

Description

Technical Field

[0001] The present invention relates to a method of manufacturing a reconstituted tobacco material, and an apparatus used in the method.

Background Art

[0002] Various components such as nicotine, nitrates, nitrosamines, hydrocarbons and proteins are contained in tobacco materials such as the leaf, shreds, stem, stalk, and root of natural tobacco plants. These components are extracted from natural tobacco materials and are used as a smoking flavor additive to tobacco. These components include those which are desirable to be decreased in amount or to be removed (undesired components), and also include those which are desirable not to be removed or to be increased in amount (desired components), in view of the smoking flavor or some other reasons. The desired components include amino acids, sugars, nicotine, leaf surface resins, and alkaloids. The undesired components include nitrates, and nitrosamines such as tobacco-specific nitrosamines (TSNAs).

[0003] Patent Document 1 discloses a method of manufacturing a regenerated tobacco material. The method comprises extracting a natural tobacco material to obtain an extracted solution and an extraction residue, and subjecting the extracted solution to fractionating treatment by means of ultrafiltration or reverse osmosis filtration or fractionating treatment by means of reversed-phase partition chromatography to obtain a first fraction enriched in the desired components and depleted in the undesired components and a second fraction enriched in the undesired components and depleted in the desired components. The regenerated tobacco material is manufactured by preparing a regenerated tobacco web from the extraction residue and adding the first fraction to the regenerated tobacco web.

[0004] Patent Document 1 discloses that since the first fraction (membrane impermeable fraction) obtained by fractionating treatment by means of ultrafiltration or reverse osmosis filtration may contain nitrosamines such as TSNAs, it is desirable to subject the membrane impermeable fraction to an additional treatment so as to remove nitrosamines before the membrane impermeable fraction is added to the regenerated tobacco web.

Prior Art Document

Patent Document

[0005] Patent Document 1: USP 7677253

Summary of Invention

Problem to be solved by the Invention

[0006] An object of the present invention is to provide a method of manufacturing a reconstituted tobacco material which contains desired components of a significant amount and undesired components including TSNAs with a significantly reduced amount, by achieving practical separation of desired components and undesired components including TSNAs by means of a reverse osmosis membrane.

[0007] In addition, an object of the present invention is to provide an apparatus for obtaining, from a tobacco extracted liquid, a fraction which contains desired components of a significant amount, and from which undesired components including TSNAs are removed by a significant amount, by means of a reverse osmosis membrane.

Means for solving the Problem

[0008] According to one aspect of the present invention, there is provided a method of manufacturing a reconstituted tobacco material, comprising: (a) extracting a natural tobacco material with an extracting solvent to obtain an extraction residue and a tobacco extracted liquid containing desired components and undesired components including TSNA; (b) subjecting the tobacco extracted liquid to a fractionating treatment by means of a reverse osmosis membrane to obtain a membrane impermeable fraction containing the desired components and depleted in the undesired components and a membrane permeable fraction depleted in the desired components and enriched in the undesired components; (c) controlling the tobacco extracted liquid during the fractionating treatment to have a temperature suitable for the fractionating treatment (generally, a temperature within a range of 40 to 80°C); (d) removing precipitates, which are precipitated in the tobacco extracted liquid during the fractionating treatment, from the tobacco extracted liquid; (e) preparing a reconstituted tobacco web containing the extraction residue; and (f) adding the membrane impermeable fraction to the reconstituted tobacco web.

[0009] According to another aspect of the present invention, there is provided a fractionating apparatus for separating desired components from TSNA-including undesired components in a tobacco extracted liquid, comprising: a process vessel which contains the tobacco extracted liquid; a fractionating device comprising a reverse osmosis membrane by which the tobacco extracted liquid is fractionated into a membrane impermeable fraction containing the desired components and depleted in the undesired components and a membrane permeable fraction depleted in the desired components and enriched in the undesired components; a pump which feeds the tobacco extracted liquid to the fractionating device under pressure; a filter for removing precipitates such as

protein which are precipitated in the tobacco extracted liquid during the fractionating treatment; and a temperature controlling device which controls the tobacco extracted liquid to have a temperature suitable for the fractionating treatment during the fractionating treatment (generally, a temperature within a range of 40 to 80°C).

