

# **Dry-process Reconstituted Tobacco Leaf, Method and Device for Producing Dry-process Reconstituted Tobacco Leaf**

## **Technical Field**

The present disclosure relates to the field of reconstituted tobacco leaf production, and particularly to dry-process reconstituted tobacco leaf, a method and a device for producing a dry-process reconstituted tobacco leaf.

## **Background Art**

As an important tobacco raw material in traditional cigarette products, the reconstituted tobacco leaf has increasingly wide applications in cigarette industry. Not only is it about simple waste utilization, but also it starts to play an important role in improving cigarette flammability, improving the internal quality of cigarette products, reducing harmful ingredients in cigarettes and reducing tar and nicotine contents, among others. In addition, its range of applications is no longer limited to tobacco fillers, but has become wider and wider, e.g. cigarette filter and cigar wrapper. The international situation of tobacco control has become increasingly severe, and tobacco product consumers become more and more concerned about their own health. Given these situations, scientific and technological tobacco staff has been gradually devoting to the development of low-harm tobacco products. Heat-not-burn cigarette is born at this moment. Using reconstituted tobacco leaves as the cigarette core material for heat-not-burn cigarette is not only another expansion of the functions of reconstituted tobacco leaf, but also provides a new path and assistance to the development of heat-not-burn cigarette technology.

However, but the existing reconstituted tobacco leaf productions present one or more prevailing problems, e.g. in water consumption, environmental pollution, comprehensive utilization ratio of tobacco raw materials and processing adaptability.

## **Summary of the Disclosure**

The purpose of the present disclosure is to provide dry-process reconstituted tobacco leaf, a method and a device for producing dry-process reconstituted tobacco leaf, which are featured by nearly zero water consumption, environmental friendliness, high comprehensive utilization ratio of tobacco raw materials and high processing adaptability.

The present disclosure adopts the following technical solutions.

A method for producing a dry-process reconstituted tobacco leaf, provided by embodiments of the present disclosure, includes steps of:

pulverizing and defibering, under an anhydrous condition, plant fibers to generate a base sheet;

mixing tobacco powder with water, adhesive, smoke agent, tobacco essence flavor and humectant to provide coating liquid; and

loading the coating liquid onto the base sheet and performing a drying process, to generate the dry-process reconstituted tobacco leaf.

In an embodiment of the present disclosure, the plant fibers include one or more selected from the group consisting of hemp pulp, bamboo pulp and wood pulp.

In an embodiment of the present disclosure, the tobacco powder is obtained by pulverizing tobacco raw materials under an anhydrous condition.

In an embodiment of the present disclosure, the smoke agent includes glycerol, propylene glycol and sorbitol, and the tobacco essence flavor includes burley tobacco absolute oil, cocoa extractive, tobacco leaf extractive and aromatic tobacco concrete.

In an embodiment of the present disclosure, the plant fibers are pulverized and defibered under an anhydrous condition to generate a base sheet by a dry air forming manner, which includes performing a destaticization process on monofilament fibers obtained by the pulverizing and defibering.

In an embodiment of the present disclosure, the step of loading the coating liquid onto the base sheet includes spraying, in a non-physical contact manner, the coating liquid onto the base sheet.

In an embodiment of the present disclosure, the method for producing a dry-process reconstituted tobacco leaf further includes rewinding, calendering and cutting the dry-process reconstituted tobacco leaf, so as to be used as a core material for a cigarette filter or a heat-not-burn cigarette.

In an embodiment of the present disclosure, the step of performing a drying process includes placing the base sheet, on which the coating liquid is loaded, into heated air for drying.

In an embodiment of the present disclosure, the step of loading the coating liquid onto the base sheet and performing a drying process includes:

spraying the coating liquid onto a front face of the base sheet and then performing a drying process, if a back face of the base sheet is under a negative pressure;

spraying the coating liquid onto a back face of the base sheet and performing a drying process, if a front face of the base sheet is under a negative pressure.

A device for producing a dry-process reconstituted tobacco leaf, provided by embodiments of the present disclosure, includes:

a fiber defibering means configured to pulverize and defiber plant fibers;

a base sheet forming means configured to make the pulverized and defibered plant fibers formed into a base sheet;

a spraying means configured to spray coating liquid onto the base sheet;  
and

a drying means configured to dry the base sheet on which the coating liquid is loaded, so as to obtain a dry-process reconstituted tobacco leaf.

In an embodiment of the present disclosure, the fiber defibering means includes a fiber frame as well as a rough pulverizer and a fine pulverizer, with the rough pulverizer and the fine pulverizer connected in sequence. Specifically, the fiber frame is configured to support the plant fibers, and the rough pulverizer and the fine pulverizer are configured to pulverize and defiber the plant fibers.

In an embodiment of the present disclosure, the fiber defibering means further includes a fiber metering means. The rough pulverizer, the fine pulverizer and the fiber metering means are connected in sequence, and the fiber metering means is configured to precisely control output quantity of the fibers.

In an embodiment of the present disclosure, the fiber defibering means further includes a humidifying means. The humidifying means is configured to humidify air within the rough pulverizer, the fine pulverizer and the fiber metering means.

In an embodiment of the present disclosure, the base sheet forming means includes a plurality of fiber delivering tubes, a screening drum, a mesh belt, a plurality of guide rollers and a first negative pressure tank. Each of the plurality of fiber delivering tubes is communicated with the screening drum. The mesh belt is located below the screening drum and configured to gather fibers output from the screening drum, so that the base sheet is formed. The mesh belt is supported and driven by the plurality of guide rollers, so as to operate in cycles. The first negative pressure tank is provided within an area enclosed by the mesh belt and configured to draw the fibers to be gathered on the mesh belt.

