hydrazine (DNPH) in 1 L of acetonitrile, followed by adding 5.6 mL of 60% perchloric acid and subsequently diluting the resultant solution with ultra pure water to 2 L.

[0022] The construction of the measuring apparatus will now be described with reference to FIG. 1. As shown in FIG. 1, a DNPH trapping solution 12 is put in a Drechsel type trap 11. The Drechsel type trap 11 has an inner volume of 250 mL, the amount of the DNPH trapping

solution is 100 mL, and the dead volume is 150 mL. The Drechsel type trap 11 is put in an ice water bath 13 so as to be cooled. The lower end of a glass pipe 14 having a cigarette 1 mounted to the top end thereof is dipped in the trapping solution 12 within the Drechsel type trap 11. Further, a glass pipe 15 and a Cambridge pad 16 are mounted to communicate with the dead volume of the Drechsel type trap 11, and an automatic smoking machine 17 is connected to the Cambridge pad 16.

[0023] The cigarette 1 is attached to the glass pipe 14 so as to permit the cigarette 1 to be automatically smoked under the standard smoking conditions specified in ISO standards. To be more specific, the operation of sucking 35 mL of the smoke in a single puff for two seconds is repeated at an interval of 58 seconds for a single cigarette. While the mainstream smoke is being bubbled, eight components of carbonyl compounds are converted into derivatives of DNPH. Two cigarettes are used for the measurement.

[0024] The derivatives thus formed are measured by HPLC. In the first step, the trapping solution is filtered, followed by diluting the filtrated trapping solution with a Trizma Base solution (4 mL of trapping solution : 6 mL of Trizma Base solution). Then, the diluted solution is measured by HPLC. The measuring conditions for HPLC are as follows:

Column: HP LiChrospher 100RP-18(5 μ)250 $\times$ 4 mm;

Guard column: HP LiChrospher 100RP-18(5 μ)4 $\times$ 4 mm;

Column temperature: 30°C;

Detection wavelength: DAD 356 nm;

Injection amount: 20 μ L;

[0025] Mobile phase: Gradients with three phases (solution A: ultra pure aqueous solution containing 30% of acetonitrile, 10% of tetrahydrofuran and 1% of IPA; solution B: ultra pure aqueous solution containing 65% of acetonitrile, 1% of tetrahydrofuran and 1% of IPA; and solution C: 100% of acetonitrile).

[0026] The construction of the cigarette used as a sample will now be described with reference to the cross-sectional view shown in FIG. 2. As shown in FIG. 2, the cigarette has a tobacco section 20 in which cut tobacco 21 is wrapped with a cigarette wrapper 22, and a filter section 30 in which a filter 31 is wrapped with a forming paper 32. The filter section 30 is connected to the tobacco section 20 by using a tipping paper 40. It is possible to use, for example, cellulose acetate tow as the filter material.

[0027] In testing a cigarette prepared by using a test filter having a basic amino acid or a basic amino acid salt and a moisturizing agent added thereto, a tobacco section is taken out by cutting the acetate filter from a 6 mg-tar cigarette available on the market, and the tobacco section is connected to the test filter so as to provide a sample. An atomizer is used for adding a basic amino

acid or a basic amino acid salt and a moisturizing agent to the test filter.

Test 1:

[0028] A 25 mm-long acetate filter was prepared as a base filter. Also, a test filter for reference was prepared by allowing the base filter to contain 6.5 mg of water. Further, test filters were prepared by allowing the base filter to contain 6.5 mg of water and 3.5 mg of an additive. The additive was selected from the group consisting of L-arginine, arginine glutamate, hydrazide formate, ammonia, acetamide and urea, classified as nitrogen-containing basic substances.

[0029] Each filter was connected to the tobacco section noted above to prepare a sample cigarette, and the delivery of formaldehyde ($\mu\text{g}/\text{cig}$) in the mainstream smoke per cigarette was measured by the measuring method described above. FIG. 3 is a graph showing the results. FIG. 3 clearly supports that L-arginine, which is a basic amino acid, and arginine glutamate, which is a basic amino acid salt, are particularly effective for lowering the delivery of formaldehyde, compared with the case where the base filter is allowed to contain water alone.