Effects of the Invention

[0010] According to the present invention, it is possible to manufacture a reconstituted tobacco material which contains desired components of a significant amount and undesired components including TSNAs with a significantly reduced amount, by achieving practical separation of desired components and undesired components in a tobacco extracted liquid by means of a reverse osmosis membrane.

Brief Description of Drawings

[0011] FIG. 1 is a schematic diagram of a fractionating apparatus according to an embodiment of the present invention.

Mode for Carrying Out the Invention

[0012] An aspect of the present invention relates to a method of manufacturing a reconstituted tobacco material by using a tobacco extracted liquid and an extraction residue which are obtained by extracting a natural tobacco material. On one hand, a reconstituted tobacco web containing the extraction residue is manufactured. On the other hand, the tobacco extracted liquid is subjected to fractionating treatment by means of a reverse osmosis membrane. The fractionating treatment produces a membrane impermeable fraction which contains desired components and is depleted in undesired components including TSNAs, and a membrane permeable fraction which is depleted in the desired components and enriched in the undesired components including TSNAs. A desired reconstituted tobacco material is manufactured by adding the membrane impermeable fraction to the reconstituted tobacco web. The membrane permeable fraction is discarded.

[0013] More specifically, first, natural tobacco material is mixed with an extracting solvent, and the mixture is stirred. As the natural tobacco material, tobacco leaf, shreds, stem, stalk, and root, and a mixture thereof may be used. As the extracting solvent, water, or a mixture of water and a water-miscible organic solvent may be used. Examples of the water-miscible organic solvent include alcohols such as ethanol, and ethers such as diethyl ether. In general, the extracting treatment is carried out at a temperature of 0 to 100°C for 5 minutes to 6 hours.

[0014] After completion of the extracting treatment, the extracted mixture obtained is subjected to separating treatment by, for example, filtration or centrifugation to separate the extracted mixture into a tobacco extracted

liquid and an extraction residue.

[0015] The natural tobacco material contains salts of metals such as potassium salt, nitrates, nicotine, sugars such as sucrose, amino acids, glycosides, amino-sugar compounds, proteins, hydrocarbons (saturated hydrocarbons, unsaturated hydrocarbons, aromatic hydrocarbons), alcohols, ethers, aldehydes, ketones, esters, lactones, quinones, acids (including acid anhydrides), phenols, amines, pyrroles, pyridines, pyrazines, alkaloids, polycyclic nitrogen-containing compounds, nitroso compounds such as nitrosamines (including TSNAs), amides, lipids, halides, sulfur-containing compounds, and inorganic elements. The tobacco extracted liquid obtained by the above extracting treatment can contain substantially all of the components mentioned above, though depending on the type of the extracting solvent used. Of these components, the desired components include amino acids, sugars, nicotine, leaf surface resins, and alkaloids, and the undesired components include nitrates and nitrosamines such as TSNAs. Typical examples of TSNAs are nitrosamines (N'-nitrosornicotine (NNN), 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK), N'-nitrosoanatabine (NAT), and N'-nitrosoanabesine (NAB)). According to the present invention, nicotine and TSNAs which are similar in the chemical structures can be effectively separated from each other by a reverse osmosis membrane.

[0016] The extraction residue is a component insoluble in the extracting solvent and consists essentially of fibers. A reconstituted tobacco web is manufactured by an ordinary method by using the extraction residue. The extraction residue may constitute the entire reconstituted tobacco web or a part of the reconstituted tobacco web. For example, a reconstituted tobacco web can be obtained by subjecting pulp material containing the extraction residue to an ordinary paper-making process.

[0017] On the other hand, the tobacco extracted liquid is contained in a process vessel and fed to a reverse osmosis membrane under pressure. The reverse osmosis membrane fractionates the tobacco extracted liquid into a membrane permeable fraction and a membrane impermeable fraction. The membrane permeable fraction is enriched in undesired components including TSNAs. Correspondingly, the membrane impermeable fraction is depleted in the undesired components including TSNAs. In the membrane impermeable fraction, the initial amount of desired components (such as nicotine) in the tobacco extracted liquid is substantially maintained (85 wt% or more). Correspondingly, the membrane permeable fraction substantially contains no desired components.