In an embodiment of the present disclosure, a break-apart roller is provided within the screening drum.

In an embodiment of the present disclosure, the base sheet forming means includes a humidity controller and a destaticizing mesh, the humidity controller is configured to control ambient humidity during a formation process of the base sheet, the destaticizing mesh is provided in the screening drum and is configured to reduce static during the formation process of the base sheet formation.

In an embodiment of the present disclosure, the spraying means includes a storage tank, a buffer and a nozzle communicated in sequence. The storage tank is configured to store coating liquid, and the buffer is configured to adjust flow velocity and pressure of coating liquid.

In an embodiment of the present disclosure, the storage tank is provided with a constant pressurizer and the nozzle is provided with a compressed air inlet.

In an embodiment of the present disclosure, the drying means includes an air circulating means and a drying tank. The air circulating means includes an air circulating passage, a heating means and a negative pressure fan. The heating means is configured to heat air within the air circulating passage, and the negative pressure fan is configured to drive the heated air within the air circulating passage to circulate. An inlet and an outlet of the air circulating passage are both communicated with the drying tank. The drying tank is configured to store the base sheet to be dried. A guide plate and a second negative pressure tank are provided within the drying tank. The guide plate is configured to guide a flow direction of air in the drying tank. The second negative tank works with the negative pressure fan to ensure circulation of the air.

A dry-process reconstituted tobacco leaf, provided by embodiments of the present disclosure, is produced by the method for producing a dry-process reconstituted tobacco leaf or the device for producing a dry-process reconstituted tobacco leaf mentioned above.

The present disclosure has the following beneficial effects.

(1) Compared with the currently mainstream processes for producing the reconstituted tobacco leaf, the method for producing a dry-process reconstituted tobacco leaf, provided by embodiments of the present disclosure, has a simple productive procedure, barely discharges solid or liquid wastes in the productive procedure and thus has no cost of waste treatment, and thus is environmentally friendly. Water is almost not used in the tobacco raw materials pulverization, fiber defibering, base sheet formation or even the whole production process, and thus the water consumption is significantly reduced and the loss of effective ingredients from the tobacco raw materials is prevented, which improves the comprehensive utilization ratio of the tobacco raw materials and the quality of the obtained products. The method for producing a dry-process reconstituted tobacco leaf, provided by embodiments of the present disclosure, is a simple, efficient, clean and environmental production method.

(2) The device for producing a dry-process reconstituted tobacco leaf, provided by embodiments of the present disclosure, has a low water consumption, presents little pollution to the environment, produces high-quality products and additionally provided with, on the basis of conventional devices for producing sheet-like reconstituted tobacco leaf products, a smoke agent and/or tobacco essence flavor adding device and an online moisture monitoring device, which further ensures a good and stable quality for the products.

(3) The dry-process reconstituted tobacco leaf, provided by embodiments of the present disclosure, can bear a high proportion of tobacco raw materials and/or tobacco flavor raw materials, has a loose and porous physical structure, and is suitable for the filters of conventional burning cigarettes. In this way, not only a novel form is created, where the cigarette filter and the cut tobacco are both made from tobacco leaf substances, but also the smoke flavor of cigarettes can be effectively improved, and the effect of preserving moisture and enhancing fragrance is achieved.

(4) The dry-process reconstituted tobacco leaf, provided by embodiments of the present disclosure, can bear a high proportion of smoke agent and/or tobacco flavor raw materials. With the high reducibility and the loose and porous physical structure of its effective tobacco ingredients, a high efficiency smoke generation by the produced heat-not-burn cigarettes is ensured, and a high sensory quality for the produced heat-not-burn cigarette products and efficient volatilization of the formed smoke is also ensured, which causes the heat-not-burn cigarette products to provide a good sensory quality and user experience.

### **Brief Description of Drawings**

In order to more clearly explain the technical solutions in the embodiments of the present disclosure or in the prior art, figures to be used in the description of the embodiments or the prior art will be briefly described. Obviously, the figures in the following description merely show some of the embodiments of the present disclosure. Other figures may be obtained by those ordinarily skilled in the art based on these figures without creative efforts.

Fig. 1 is a flow chart of a method for producing a tobacco leaf provided by an example of the present disclosure;

Fig. 2 is a schematic structural diagram of a fiber defibering means provided by an example of the present disclosure;

Fig. 3 is a schematic structural diagram of a base sheet forming means provided by an example of the present disclosure;

Fig. 4 is a schematic structural diagram of a spraying means provided by an example of the present disclosure;

Fig. 5 is a schematic structural diagram of the drying tank of a drying means provided by an example of the present disclosure;

Fig. 6 is a schematic structural diagram of the air circulating means of a drying means provided by an example of the present disclosure.

Reference signs: 1-fiber frame; 2- rough pulverizer; 3-fine pulverizer; 4-fiber metering means; 5- humidifying means; 6-first air inlet; 7-second air inlet; 8-fiber delivering tube; 9-screening drum; 10-break-apart roller; 11-mesh belt; 12-guide roller; 13-first negative pressure tank; 14-forming frame; 15-mounting case; 16-spraying frame; 17-buffer; 18-buffer mounting bracket; 19-main

nozzle bracket; 20-auxiliary nozzle bracket; 21-nozzle; 22-guide plate; 23-second negative pressure tank; 24-dehumidifying means; 25-negative pressure fan; 26-third air inlet.

### **Detailed Description of Embodiments**

To facilitate understanding of the present disclosure, the technical solutions of the present disclosure will be further described with reference to examples. A lot of specific details are given in the following description for sufficient understanding of the present disclosure. However, the present disclosure can be implemented by many other ways than those described herein. And those skilled in the art would have made similar improvements without departing from the essence of the present disclosure. Therefore, the present disclosure is not limited to the specific examples as disclosed below.