[0030] Incidentally, it has been found that, in order to lower the delivery of formaldehyde, the amount of L-arginine or arginine glutamate in the filter should preferably be 3.5 mg or more.

Test 2:

[0031] The base filter was allowed to contain 3.5 mg of L-arginine and a varied amount of water. Each of the filters differing in the water content was connected to the tobacco section noted above to prepare a sample cigarette, and the delivery of formaldehyde ($\mu\text{g}/\text{cig}$) in the mainstream smoke per cigarette was measured by the measuring method described above. FIG. 4 is a graph showing the results. As apparent from FIG. 4, formaldehyde in the mainstream smoke can be effectively lowered if the water content of the filter is 5 mg or more in the case where the filter contains 3.5 mg of L-arginine.

Test 3:

[0032] The base filter was allowed to contain L-arginine and glycerin used as a moisturizing agent so as to examine the increased amount of water in the filter. The L-arginine content was set at 3.5 mg, 7.0 mg or 10.5 mg. The glycerin content was set at 18 mg or 52 mg. FIG. 5 is a graph showing the results. FIG. 5 clearly supports that the amount of water held by the filter can be increased with increase in the amount of the moisturizing agent, i.e., glycerin.

Test 4:

[0033] A test filter for reference, containing no moisturizing agent, was prepared by allowing the base filter to contain 3.5 mg of L-arginine alone. Also, test filters were prepared by allowing the base filter to contain 3.5 mg of L-arginine and a moisturizing agent. The moisturizing agent was selected from the group consisting of glycerin, xylitol, sodium pantothenate, sodium PCA, sodium lactate, sodium propionate, sodium DL-malate, D-mannose and calcium chloride. Each test filter was connected to the tobacco section noted above to prepare a sample cigarette, and the delivery of formaldehyde ($\mu\text{g}/\text{cig}$) in the mainstream smoke per cigarette was measured by the measuring method described above. FIG. 6 is a graph showing the results. As apparent from FIG. 6, glycerin, sodium lactate and sodium propionate, which are used as the moisturizing agent, permit effectively lowering the delivery of formaldehyde, compared with the case where the base filter is allowed to contain L-arginine alone. These moisturizing agents are also suitable in view of the manufacturing process of the filter.

Test 5:

[0034] Various test filters in which the base filter contained 3.5 mg of L-arginine and a varied amount of sodium lactate used as the moisturizing agent were prepared. The ratio of sodium lactate to L-arginine was set at 1:1, 1:2 or 1:3.

[0035] Each test filter was connected to the tobacco section noted above to prepare a sample cigarette, and the delivery of formaldehyde ($\mu\text{g}/\text{cig}$) in the mainstream smoke per cigarette was measured by the measuring method described above. FIG. 7 is a graph showing the results. FIG. 7 supports that the delivery of formaldehyde in the mainstream smoke can be effectively lowered by allowing the base filter to contain L-arginine and sodium lactate at a ratio of 1:1 or 1:2.

Industrial Applicability

[0036] The cigarette filter of the present invention makes it possible lower effectively the amount of aldehydes contained in the mainstream smoke of a cigarette.

Claims

1. A cigarette filter, **characterized by** comprising a filter medium containing a basic amino acid or a basic amino acid salt and a moisturizing agent.
2. The cigarette filter according to claim 1, **characterized in that** the basic amino acid or the basic amino acid salt is selected from the group consisting of arginine, arginine salt, lysine, lysine salt, histidine,

histidine salt, ornithine, ornithine salt, citrulline, citrulline salt, hydroxyzine and hydroxyzine salt.