[0018] The reverse osmosis membrane is a membrane which is permeable to the undesired components, and substantially impermeable to the desired components. The reverse osmosis membrane is preferably impermeable to soluble components (excluding TSNAs), such as sugar, contained in the tobacco extracted liquid. A reverse osmosis membrane having a pore size of 0.1 to 3

nm may be used. The reverse osmosis membrane may be a flat sheet membrane, a membrane obtained by forming a bag-shaped membrane into a tubular shape (spiral membrane), or a hollow fiber membrane or a tubular membrane. The tobacco extracted liquid can be supplied to the reverse osmosis membrane under a pressure of, for example, 1 to 3 MPa. The membrane permeable fraction is discarded. Supply of the tobacco extracted liquid to the reverse osmosis membrane can be performed by using a high-pressure pump.

[0019] During the fractionating treatment, the tobacco extracted liquid is sent under high pressure by the high-pressure pump, and thus the temperature of the tobacco extracted liquid rises. Therefore, in order to efficiently perform the fractionating treatment by means of the reverse osmosis membrane, the tobacco extracted liquid is controlled to fall within a temperature of generally 40 to 80°C (generally by cooling) during the fractionating treatment. Further, precipitates such as protein are precipitated in the tobacco extracted liquid because the tobacco extracted liquid reaches a relatively high temperature during the fractionating treatment, and thus the precipitates are removed. To remove the precipitates such as protein from the tobacco extracted liquid, the tobacco extracted liquid is made to pass through a filter. Since the precipitates such as protein have a diameter of 3 μm or more, a metal filter having a pore size of 3 μm or less can be used as the filter. The pore size of the filter is generally 1.8 μm or more. The precipitates, when not removed, decrease the fractionation efficiency of the reverse osmosis membrane, and makes the reverse osmosis membrane inoperative in the end. Since fine suspended matter may exist in the tobacco extracted liquid as extracted, the tobacco extracted liquid is preferably made to pass through a filter to remove the fine suspended matter in advance. The tobacco extracted liquid which is initially contained in the process vessel may have a temperature within a range of 40 to 80°C.

[0020] In an embodiment, in order to improve the treatment efficiency, the membrane impermeable fraction can be concentrated by repeating a cycle of returning the membrane impermeable fraction to the process vessel and then subjecting the membrane impermeable fraction to the membrane fractionating treatment.

[0021] The membrane impermeable fraction concentrated as described above is supplied with process water in the process vessel, in order to improve the fractionation efficiency by means of the reverse osmosis membrane. The membrane impermeable fraction, to which the process water has been added, is subjected to the membrane fractionating treatment, and then the obtained membrane impermeable fraction is returned to the process vessel. The cycle consisting of addition of the process water, membrane fractionating treatment, and return of the membrane impermeable fraction to the process vessel is repeated until the TSNA amount in the membrane impermeable fraction is reduced to, for example, approximately 40 wt% or less of the initial amount (TSNA removal

rate is 60 wt% or more), 20 wt% or less of the initial amount (TSNA removal rate is 80 wt% or more), or 10 wt% or less of the initial amount (TSNA removal rate is 90 wt% or more). The desired components (for example, nicotine) can be maintained at 85 wt% or more of the initial amount.

[0022] In the meantime, the process water preferably contains no bicarbonate ions. It has been found that when process water containing bicarbonate ions is used, the fractionating treatment needs more time. Thus, it is preferable to use soft water containing no bicarbonate ions as the process water. When hard water containing bicarbonate ions is used as the process water, it is preferable to remove bicarbonate ions in advance by, for example, an ultrafiltration membrane.

[0023] The above fractionating treatment can be executed by means of a fractionating apparatus for separating desired components from TSNA-including undesired components in the tobacco extracted liquid, the fractionating apparatus comprising: a process vessel which contains the tobacco extracted liquid, a fractionating device comprising a reverse osmosis membrane by which the tobacco extracted liquid is fractionated into a membrane impermeable fraction containing the desired components and depleted in the undesired components and a membrane permeable fraction enriched in the undesired components, a pump which feeds the tobacco extracted liquid to the fractionating device under pressure, a filter for removing precipitates such as protein which are precipitated in the tobacco extracted liquid during the fractionating treatment, and a temperature controlling device which controls the tobacco extracted liquid to have a temperature suitable for the fractionating treatment (generally, a temperature within a range of 40 to 80°C) during the fractionating treatment.