The applicant claims that the specific processing devices and procedures of the present disclosure are illustrated by the following examples, but the present disclosure is not limited to these specific processing devices and procedures, which means that the present disclosure can also be implemented other than relying on the following specific processing devices and procedures. It is apparent to those skilled in the art that any improvements, equivalent replacements of raw materials and addition of auxiliary ingredients to the products of the present disclosure, and selection of a specific method all fall within the scope of protection and disclosure of the present disclosure.

Referring to Fig. 1, the method for producing a dry-process reconstituted tobacco leaf, provided by embodiments of the present disclosure, includes the steps of:

- pulverizing and defibering, under an anhydrous condition, plant fibers to generate a base sheet;

- mixing tobacco powder with water, adhesive, smoke agent, tobacco essence flavor and humectant to provide coating liquid; and

- loading the coating liquid onto the base sheet and performing a drying process to generate the dry-process reconstituted tobacco leaf.

Specifically, the plant fibers include one or more selected from the group consisting of hemp pulp, bamboo pulp and wood pulp. The plant fibers are pulverized and defibered under an anhydrous condition to generate a base sheet by a dry air forming manner, which includes performing a destaticization process on monofilament fibers obtained by the pulverizing and defibering.

The tobacco powder is obtained by pulverizing tobacco raw materials under an anhydrous condition. The smoke agent includes glycerol, propylene glycol and sorbitol, etc. The tobacco essence flavor includes burley tobacco absolute oil, cocoa extractive, tobacco leaf extractive and aromatic tobacco concrete, etc. The step of loading the coating liquid onto the base sheet includes spraying, in a non-physical contact manner, the coating liquid onto the base sheet.

The step of performing a drying process includes placing the base sheet, on which the coating liquid is loaded, into heated air for drying. Furthermore, the step of loading the coating liquid onto the base sheet and performing a drying process includes: spraying the coating liquid onto a front face of the base sheet and then performing a drying process, if a back face of the base sheet is under a negative pressure; or spraying the coating liquid onto a back face of the base sheet and performing a drying process, if a front face of the base sheet is under a negative pressure.

Specifically, the production process mainly includes the processes of tobacco powder preparation, coating liquid formulation, base sheet forming, coating and drying, adding smoke agent and/or top-note-flavor type tobacco essence flavor, etc.

Furthermore, in the whole production process, water is barely needed except for the procedure of coating liquid preparation, hence water consumption is significantly reduced. In addition, the water in the coating liquid volatilizes during the drying procedure and thus basically no solid or liquid waste will be discharged during the production process. Hence, this production process is relatively friendly to the environment and thus is a clean and environmentally friendly production method.

Furthermore, in the process of tobacco powder preparation, the tobacco raw materials may be pre-treated by means of microorganisms or bio-enzymes, etc., so that the macromolecular substances of the tobacco raw materials become micromolecular substances which facilitate the sensory quality for the products and volatilize more easily. And the pre-treated tobacco raw materials, after being directly pulverized and screened, are all used in coating liquid formulation, prevent the loss of effective ingredients from the tobacco raw materials, and thereby improving the comprehensive utilization ratio of the raw materials.

Furthermore, the process of coating liquid formulation can not only achieve a basic function of the effectively mixing of the tobacco raw materials, adhesive, smoke agent, tobacco essence flavor and other minor ingredients, but also the demand that a large portion of materials e.g. smoke agent and tobacco essence flavor need to be added into the heat-not-burn cigarette core can be satisfied,. This can not only avoid too viscous coating liquid due to the addition of a large portion of smoke agent and tobacco essence flavor or the like, which affects the coating process and thus leads to unstable product quality, but also ensures that no extra pressure will be created to the drying process, such that the process is adjustable, controllable and flexible.

Furthermore, the process of base sheet forming is a low quantitative base sheet forming process which can eliminate static flocculation. Not only is the process of base sheet forming applicable to a single addition of common plant fibers e.g. wood pulp, hemp pulp and bamboo pulp, but also the process of base sheet forming allows simultaneous additions of the aforementioned plant fibers, tobacco stems or even various raw fiber materials in special fibers such

as tea steams, agarwood, agarwood leaf and liquorice fiber. The process has relatively good adaptability.

Furthermore, regarding the processes of coating and drying, with the adjustable and controllable coating process, not only the evenness, metering and a large portion of addition of high-viscosity and high-solid-content coating liquid can be realized, but also the preservation of volatile effective ingredients e.g. smoke agent and tobacco essence flavor in the products are most possibly improved by the adjustment of a process such as speed reduction, hot-air circulating through-air drying and low temperature drying, and meanwhile the products are ensured to be fully dried, and thereby guaranteeing the product quality.

Furthermore, the process of adding smoke agent and/or top-note-flavor type tobacco essence flavor is an innovative means which is designed to avoid the drying process and ensures, in the case of fully-dried products, that the smoke agent and top-note-flavor type tobacco essence flavor have an obvious influence on the heat-not-burn cigarette quality and fully preserve the highly volatile ingredients. In this way, the qualities of the heat-not-burn cigarette core materials and the cigarette products made from such core materials are further guaranteed.

Furthermore, regarding smoke agent and/or top-note-flavor type tobacco essence flavor, the smoke agent includes but is not limited to glycerol, propylene glycol and sorbitol, and the top-note-flavor type tobacco essence flavor include but are not limited to burley tobacco absolute oil, cocoa extractive, tobacco leaf extractive and aromatic tobacco concrete. The above materials may be directly added to the coating liquid or added separately, or may be added to the coating liquid after being processed by certain technical means, a method of which includes but is not limited to concentration and microencapsulation, so as to improve the stability and the retention rate of the above materials in the production process.