3. The cigarette filter according to claim 1, **characterized in that** the moisturizing agent is selected from the group consisting of glycerin, sodium propionate and sodium lactate. 5
4. The cigarette filter according to claim 1, **characterized in that** the basic amino acid or the basic amino acid salt is contained in an amount of 3.5 mg or more. 10
5. The cigarette filter according to claim 1, **characterized in that** the ratio of the basic amino acid or the basic amino acid salt to the moisturizing agent falls within a range of between 1:1 and 1:2. 15

20

25

30

35

40

45

50

55

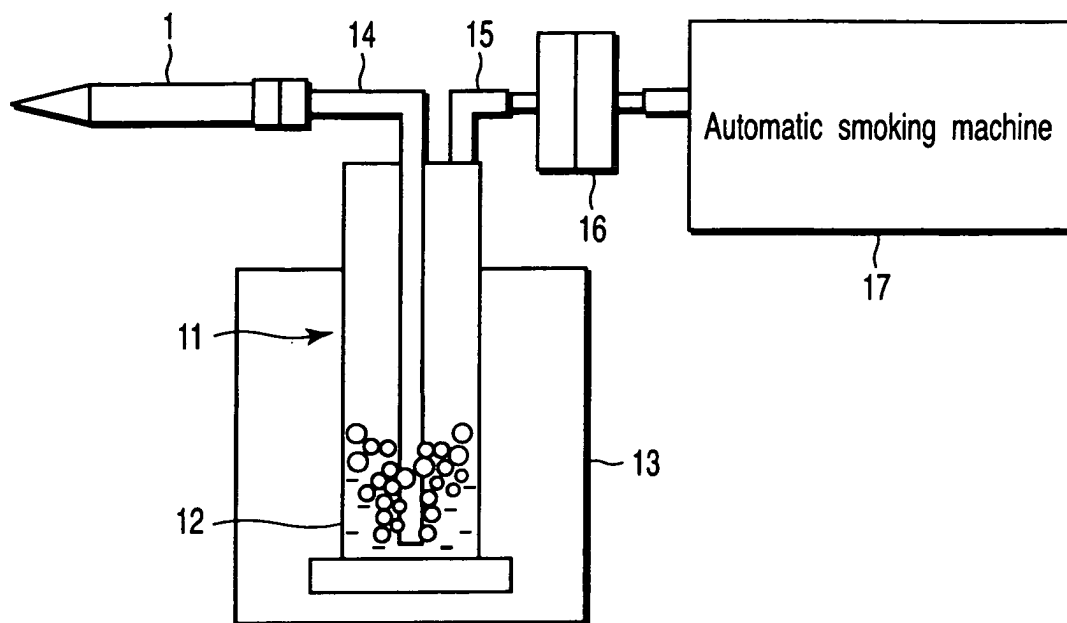


FIG. 1

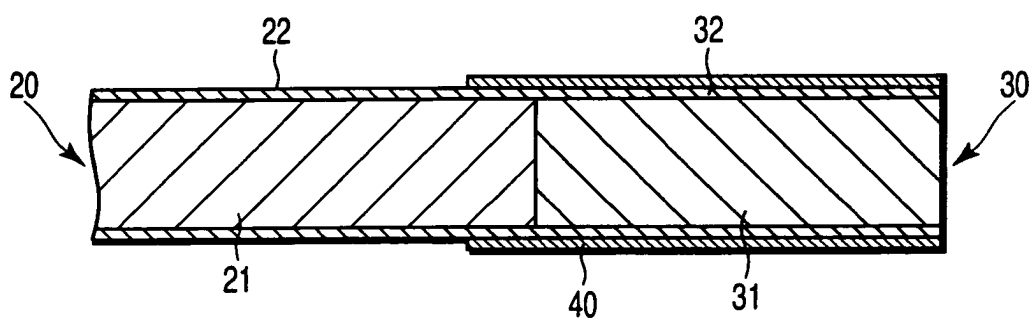


FIG. 2

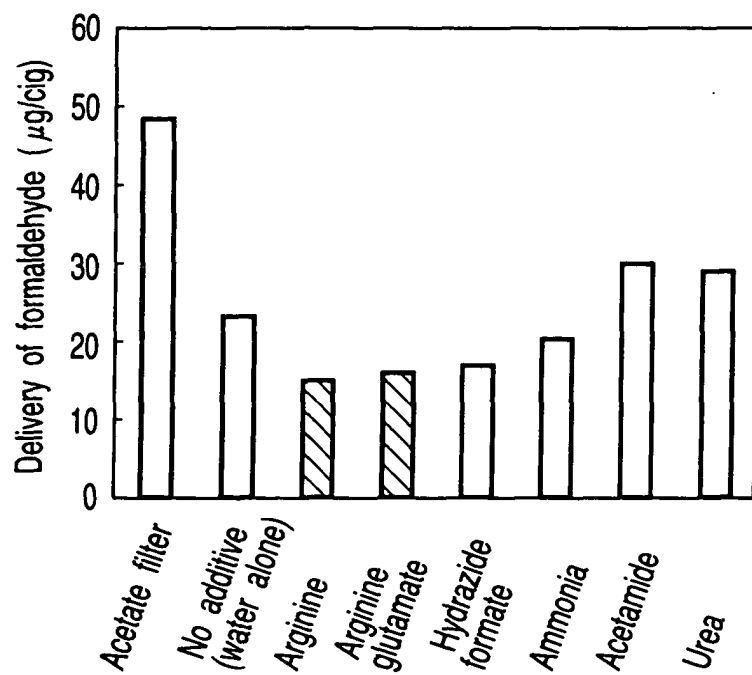


FIG. 3

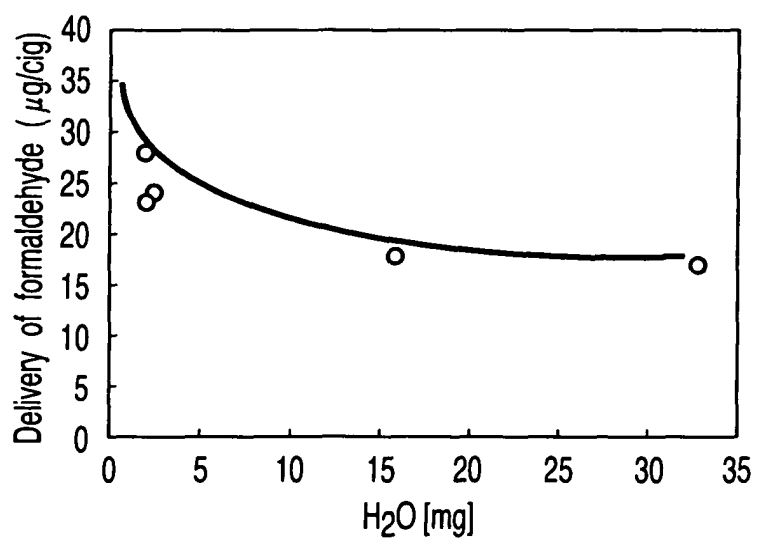


FIG. 4

