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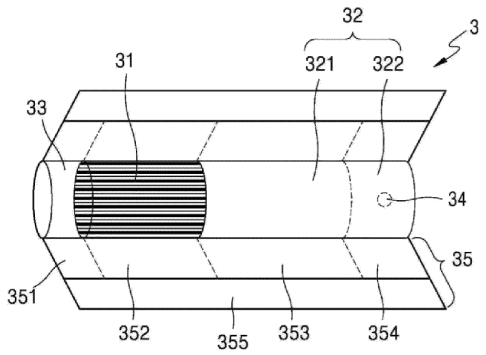
## (54) SMOKING ARTICLE INCLUDING LYOCELL TOW

(57) Provided is a smoking article. The smoking article includes a tobacco rod, a front-end plug arranged on one side of the tobacco rod and having at least one channel formed therein, a first segment arranged on the other side opposite to the one side of the tobacco rod, and a second segment arranged on the other side of the first segment, wherein the tobacco rod includes lyocell tow including a plurality of lyocell fibers, and a medium substrate.

FIG. 4

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## Description

[Technical Field]

**[0001]** The present invention relates to a smoking article which includes lyocell tow in a tobacco rod including a tobacco material (for example, a tobacco material which may be included in a medium substrate) to improve the settling rate of the tobacco material (for example, a tobacco material which may be included in a medium substrate) and prevent the medium portion from being deformed by heat applied to heat the smoking article, thereby providing a user (a consumer) with a more improved smoking experience.

[Background Art]

**[0002]** Modern smoking alternative devices and related technologies have adopted a structure that uses various medium portions to effectively transfer tobacco components. In general, the devices use the principle that a stick is heated to a high temperature of approximately 150 to 300 degrees (°C) and this heat is transferred to a medium portion to increase the temperature of the medium portion, thereby smoothly transferring the tobacco components such as nicotine and the like.

**[0003]** In particular, components such as glycerin play an important role in generating an aerosol to provide smokers with a sense of satisfaction from smoking. However, when the heating temperature of the device is set below the boiling point of glycerin, atomization does not occur smoothly, which has the disadvantage of deteriorating the smoking experience.

**[0004]** To solve such problems, techniques in which a medium portion contains a humectant or a reconstituted tobacco leaf is used as the medium portion have been developed in the art. Specifically, a method of cutting a reconstituted tobacco leaf including a humectant lengthwise to form a medium portion or inserting a reconstituted tobacco leaf manufactured in a sheet form has been used. Although such a method has provided a certain level of performance improvement, it still has the following problems.

**[0005]** First, in the process of cutting the reconstituted tobacco leaf to insert the cut reconstituted tobacco leaf into the medium portion, there were cases in which some of the cut reconstituted tobacco leaf moved into the internal structure of the device, such as a paper tube or a front tube, thereby causing contamination. This became a factor that contaminates the internal structure of the device or interferes with the adhesion of the tobacco stick.

**[0006]** Second, when only a reconstituted tobacco leaf was used, it was difficult to include additional components such as activated carbon and nicotine liquid during the manufacturing process. Although these additional components are useful for enhancing the transfer efficiency of tobacco components, their application was limited in the structure of the medium portion based on the reconstituted tobacco leaf.

**[0007]** As a way to improve these problems, a method of utilizing a folding-type paper base was proposed. When components such as activated carbon, nicotine salt, and granules are included in the folding-type paper base, a method of configuring the medium portion provided flexibility so that the medium portion can include various components. However, this method also had some limitations. Since the folding structure did not structurally bind the components tightly, the loss rate (dropout rate) of the components was high during the manufacturing process, and the paper smell and off-flavor (external smell) generated from the paper base deteriorated the user's smoking experience.

**[0008]** Also, in the related art, there have been attempts to stably fix substances such as activated carbon, nicotine salt, and granules by applying a dual composite filter (***e.g.,*** an activated carbon CA filter (***i.e.,*** an activated carbon cellulose acetate filter) and a CA filter (***i.e.,*** a cellulose acetate filter)) or a single filter to the medium portion. The activated carbon CA filter is suitable for effectively fixing the components structurally, but the cellulose acetate tow constituting the filter has a disadvantage of melting at high temperatures, which makes it difficult to use in a high-temperature environment.

[Disclosure]

[Technical Problem]

**[0009]** One object of the present invention is to provide a smoking article which includes lyocell tow in a tobacco rod including a tobacco material (for example, a tobacco material which may be included in a medium substrate) to improve the settling rate of the tobacco material and prevent a tobacco rod from being deformed by heat applied to heat the smoking article, thereby providing a user with a more improved smoking experience.

**[0010]** The objects of the present invention are not limited to those mentioned above, and other unmentioned objects can be clearly understood by those of ordinary skill in the art to which the present invention pertains from the description below.