Furthermore, after such slight adjustment, the production process can allow production of the dry-process reconstituted tobacco leaf products for a filter rod and for heat-not-burn cigarettes, and has a relatively good functional expandability.

Furthermore, this production process is a method for producing heat-not-burn cigarette core materials which allows batch production.

### **Example 1**

Bleached wood pulp was used as the raw plant fiber material. The base sheet was designed to have a fixed quantity of  $22\text{g/m}^2$ . The dry-process reconstituted tobacco leaf product was designed to have a fixed quantity of  $110\text{g/m}^2$ . The tobacco raw material was flue-cured leaf group formula. The running speed of the production line was  $10\text{m/min}$ . The method and device for producing a dry-process reconstituted tobacco leaf were used for the production, as specifically described below.

## 1. Formulation of coating liquid

(1) Preparation of tobacco powder: flue-cured leaf group formula with a water content below 10% was used, pulverized by a pulverizer at a low temperature and then sieved by a 400-mesh screen, for later use;

(2) Formulation of coating liquid: the tobacco powder as prepared was evenly mixed with smoke agent, moisture-proofing agent, adhesive, tobacco essence flavor, and suitable amount of water to form coating liquid with a solid content of 15%, for later use.

## 2. Base sheet forming

The internal humidity during the fiber defibering and the base sheet forming was controlled to be  $\geq 85\%$ . The bleached wood pulp with a degree of dryness  $\geq 80\%$  was defibered into monofilament fibers by a fiber defibering device, metered and delivered to a base sheet former, and then subjected to two-group four-stage formation within the base sheet former under the control of the manners such as breaking apart effect of the break-apart roller, internal humidity control, the destaticizing mesh, the negative pressure effect of the negative pressure vacuum tank and the air uniformizing mechanism to form a base sheet with a fixed quantity of  $22\text{g/m}^2$ , for later use.

## 3. Spraying and drying

(1) First spraying: the coating liquid was sprayed on the front face of the base sheet; when spraying, there was a negative pressure suction box on the back face of the base sheet for negative pressure vacuum suction; the spraying amount was set to be 18% of total spraying amount;

(2) First drying: the base sheet, subjected to the first spraying, was delivered, by the mesh belt, to the drying tank for drying; the hot air temperature was set to be  $75^{\circ}\text{C}$ ;

(3) Second spraying: the coating liquid was sprayed on the back face of the base sheet; when spraying, there was a negative pressure suction box on the front face of the base sheet for negative pressure vacuum suction; the spraying amount was set to be 24% of the total spraying amount;

(4) Second drying: the base sheet, subjected to the second spraying, was delivered, by the mesh belt, to the drying tank for drying; the hot air temperature was set to be  $80^{\circ}\text{C}$ ;

(5) Third spraying: the coating liquid was sprayed on the front face of the base sheet; when spraying, there was a negative pressure suction box on the back face of the base sheet for negative pressure vacuum suction; the spraying amount was set to be 32% of the total spraying amount;

(6) Third drying: the base sheet, subjected to the third spraying, was delivered, by the mesh belt, to the drying tank for drying; the hot air temperature was set to be  $95^{\circ}\text{C}$ ;

(7) Fourth spraying: the coating liquid was sprayed on the back face of the base sheet; when spraying, there was a negative pressure suction box on the front face of the base sheet for negative pressure vacuum suction; the spraying amount was set to be 26% of the total spraying amount;

(8) Fourth drying: the base sheet, subjected to the fourth spraying, was delivered, by the mesh belt, to the drying tank for drying; the hot air temperature was set to be 90°C;

(9) Adding procedure: glycerol, accounting for 8% of the product, and burley tobacco absolute oil, accounting for 0.5% of the product, were added to paper web;

(10) Status adjusting drying: based on the drying condition of the dry-process reconstituted tobacco leaf, it was determined whether an status adjusting oven was used and which value the temperature should be set if the status adjusting oven was used, so as to ensure the dry-process reconstituted tobacco leaf product had a water content ranging from 10% to 12% and thus the dry-process reconstituted tobacco leaf product for heat-not-burn cigarettes was obtained.

## **Example 2**

Unbleached hemp pulp was used as the plant fiber raw material. The base sheet was designed to have a fixed quantity of 15g/m<sup>2</sup>. The dry-process reconstituted tobacco leaf product was designed to have a fixed quantity of 75g/m<sup>2</sup>. Flue-cured monomer raw material was used as the tobacco raw material. The running speed of the production line was 40m/min. The method and device for producing a dry-process reconstituted tobacco leaf were used for production, as specifically described below.

### **1. Formulation of coating liquid**

(1) Preparation of tobacco powder: flue-cured monomer tobacco leaf with a water content below 10% was used, pulverized by a pulverizer at a low temperature and then sieved by a 40-mesh screen, for later use;

(2) Formulation of coating liquid: the tobacco powder as prepared was evenly mixed with humectant, adhesive, tobacco essence flavor, and suitable amount of water to form coating liquid with a solid content of 25%, for later use.

### **2. Base sheet forming**

The internal humidity during the fiber defibering and the base sheet forming was controlled to be ≥85%. The unbleached hemp pulp with a degree of dryness ≥80% was defibered into monofilament fibers by a fiber defibering device, metered and delivered to a base sheet former, and then subjected to two-group four-stage formation within the base sheet former under the control of the manners such as breaking apart effect of the break-apart roller, internal humidity control, the destaticizing mesh, the negative pressure effect of the

negative pressure vacuum tank and the air uniformizing mechanism to form a base sheet with a fixed quantity of  $15 \text{ g/m}^2$ , for later use.