[0024] FIG. 1 is a schematic diagram illustrating a structure of the above apparatus. A fractionating apparatus 100 illustrated in FIG. 1 comprises a process vessel 110 which contains the tobacco extracted liquid. The process vessel 110 communicates with a high-pressure pump 130 by a line L1, and the high-pressure pump 130 communicates with a fractionating device 140 comprising a reverse osmosis membrane 141 by a line L2. The fractionating device 140 communicates with the process vessel 110 by a line L3. The fractionating device 140 has a discard line L4 for discarding a membrane permeable fraction. The line L1 is provided with a filter 120 for removing precipitates such as protein which are precipitated in the tobacco extracted liquid, wherein the precipitates are increased by repeated fractionating treatments of the tobacco extracted liquid by means of the fractionating device 140. As described above, the filter 120 has pores of 3 μm in order to prevent precipitates such as protein precipitated in the tobacco extracted liquid from passing through the filter 120. The line L3 is provided with a heat exchanger 150 serving as a temperature controlling device which controls and maintains a temperature of the tobacco extracted liquid within a range of 40

to 80°C, wherein the temperature of the tobacco extracted liquid rises during the repeated fractionating treatments. For example, the heat exchanger 150 can be a device which introduces cooling water into a part around the line L3 from a line L5, and discharges the water after heat exchange from a line L6.

[0025] The tobacco extracted liquid obtained by the above extracting treatment can be stored in a storage vessel 160. The tobacco extracted liquid contained in the storage vessel 160 may be stored at low temperature (of 10 to 20°C) in order to prevent decomposition.

[0026] One batch of tobacco extracted liquid TEL is supplied to the process vessel 110 from the storage vessel 160 through a line L7. Then, the tobacco extracted liquid contained in the process vessel 110 is fed from the process vessel 110 to the fractionating device 140 through the filter 120 by drive of the high-pressure pump 130. In the fractionating device 140, the tobacco extracted liquid is fractionated into a membrane permeable fraction which is depleted in the desired components and enriched in the undesired components including TSNAs, and a membrane impermeable fraction which is depleted in the undesired components including TSNAs and containing the desired components, by means of the reverse osmosis membrane 141 of the fractionating device 140. The membrane permeable fraction is discarded from the fractionating device 140 through the line L4.

[0027] The membrane impermeable fraction is returned to the process vessel 110 through the line L3. The membrane impermeable fraction which has been returned to the process vessel 110 is supplied again to the fractionating device 150 by the high-pressure pump 130 through the lines L1 and L2, and fractionated into a membrane permeable fraction and a membrane impermeable fraction. The membrane impermeable fraction can be returned to the process vessel 110 through the line L3. Needless to say, the membrane permeable fraction is discarded each time through the line L4.

[0028] When the membrane impermeable fraction is concentrated by repeated fractionating treatments as described above, process water is added from a water vessel 170 to the membrane impermeable fraction contained in the process vessel 110 through a line L8, in order to prevent decrease in efficiency of the fractionating treatment by means of the reverse osmosis membrane. The line L8 may be provided with an ultrafiltration device 180 comprising an ultrafiltration membrane 181, in order to remove bicarbonate ions in the case where the water is hard water containing bicarbonate ions. A filtrate (bicarbonate ion-removed water) derived from the ultrafiltration device 180 is added as the process water to the process vessel 110 through the line L8. The membrane impermeable fraction to which the process water has been added is repeatedly subjected to the fractionating treatment until the amount of TSNAs in the fraction is reduced to, for example, approximately 40 wt% or less, 20 wt% or less, or 10 wt% or less, of the initial amount thereof. The amount (volume) of the membrane permeate ob-

tained by fractionating the membrane impermeable fraction containing the process water is the same as the amount (volume) of the added process water. During the concentration and the repeated cycle of water addition and fractionating treatment, the tobacco extracted liquid (the concentrated tobacco extracted liquid and the tobacco extracted liquid containing the process water) is cooled to a temperature of 40 to 80°C by the heat exchanger 150, and maintained at the temperature, and precipitates such as protein are removed from the tobacco extracted liquid by the filter 120. The amount of the undesired components, such as TSNAs, in the membrane impermeable fraction can be determined by measuring the amount of the desired components or the undesired components contained in the membrane permeable fraction discharged from the line L4. The temperature of the tobacco extracted liquid can be monitored by a temperature sensor 180, which is provided on the line L2 and close to the fractionating device 141.