[Technical Solution]

**[0011]** One aspect of the present application for achieving the one object provides a smoking article including: a tobacco rod, a front-end plug arranged on one side of the tobacco rod and having at least one channel formed therein, a first segment arranged on the other side opposite to the one side of the tobacco rod, and a second segment arranged on the other side of the first segment, wherein the tobacco rod includes lyocell tow including a plurality of lyocell fibers, and a medium substrate. In some embodiments, the front-end plug, the tobacco rod, the first segment, and the second segment may be sequentially arranged along the longitudinal direction of the smoking article.

**[0012]** In some embodiments, the medium substrate may be filled in a dispersed form in the lyocell tow. This means that the lyocell tow may include the medium substrate in a dispersed form.

**[0013]** In some embodiments, the medium substrate may be located in a space between the plurality of lyocell fibers.

**[0014]** In some embodiments, the medium substrate may include a tobacco material, and may be is in the form of at least one of tobacco particles, tobacco sheets, tobacco beads, tobacco granules, and tobacco powder.

**[0015]** In some embodiments, the medium substrate may include a plurality of tobacco granules in the form of granules including the tobacco material.

**[0016]** In some embodiments, the first segment may have a tube shape having a hollow formed therein, and the second segment may include at least one of cellulose acetate (hereinafter, may be abbreviated as "CA") and lyocell.

**[0017]** In some embodiments, the first segment may include at least one of a cellulose acetate filter, a lyocell filter, and a paper tube filter.

**[0018]** In some embodiments, the smoking article may further include a wrapper configured to wrap at least one of the tobacco rod, the front-end plug, the first segment, and the second segment.

**[0019]** Another aspect of the present application for achieving the one object provides a system including the above-described smoking article and an aerosol generation device to which the smoking article is applied.

[Advantageous Effects]

**[0020]** Since a smoking article according to one embodiment includes lyocell tow in a tobacco rod including a tobacco material (for example, a tobacco material which may be included in a medium substrate), the settling rate of the tobacco material can be improved and the tobacco rod can be prevented from being deformed by heat applied to heat the smoking article, thereby providing a user with a more improved smoking experience.

**[0021]** Advantageous effects according to the technical spirit of the present disclosure are not limited to those mentioned above, and other unmentioned advantageous effects can be clearly understood by those of ordinary skill in the art from the description below.

[Description of Drawings]

**[0022]**

FIGS. 1 to 3 are diagrams showing examples of smoking articles inserted into an aerosol generation device.
FIG. 4 is a diagram showing a smoking article according to one embodiment.
FIG. 5 is an image obtained by photographing filters of Example 1 and Comparative Example 1 before and after heating so as to compare the heat resistance characteristics of the filters of Example 1 and Comparative Example 1.
FIG. 6 is an image obtained by photographing a tobacco rod of Example 2 and a tobacco rod of Comparative Example 2. Here, FIG. 6A is an image obtained by photographing the tobacco rods of Comparative Example 2 and Example 2 before the experiment (before smoking), and FIG. 6B is an image obtained by photographing the tobacco rods of Comparative Example 2 and Example 2 after the experiment (after smoking).

[Mode for Invention]

**[0023]** Hereinafter, preferred embodiments of the present disclosure will be described in detail with reference to the accompanying drawings. Advantages and features of the present disclosure and methods of achieving the same should become clear with embodiments described in detail below with reference to the accompanying drawings. However, the technical spirit of the present disclosure is not limited to the following embodiments and may be implemented in various different forms. The following embodiments are only provided to make the technical spirit of the present disclosure complete and completely inform those of ordinary skill in the art to which the present disclosure pertains of the scope of the present disclosure. The technical spirit of the present disclosure is defined only by the scope of the claims.

**[0024]** In assigning reference numerals to components in each of the drawings, it should be noted that the same reference numerals are assigned to the same components wherever possible even when the components are shown in

different drawings. Also, in describing the present disclosure, when it is determined that the detailed description of a known related configuration or function may obscure the gist of the present disclosure, the detailed description thereof will be omitted.

**[0025]** Unless otherwise defined, all terms (including technical or scientific terms) used herein have the same meaning as commonly understood by those of ordinary skill in the art to which the present disclosure pertains. Also, terms defined in commonly used dictionaries should not be interpreted in an idealized or overly formal sense unless expressly so defined herein. Terms used herein are for describing the embodiments and are not intended to limit the present disclosure. In the present specification, a singular expression includes a plural expression unless the context clearly indicates otherwise.

**[0026]** Also, in describing components of the present disclosure, the terms such as first, second, A, B, (a), and (b) may be used. Such terms are only used for distinguishing one component from another component, and the essence, order, sequence, or the like of the corresponding component is not limited by the terms. In a case in which a certain component is described as being "connected," "coupled," or "linked" to another component, it should be understood that, although the component may be directly connected or linked to the other component, still another component may also be "connected," "coupled," or "linked" between the two components.