### 3. Spraying and drying

(1) First spraying: the coating liquid was sprayed on the front face of the base sheet; when spraying, there was a negative pressure suction box on the back face of the base sheet for negative pressure vacuum suction; the spraying amount was set to be 20% of total spraying amount;

(2) First drying: the base sheet, subjected to the first spraying, was delivered, by the mesh belt, to the drying tank for drying; the hot air temperature was set to be  $115^{\circ}\text{C}$ ;

(3) Second spraying: the coating liquid was sprayed on the back face of the base sheet; when spraying, there was a negative pressure suction box on the front face of the base sheet for negative pressure vacuum suction; the spraying amount was set to be 25% of the total spraying amount;

(4) Second drying: the base sheet, subjected to the second spraying, was delivered, by the mesh belt, to the drying tank for drying; the hot air temperature was set to be  $120^{\circ}\text{C}$ ;

(5) Third spraying: the coating liquid was sprayed on the front face of the base sheet; when spraying, there was a negative pressure suction box on the back face of the base sheet for negative pressure vacuum suction; the spraying amount was set to be 30% of the total spraying amount;

(6) Third drying: the base sheet, subjected to the third spraying, was delivered, by the mesh belt, to the drying tank for drying; the hot air temperature was set to be  $135^{\circ}\text{C}$ ;

(7) Fourth spraying: the coating liquid was sprayed on the back face of the base sheet; when spraying, there was a negative pressure suction box on the front face of the base sheet for negative pressure vacuum suction; the spraying amount was set to be 25% of the total spraying amount;

(8) Fourth drying: the base sheet, subjected to the fourth spraying, was delivered, by the mesh belt, to the drying tank for drying; the hot air temperature was set to be  $125^{\circ}\text{C}$ ;

(9) Status adjusting drying: based on the drying condition of the dry-process reconstituted tobacco leaf, it was determined whether an status adjusting oven was used and which value the temperature should be set if the status adjusting oven was used, so as to ensure the dry-process reconstituted tobacco leaf product had a water content ranging from 10% to 12%, and thus flue-cured sheet-like dry-process reconstituted tobacco leaf product was obtained.

### Example 3

Unbleached fluff pulp was used as the plant fiber raw material. The base sheet was designed to have a fixed quantity of  $25\text{g/m}^2$ . The dry-process

reconstituted tobacco leaf product was designed to have a fixed quantity of  $100\text{g/m}^2$ . The tobacco raw material was flue-cured leaf group formula and characteristically fragrant agarwood plant raw material. The running speed of the production line was  $30\text{m/min}$ . The method and device for producing dry-process reconstituted tobacco leaf were used for the production, as specifically described below.

### 1. Formulation of coating liquid

(1) Preparation of tobacco powder: flue-cured leaf group formula and characteristically agarwood fragrant plant raw material both with a water content below 10% were used, pulverized by a pulverizer at a low temperature and then separately sieved by a 150-mesh screen, for later use;

(2) Formulation of coating liquid: the tobacco powder and agarwood powder as prepared were evenly mixed with humectant, adhesive, tobacco essence flavor, and suitable amount of water to form coating liquid with a solid content of 20%, for later use.

### 2. Base sheet forming

The internal humidity during the fiber defibering and the base sheet forming was controlled to be  $\geq 85\%$ . The unbleached fluff pulp with a degree of dryness  $\geq 80\%$  was defibered into monofilament fibers by a fiber defibering device, metered and delivered to a base sheet former, and then subjected to two-group four-stage formation within the base sheet former under the control of the manners such as breaking apart effect of the break-apart roller, internal humidity control, the destaticizing mesh, the negative pressure effect of the negative pressure vacuum tank and the air uniformizing mechanism to form a base sheet with a fixed quantity of  $25\text{g/m}^2$ , for later use.

### 3. Spraying and drying

(1) First spraying: the coating liquid was sprayed on the front face of the base sheet; when spraying, there was a negative pressure suction box on the back face of the base sheet for negative pressure vacuum suction; the spraying amount was set to be 15% of total spraying amount;

(2) First drying: the base sheet, subjected to the first spraying, was delivered, by the mesh belt, to the drying tank for drying; the hot air temperature was set to be  $100^\circ\text{C}$ ;

(3) Second spraying: the coating liquid was sprayed on the back face of the base sheet; when spraying, there was a negative pressure suction box on the front face of the base sheet for negative pressure vacuum suction; the spraying amount was set to be 30% of the total spraying amount;

(4) Second drying: the base sheet, subjected to the second spraying, was delivered, by the mesh belt, to the drying tank for drying; the hot air temperature was set to be  $130^\circ\text{C}$ ;

(5) Third spraying: the coating liquid was sprayed on the front face of the base sheet; when spraying, there was a negative pressure suction box on the back face of the base sheet for negative pressure vacuum suction; the spraying amount was set to be 35% of the total spraying amount;

(6) Third drying: the base sheet, subjected to the third spraying, was delivered, by the mesh belt, to the drying tank for drying; the hot air temperature was set to be 135°C;

(7) Fourth spraying: the coating liquid was sprayed on the back face of the base sheet; when spraying, there was a negative pressure suction box on the front face of the base sheet for negative pressure vacuum suction; the spraying amount was set to be 20% of the total spraying amount;

(8) Fourth drying: the base sheet, subjected to the fourth spraying, was delivered, by the mesh belt, to the drying tank for drying; the hot air temperature was set to be 120°C;

(9) Status adjusting drying: based on the drying condition of the dry-process reconstituted tobacco leaf, it was determined whether the status adjusting oven was used and which value the temperature should be set if the status adjusting oven was used, so as to ensure the dry-process reconstituted tobacco leaf product had a water content ranging from 10% to 12% and thus dry-process reconstituted tobacco leaf product with characteristic agarwood fragrance was obtained.