[0029] In the above embodiment, although the filter 120 is provided (on the line L1) between the process vessel 110 and the high-pressure pump 130, a similar filter 120' may be provided on the line L3 between the fractionating device 140 and the heat exchanger 150, and/or a similar filter 120 may be provided on the line L3 between the heat exchanger 150 and the process vessel 110, instead of or in addition to the filter 120, as indicated by broken lines in FIG. 1. In addition, as indicated by broken lines in FIG. 1, the process vessel 110 may be externally provided with a line L9 to circulate the tobacco extracted liquid contained in the process vessel 110, and the line L9 may be provided with a similar filter 120". To provide a filter (on the line L2) between the high-pressure pump 110 and the fractionating device 140, however, is not preferable, because precipitates such as protein which have been captured by the filter, undesirably pass through the pores of the filter by the tobacco extracted liquid which is pumped under high pressure by the high-pressure pump 130 and have adverse influence on the fractionating treatment.

EXAMPLES

[0030] The present invention will be explained hereinafter by examples, but the present invention is not limited by them.

EXAMPLE 1

[0031] In the present Example, fractionating treatment was performed by using the apparatus illustrated in FIG. 1. Duratherm Excel R0 4040HR manufactured by GE Water Technologies was used as the reverse osmosis membrane.

[0032] First, 10 kg of tobacco scraps consisting of a mixture of tobacco leaf scraps (mixture of flue-cured type and Burley type) and stem scraps was mixed with 50 L of water at a temperature of 60°C, and stirred to perform

extraction of tobacco shreds. The extracted mixture obtained was filtered to be separated into tobacco extracted liquid and extraction residue. The concentration of TSNA's (sum of NNN, NNK, NAT, and NAB) in the tobacco extracted liquid was measured by chromatography. The concentration was 424 mg/m³.

[0033] The extraction residue was subjected to paper-making process, and thereby a reconstituted tobacco web was obtained. On the other hand, the tobacco extracted liquid was stored in the storage vessel 160.

[0034] Next, 33.5 L of tobacco extracted liquid was introduced into the process vessel 110 from the storage vessel 160. By driving the high-pressure pump 130 (which feeds the tobacco extracted liquid under a pressure of 2 MPa), the tobacco extracted liquid was supplied to the reverse osmosis membrane 141 through the filter 120 (stainless steel filter having a pore size of 3 μm). A membrane impermeable fraction was returned to the process vessel 110. The membrane impermeable fraction which has been returned to the process vessel 110 was repeatedly subjected to the above fractionation cycle, until the amount of the membrane impermeable fraction was reduced to 18 L.

[0035] 1L of water (process water), from which bicarbonate ions have been removed in advance by means of the ultrafiltration membrane 181, was added to the 18L of concentrated membrane impermeable fraction in the process vessel 110, and membrane fractionating treatment was performed in a similar manner. The membrane impermeable fraction was returned to the process vessel 110, 1L of water, from which bicarbonate ions have been removed in advance, was added to the membrane impermeable fraction again, and the membrane impermeable fraction was returned to the process vessel 110. Addition of the process water and fractionating treatment were repeated until the total amount of the added process water reached 133 L, and thereby a desired (final) membrane impermeable fraction was obtained (it took approximately one hour since concentration was started). During the fractionating treatments, the tobacco extracted liquid was maintained at approximately 60°C, and precipitates such as protein were removed by the filter 120. The amount of TSNA's in the obtained membrane impermeable fraction was 4.5% of the initial amount thereof (removal rate of 95.5%), and nicotine was maintained at approximately 86.6% of the initial amount thereof. The membrane impermeable fraction obtained as described above was added to the reconstituted tobacco web, and thereby a reconstituted tobacco material was obtained.

EXAMPLE 2

[0036] Example 2 was performed in the same procedure as Example 1, except that hard water, from which bicarbonate ions were not removed, was used without any treatment as the process water. In the present case, 133 L of hard water in total was added in order to obtain a final membrane impermeable fraction having the same

TSNA removal rate and nicotine maintenance rate as those of Example 1. Approximately 80 minutes was required to obtain the final membrane impermeable fraction since concentration was started.