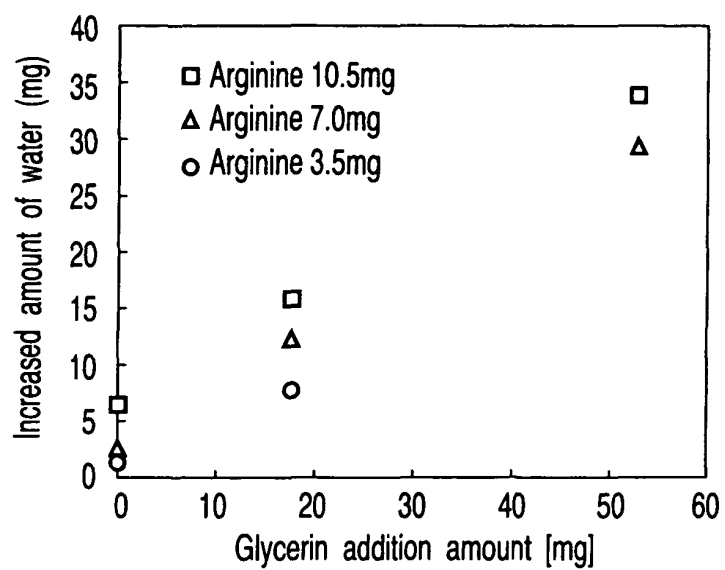


FIG. 5

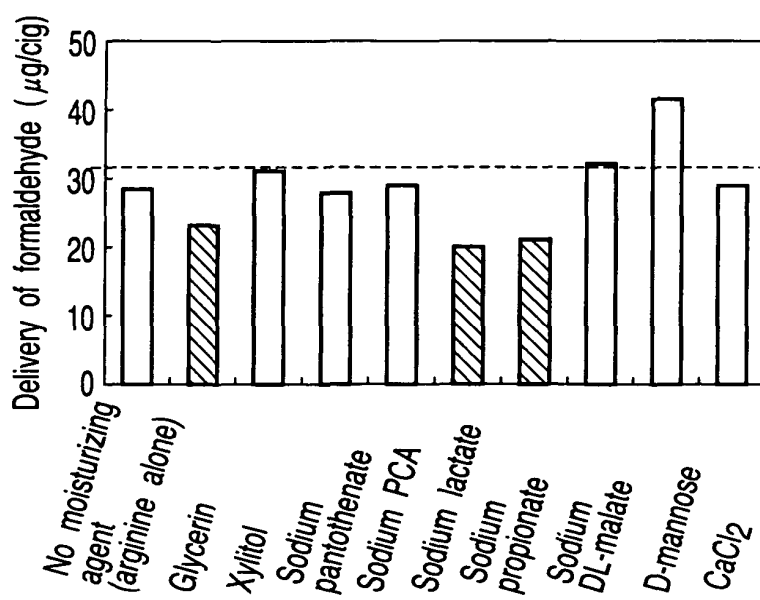


FIG. 6

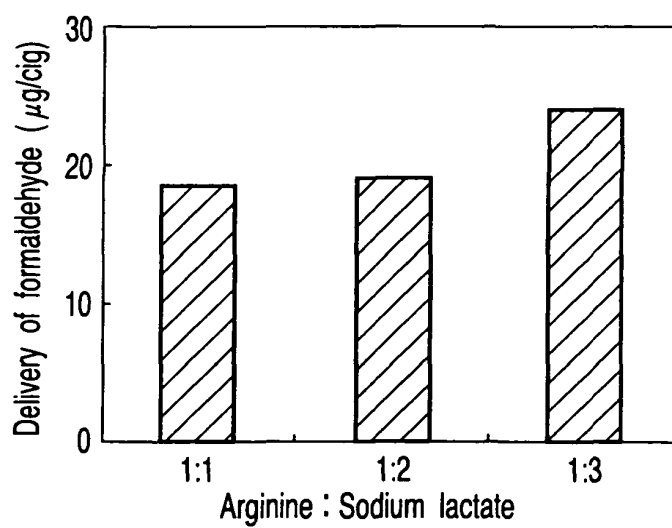


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP03/11724

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl ⁷ A24D3/14		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) Int.Cl ⁷ A24D3/14		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1926-1996 Toroku Jitsuyo Shinan Koho 1994-2003 Kokai Jitsuyo Shinan Koho 1971-2003 Jitsuyo Shinan Toroku Koho 1996-2003		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 2968306 A (EASTMAN KODAK CO.), 17 June, 1961 (17.06.61), Column 3, line 51 to column 4, line 8; column 4, line 74 to column 5, line 2; Figs. 1 to 2 (Family: none)	1, 2, 3 4, 5
Y A	JP 62-232371 A (Mitsui Toatsu Chemicals, Inc.), 12 October, 1987 (12.10.87), Page 2, upper right column, line 15 to lower left column, line 7 (Family: none)	1, 2, 3 4, 5
☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed		"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family
Date of the actual completion of the international search 31 October, 2003 (31.10.03)		Date of mailing of the international search report 18 November, 2003 (18.11.03)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP03/11724

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 11-500926 A (LESSER, Craig), 26 January, 1999 (26.01.99), Page 5, lines 21 to 26 & AU 1895795 A & FR 2716819 A & WO 95023663 A1 & CA 2184742 A & EP 748266 A & CN 1146737 A & US 5772908 A & EP 868126 A & WO 97022268 A1 & EP 868126 A & DE 69523345 T	1, 2, 3 4, 5

Form PCT/ISA/210 (continuation of second sheet) (July 1998)