#### **Example 4**

Unbleached bamboo pulp and tobacco stems were used as the plant fiber raw material. The base sheet was designed to have a fixed quantity of 35g/m<sup>2</sup>. The dry-process reconstituted tobacco leaf product was designed to have a fixed quantity of 50g/m<sup>2</sup>. The tobacco raw material was mixed-type leaf group formula. The running speed of the production line was 20m/min. The method and device for producing a dry-process reconstituted tobacco leaf were used for the production, as specifically described below.

##### **1. Formulation of coating liquid**

(1) Preparation of tobacco powder: raw materials of the mixed-type leaf group formula with a water content below 10% were used, pulverized by a pulverizer at a low temperature and then sieved by a 200-mesh screen, for later use;

(2) Formulation of coating liquid: the tobacco powder as prepared was evenly mixed with humectant, adhesive, tobacco essence flavor, and suitable amount of water to form coating liquid with a solid content of 10%, for later use.

##### **2. Base sheet forming**

The internal humidity during the fiber defibering and the base sheet forming was controlled to be ≥85%. The unbleached bamboo pulp and tobacco stems both with a degree of dryness ≥80% were defibered into monofilament fibers

by a fiber defibering device, separately metered and delivered to a base sheet former by a plurality of fiber delivering tubes, and then subjected to two-group four-stage formation within the base sheet former under the control of the manners such as breaking apart effect of the break-apart roller, internal humidity control, the destaticizing mesh, the negative pressure effect of the negative pressure vacuum tank and the air uniformizing mechanism to form a base sheet with a fixed quantity of 35g/m<sup>2</sup>, for later use.

### 3. Spraying and drying

(1) First spraying: the adhesive was sprayed on the front face of the base sheet; when spraying, there was a negative pressure suction box on the back face of the base sheet for negative pressure vacuum suction; the spraying amount was set to be 1.5% of the total amount of the base sheet;

(2) First drying: the base sheet, subjected to the first spraying, was delivered, by the mesh belt, to the drying tank for drying; the hot air temperature was set to be 80°C;

(3) Second spraying: the adhesive was sprayed on the back face of the base sheet; when spraying, there was a negative pressure suction box on the front face of the base sheet for negative pressure vacuum suction; the spraying amount was set to be 1.5% of the total amount of the base sheet;

(4) Second drying: the base sheet, subjected to the second spraying, was delivered, by the mesh belt, to the drying tank for drying; the hot air temperature was set to be 90°C;

(5) Third spraying: the coating liquid was sprayed on the front face of the base sheet; when spraying, there was a negative pressure suction box on the back face of the base sheet for negative pressure vacuum suction; the spraying amount was set to be 50% of the total spraying amount;

(6) Third drying: the base sheet, subjected to the third spraying, was delivered, by the mesh belt, to the drying tank for drying; the hot air temperature was set to be 110°C;

(7) Fourth spraying: the coating liquid was sprayed on the back face of the base sheet; when spraying, there was a negative pressure suction box on the front face of the base sheet for negative pressure vacuum suction; the spraying amount was set to be 50% of the total spraying amount;

(8) Fourth drying: the base sheet, subjected to the fourth spraying, was delivered, by the mesh belt, to the drying tank for drying; the hot air temperature was set to be 100°C;

(9) Status adjusting drying: based on the drying condition of the dry-process reconstituted tobacco leaf, it was determined whether the status adjusting oven was used and which value the temperature should be set if the status adjusting oven was used, so as to ensure the dry-process reconstituted

tobacco leaf product had a water content ranging from 10% to 12%, and thus the dry-process reconstituted tobacco leaf product for a filter rod was obtained.

Referring to Figs. 2-6, the present example further discloses a device for producing a dry-process reconstituted tobacco leaf. The device for producing a dry-process reconstituted tobacco leaf includes a fiber defibering means, a base sheet forming means, a spraying means and a drying means. The fiber defibering means is configured to pulverize and defiber plant fibers. The base sheet forming means is configured to make the pulverized and defibered fibers formed into a base sheet. The spraying means is configured to spray coating liquid onto the base sheet. The drying means is configured to dry the base sheet on which the coating liquid is loaded, so as to obtain the dry-process reconstituted tobacco leaf.

Specifically, the fiber defibering means includes fiber frame 1 as well as a rough pulverizer 2, a fine pulverizer 3 and a fiber metering means 4, with the rough pulverizer, the fine pulverizer and the fiber metering means connected in sequence. The fiber frame 1 is configured to support the plant fibers. The rough pulverizer 2 and the fine pulverizer 3 are configured to pulverize and defiber the plant fibers. The fiber metering means 4 is configured to precisely control output quantity of the fibers.

The fiber defibering means further includes a humidifying means 5. The humidifying means is communicated with both a first air inlet 6 of the rough pulverizer 2 and a second air inlet 7 of the fiber metering means 4, and is configured to humidify the air within the rough pulverizer 2, the fine pulverizer 3 and the fiber metering means 4.