Claims

1. A method of manufacturing a reconstituted tobacco material, comprising:

- (a) extracting a natural tobacco material with an extracting solvent to obtain an extraction residue and a tobacco extracted liquid containing desired components and undesired components including tobacco-specific nitrosamines;
- (b) subjecting the tobacco extracted liquid to a fractionating treatment by means of a reverse osmosis membrane to obtain a membrane impermeable fraction containing the desired components and depleted in the undesired components and a membrane permeable fraction depleted in the desired components and enriched in the undesired components;
- (c) controlling the tobacco extracted liquid during the fractionating treatment to have a temperature suitable for the fractionating treatment;
- (d) removing precipitates, which are precipitated in the tobacco extracted liquid during the fractionating treatment, from the tobacco extracted liquid;
- (e) preparing a reconstituted tobacco web containing the extraction residue; and
- (f) adding the membrane impermeable fraction to the reconstituted tobacco web.

2. The method according to Claim 1, wherein the tobacco extracted liquid is controlled to have a temperature within a range of 40 to 80°C in the step (c).

3. The method according to Claim 1 or 2, wherein the step (b) comprises:

- repeatedly performing the fractionating treatment to obtain a concentrated membrane impermeable fraction, and
- repeating a cycle of consisting of addition of process water to the concentrated membrane impermeable fraction and the fractionating treatment of the membrane impermeable fraction supplied with the process water.

4. The method according to Claim 3, wherein the cycle is repeated until a membrane impermeable fraction, from which the tobacco-specific nitrosamines contained in the tobacco extracted liquid obtained in the step (a) is removed by 60 wt% or more of its initial amount, is obtained.

5. The method according to any one of Claims 1 to 4,
wherein the step (c) is performed by using a filter
having a pore size of 3 μm or less.

6. The method according to any one of Claims 3 to 5, 5
wherein the process water is obtained by removing
bicarbonate ions from hard water containing bicar-
bonate ions.