The base sheet forming means includes a forming frame 14 and a plurality of fiber delivering tubes 8, a screening drum 9, a mesh belt 11, a plurality of guide rollers 12 and a first negative pressure tank 13 which are all provided on the forming frame 14. Each of the plurality of fiber delivering tubes 8 is communicated with the inlet of the screening drum 9. A break-apart roller 10 is provided within the screening drum 9, for breaking apart the fibers entering the screening drum. The mesh belt 11 is located below the screening drum 9 and corresponds to the outlet of the screening drum 9. The mesh belt 11 is configured to gather the fibers output from the screening drum 9 and make the fibers into a base sheet. The mesh belt 11 is supported and driven by the plurality of guide rollers 12, so as to operate in cycles. The first negative pressure tank 13 is provided within the area enclosed by the mesh belt 11, and configured to draw the fibers to be gathered and be formed on the mesh belt 11.

The base sheet forming means includes a humidity controller and a destaticizing mesh. The humidity controller is configured to control the ambient humidity during a formation process of the base sheet. The destaticizing mesh is provided in the screening drum and configured to reduce the statics during a formation process of the base sheet.

The spraying means include a spraying frame as well as a storage tank, a buffer 17 and a nozzle 21, with the storage tank, the buffer and the nozzle connected in sequence. The storage tank is configured to store the coating liquid. And the storage tank is provided with a constant pressurizer to ensure coating liquid output. The buffer 17 is provided on the spraying frame for adjusting the flow velocity and pressure of the coating liquid. The spraying frame 16 is provided with a mounting case 15. The mounting case 15 is provided with a buffer mounting bracket 18. The buffer mounting bracket 18 is provided with a main nozzle bracket 19. The main nozzle bracket 19 is provided with a plurality of auxiliary nozzle brackets 20. The buffer 17 is mounted to the buffer mounting bracket 18. There are a plurality of nozzles 21 which are respectively provided on the plurality of auxiliary nozzle brackets 20. The nozzle 21 is provided with a compressed air inlet to ensure the spraying effect of the nozzle and thus improves the quality of the formed base sheet.

The drying means includes an air circulating means, a drying tank and a dehumidifying means 24. The air circulating means includes an air circulating passage, a heating means configured to heat the air within the air circulating passage and a negative pressure fan 25 configured to drive the heated air within the air circulating passage to circulate. The inlet (i.e. the third air inlet 26) and outlet of the air circulating passage are both communicated with the drying tank. The drying tank is configured to store the base sheet to be dried. A guide plate 22 and a second negative pressure tank 23 are provided within the drying tank. The guide plate 22 is configured to guide the flow direction of the air in the drying tank. The second negative tank 23 works with the negative pressure fan 25, so as to ensure circulation of the air. The dehumidifying means 24 is provided on the drying tank for removing the moisture within the drying tank.

Specifically, the device for producing a dry-process reconstituted tobacco leaf for heat-not-burn cigarettes, combining the characteristics of heat-not-burn cigarette core materials, add a smoke agent and/or tobacco essence flavor adding device and an online moisture monitoring device on the basis of conventional devices for producing sheet-like dry-process reconstituted tobacco leaf products, and thus further ensures a good and stable quality for the products.

The examples of the present disclosure provide a dry-process reconstituted tobacco leaf. The dry-process reconstituted tobacco leaf is produced by the above method or device for producing a dry-process reconstituted tobacco leaf.

Specifically, dry-process reconstituted tobacco leaf product is a new reconstituted tobacco leaf product produced by dry-process reconstituted tobacco leaf production process using tobacco raw materials e.g. plant fibers, dry tobacco powder, and tobacco pieces, as well as adhesive, tobacco essence flavor, humectant and/or smoke agent and other auxiliary ingredients, in view of a dry air forming process.

Furthermore, dry-process reconstituted tobacco leaf are used in the same way as paper-making reconstituted tobacco in the cigarette industry, but with characteristics such as higher filling value, richer fragrance, lower water consumption, better environmental friendliness and higher comprehensive utilization ratio of tobacco raw materials.

Furthermore, the dry-process reconstituted tobacco leaf for a filter rod may be used for the filter of a regular burning cigarette. In this way, a novel form is created, where the cigarette filter and the cut tobacco are both made from tobacco leaf substances, and this can further effectively improve the smoke flavor of cigarettes, preserve moisture and enhance fragrance.

Furthermore, dry-process reconstituted leaf products for heat-not-burn cigarettes can bear a high proportion of tobacco raw materials, smoke agent and/or tobacco flavor raw materials, and thus provide a material basis for a good sensory quality for heat-not-burn cigarette products.

Furthermore, the dry-process reconstituted tobacco leaf products for heat-not-burn cigarettes have the high reducibility and the loose and porous physical structure of effective tobacco ingredients, which provides a structural basis for efficient smoke formation of the produced heat-not-burn cigarettes and effective volatilization of formed smoke, and thus further guarantees a high sensory quality and experience for the heat-not-burn cigarette products.

Furthermore, the dry-process reconstituted tobacco leaf products for filter rods and for heat-not-burn cigarettes can well adapt to the forming process, composite process and cigarette making packing process for paper filter rods, making it well adaptive to processing.

## **Industrial applicability**

### **Overall effect**

Compared with the prior art, the technical solutions of the present disclosure are featured by simple process flow, low water consumption and high utilization ratio of raw materials and have their industrial applicability.

**Claims:**

1. A method for producing a dry-process reconstituted tobacco leaf, characterized by comprising steps of:

pulverizing and defibering, under an anhydrous condition, plant fibers to generate a base sheet by a dry air forming manner, which comprises performing a destaticization process on monofilament fibers;

mixing tobacco powder with water, adhesive, smoke agent, tobacco essence flavor and humectant to provide coating liquid; and

loading the coating liquid onto the base sheet and performing a drying process, to generate the dry-process reconstituted tobacco leaf,

wherein the reconstituted tobacco leaf has a loose and porous physical structure.
2. The method for producing a dry-process reconstituted tobacco leaf according to claim 1, characterized in that the plant fibers comprise one or more selected from the group consisting of hemp pulp, bamboo pulp and wood pulp.
3. The method for producing a dry-process reconstituted tobacco leaf according to claim 1, characterized in that the tobacco powder is obtained by pulverizing tobacco raw materials under an anhydrous condition.
4. The method for producing a dry-process reconstituted tobacco leaf according to claim 1, characterized in that the smoke agent comprises glycerol, propylene glycol and sorbitol, and the tobacco essence flavor comprises burley tobacco absolute oil, cocoa extractive, tobacco leaf extractive and aromatic tobacco concrete.
5. The method for producing a dry-process reconstituted tobacco leaf according to claim 1, characterized in that the step of loading the coating liquid onto the base sheet comprises spraying, in a non-physical contact manner, the coating liquid onto the base sheet.
6. The method for producing a dry-process reconstituted tobacco leaf according to claim 1, characterized in that the method for producing a dry-process reconstituted tobacco leaf further comprises rewinding, calendering and cutting the dry-process reconstituted tobacco leaf, so as to use it as a core material for a cigarette filter or a heat-not-burn cigarette.
7. The method for producing a dry-process reconstituted tobacco leaf according to claim 1, characterized in that the step of performing a drying process comprises placing, into heated air, for drying, the base sheet on which the coating liquid is loaded.

8. The method for producing a dry-process reconstituted tobacco leaf according to claim 1, characterized in that the step of loading the coating liquid onto the base sheet and performing a drying process comprises:
  - spraying the coating liquid onto a front face of the base sheet and then performing a drying process, if a back face of the base sheet is under a negative pressure;
  - spraying the coating liquid onto a back face of the base sheet and performing a drying process, if a front face of the base sheet is under a negative pressure.
9. A device for producing a dry-process reconstituted tobacco leaf according to the method of claim 1 for producing the dry-process reconstituted tobacco leaf, characterized by comprising:
  - a fiber defibering means configured to pulverize and defiber plant fibers under an anhydrous condition;
  - a base sheet forming means configured to make the pulverized and defibered plant fibers formed into a base sheet by a dry air forming manner;
  - a spraying means configured to spray coating liquid onto the base sheet; and
  - a drying means configured to dry the base sheet on which the coating liquid is loaded, so as to obtain the dry-process reconstituted tobacco leaf, wherein the reconstituted tobacco leaf has a loose and porous physical structure.
10. The device for producing a dry-process reconstituted tobacco leaf according to claim 9, characterized in that the fiber defibering means comprises a fiber frame as well as a rough pulverizer and a fine pulverizer, with the rough pulverizer and the fine pulverizer connected in sequence, wherein the fiber frame is configured to support the plant fibers, and the rough pulverizer and the fine pulverizer are configured to pulverize and defiber the plant fibers.
11. The device for producing a dry-process reconstituted tobacco leaf according to claim 10, characterized in that the fiber defibering means further comprises a fiber metering means, wherein the rough pulverizer, the fine pulverizer and the fiber metering means are connected in sequence, and the fiber metering means is configured to precisely control output quantity of the fibers.
12. The device for producing a dry-process reconstituted tobacco leaf according to claim 11, characterized in that the fiber defibering means further comprises a humidifying means, the humidifying means is

configured to humidify air within the rough pulverizer, the fine pulverizer and the fiber metering means.

13. The device for producing a dry-process reconstituted tobacco leaf according to claim 9, characterized in that the base sheet forming means comprises a plurality of fiber delivering tubes, a screening drum, a mesh belt, a plurality of guide rollers and a first negative pressure tank, each of the plurality of fiber delivering tubes is communicated with the screening drum, the mesh belt is located below the screening drum and configured to gather fibers output from the screening drum so that the base sheet is formed, the mesh belt is supported and driven by the plurality of guide rollers, so as to operate in cycles, and the first negative pressure tank is provided within an area enclosed by the mesh belt and configured to draw the fibers to be gathered on the mesh belt.
14. The device for producing a dry-process reconstituted tobacco leaf according to claim 13, characterized in that a break-apart roller is provided within the screening drum.
15. The device for producing a dry-process reconstituted tobacco leaf according to claim 13, characterized in that the base sheet forming means comprises a humidity controller and a destaticizing mesh, the humidity controller is configured to control ambient humidity during a formation process of the base sheet, and the destaticizing mesh is provided in the screening drum and configured to reduce statics during the formation process of the base sheet.
16. The device for producing a dry-process reconstituted tobacco leaf according to claim 9, characterized in that the spraying means comprises a storage tank, a buffer and a nozzle communicated in sequence, the storage tank is configured to store the coating liquid, and the buffer is configured to adjust flow velocity and pressure of the coating liquid.
17. The device for producing a dry-process reconstituted tobacco leaf according to claim 16, characterized in that the storage tank is provided with a constant pressurizer and the nozzle is provided with a compressed air inlet.
18. The device for producing a dry-process reconstituted tobacco leaf according to claim 9, characterized in that the drying means comprises an air circulating means and a drying tank, wherein the air circulating means comprises an air circulating passage, a heating means and a negative pressure fan, the heating means is configured to heat air within the air circulating passage, and the negative pressure fan is configured to drive the heated air within the air circulating passage to circulate, an inlet and an outlet of the air circulating passage are both communicated with the drying tank, the drying tank is configured to store the base sheet to be

dried, a guide plate and a second negative pressure tank are provided within the drying tank, the guide plate is configured to guide a flow direction of air in the drying tank, and the second negative tank works with the negative pressure fan to ensure circulation of the air.