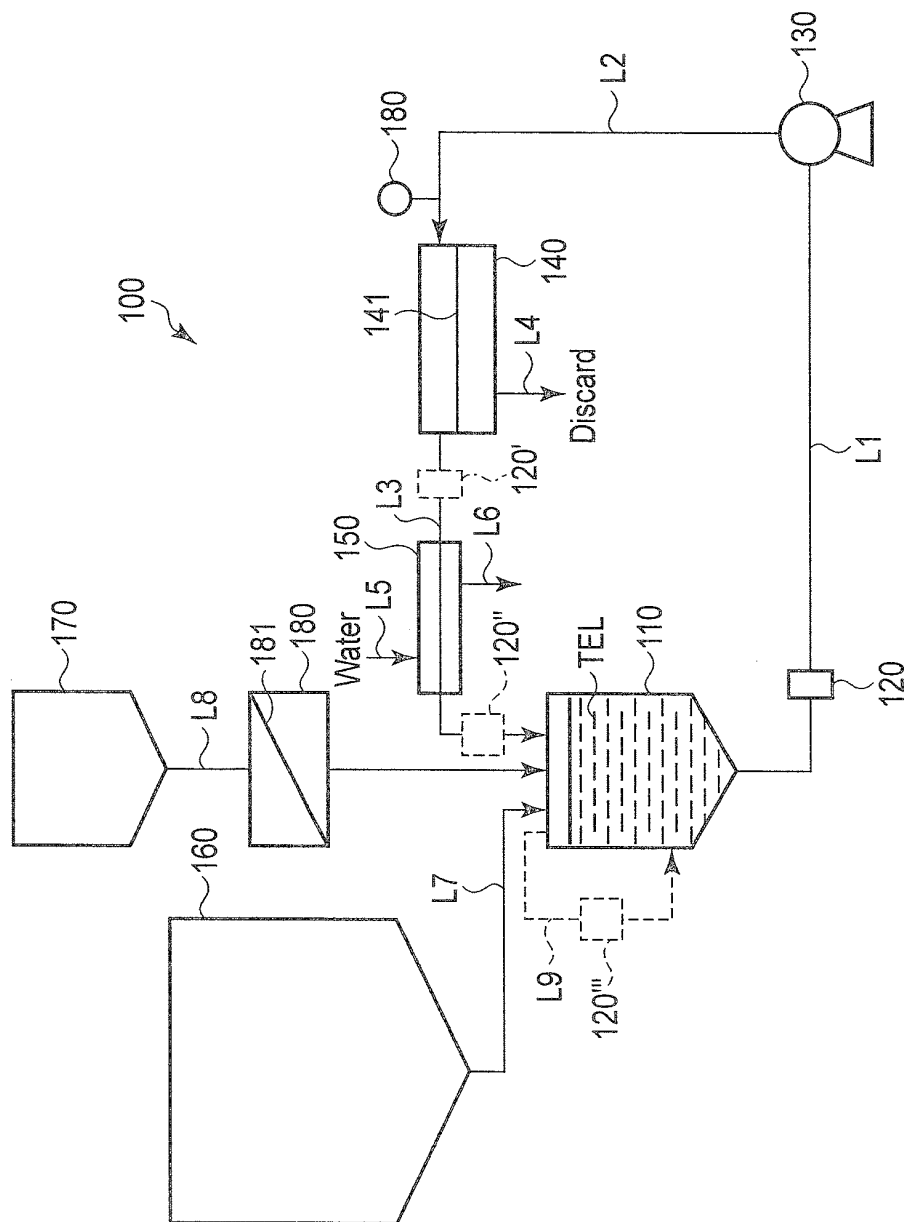
7. A fractionating apparatus for separating desired 10
components from tobacco-specific nitrosamine-in-
cluding undesired components in a tobacco extract-
ed liquid, comprising:
 - a process vessel which contains the tobacco ex- 15
tracted liquid;
 - a fractionating device comprising a reverse os-
mosis membrane by which the tobacco extract-
ed liquid is fractionated into a membrane imper-
meable fraction containing the desired compo- 20
nents and depleted in the undesired compo-
nents and a membrane permeable fraction de-
pleted in the desired components and enriched
in the undesired components;
 - a pump which feeds the tobacco extracted liquid 25
to the fractionating device under pressure;
 - a filter for removing precipitates such as protein
which are precipitated in the tobacco extracted
liquid during the fractionating treatment; and
 - a temperature controlling device which controls 30
the tobacco extracted liquid to have a tempera-
ture suitable for the fractionating treatment dur-
ing the fractionating treatment.

8. The apparatus according to Claim 7, wherein the 35
temperature controlling device controls the tobacco
extracted liquid to have a temperature within a range
of 40 to 80°C.

9. The apparatus according to Claim 7 or 8, wherein 40
the temperature controlling device is constituted of
a heat exchanger.

10. The apparatus according to any one of Claims 7 to 45
9, further comprising:
 - an ultrafiltration device which comprises ultrafil-
tration membrane for removing bicarbonate
ions. from hard water containing bicarbonate
ions, and is configured to provide bicarbonate 50
ion-removed water as process water.

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FIGURE

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2011/056077

A. CLASSIFICATION OF SUBJECT MATTER

A24B15/24 (2006.01) i

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)

A24B15/24

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2011
Kokai Jitsuyo Shinan Koho	1971-2011	Toroku Jitsuyo Shinan Koho	1994-2011

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.
Y A	JP 3867098 B2 (Japan Tobacco Inc.), 10 January 2007 (10.01.2007), page 3, line 25 to page 5, line 39 (Family: none)	1-5, 7-9 6, 10
Y A	JP 2-18058 B2 (Leaf Proteins Inc.), 24 April 1990 (24.04.1990), column 7, line 21 to column 10, line 6 (Family: none)	1-5, 7-9 6, 10
Y A	JP 2010-42368 A (Fujifilm Finechemicals Co., Ltd.), 25 February 2010 (25.02.2010), paragraphs [0011] to [0018], [0024], [0025]; fig. 1 (Family: none)	3-5, 7-9 6, 10

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:

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"&" document member of the same patent family

Date of the actual completion of the international search
07 April, 2011 (07.04.11)Date of mailing of the international search report
19 April, 2011 (19.04.11)Name and mailing address of the ISA/
Japanese Patent Office

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US P7677253 B [0005]