**[0027]** The terms "comprises" and/or "comprising" used herein do not preclude the presence or addition of one or more components, steps, operations, and/or devices other than those mentioned.

**[0028]** First, some terms used herein will be clarified.

**[0029]** In the present specification, a "smoking article" may refer to any product that can be smoked or any product that can provide a smoking experience, regardless of whether the product is based on tobacco, tobacco derivatives, expanded tobacco, reconstituted tobacco, or tobacco substitutes. For example, the smoking article may include products that can be smoked, such as cigarettes, cigars, and cigarillos.

**[0030]** In the present specification, a "smoking material" may refer to any type of material that may be used in a smoking article.

**[0031]** In the present specification, "user" may be used interchangeably with "consumer."

**[0032]** In the present specification, "upstream" or "upstream direction" may refer to a direction moving away from an oral region of a smoker, and "downstream" or "downstream direction" may refer to a direction approaching the oral region of the smoker.

**[0033]** In the present specification, a "longitudinal direction" may refer to a direction corresponding to the longitudinal axis of a smoking article. The "longitudinal axis" of the smoking article may refer to an imaginary line that extends along the main longitudinal direction of the smoking article. This axis typically runs from one end of the smoking article *(e.g.,* the mouthpiece or filter end) to the opposite end (*e.g.,* the combustion or heat source end).

**[0034]** In the present specification, a "lyocell filter" refers to a filter that includes or is composed of lyocell tow.

**[0035]** In the present specification, "lyocell tow" includes or is composed of a plurality of lyocell fibers. In some embodiments, the lyocell tow may refer to a bundle formed by cross-linking adjacent lyocell fibers.

**[0036]** In the present specification, "lyocell fiber" may refer to a fiber made of lyocell cellulose. In particular, the lyocell fiber may be a fiber made of cellulose derived from or mainly derived from wood pulp, particularly a semi-synthetic fiber.

**[0037]** In the present specification, a "reconstituted tobacco leaf" refers to a tobacco leaf reconstituted from tobacco materials.

**[0038]** In the present specification, a "reconstituted tobacco leaf" or "reconstituted tobacco sheet" may refer to a sheet made by combining tobacco by-products selected from the group consisting of stems, dust, particulates and a combination thereof with a binder. In some embodiments, the reconstituted tobacco leaf is a homogenized tobacco leaf.

**[0039]** In the present specification, a "non-circular cross-section" is defined as a cross-section having a shape including a plurality of protrusions instead of having a circular shape. For example, a cross-section having a shape in which a plurality of protrusions branch and/or extend from the center and/or the center of that cross-section may be referred to as a "non-circular cross-section." Here, the "protrusion" may refer to a distinct and extended segment or arm extending outward from the central core or joining point of the cross-section of the lyocell fiber.

**[0040]** In some embodiments, the lyocell fibers may have a Y-shaped cross-section with three protrusions branching and/or extending from the center and/or the center of the cross-section, a cross-shaped cross-section with four protrusions, a star-shaped cross-section with five protrusions, or may also have an O-shaped cross-section, but the present invention is not limited thereto.

**[0041]** In some embodiments, the lyocell fibers may include three or more protrusions branching and/or extending from the center and/or the center of the cross-section. Preferably, the lyocell fibers may include three protrusions.

**[0042]** In some embodiments, the lyocell fibers included in the lyocell tow may have a Y-shaped cross-section in terms of application to cigarette filters.

**[0043]** In the present specification, the "wrapping" of a smoking article by a wrapper may refer to at least a portion of the peripheral surface along the longitudinal axis of the smoking article being surrounded by the wrapper.

**[0044]** In the present specification, a "tubular rod" may refer to a filter rod including a hollow formed therein, whereas a filter rod including no hollow formed therein may be referred to as a "cylindrical rod."

**[0045]** In the present specification, the term "recessed rod" as the filter rod may refer to a filter rod including one or more pores.

**[0046]** In the present specification, a "recess filter" may refer to a filter including one or more pores.

**[0047]** In the present specification, a "hollow" may refer to a channel extending along in a longitudinal direction.

**[0048]** In the present specification, the cross-sectional shape of a channel formed in a front-end plug, which is "trilobal," "quadlobal," or "multilobal," may refer to a cross-section having a shape in which three, four or more protrusions branch and/or extend from the center of the cross-section of the channel, respectively. Here, the "protrusion" may refer to a distinct and extended segment or arm extending outward from the central core or joining point of the cross-section of the channel.

**[0049]** In the present specification, "basis weight" refers to a mass per unit area of wrapping paper and/or a wrapper. The basis weight of the wrapping paper and/or wrapper may be determined by measuring the mass and area of the wrapping paper and/or wrapper and dividing the mass of the wrapping paper and/or wrapper by the area. The unit of the basis weight may be gram per square meter (gsm), *i.e.,* $g/m^2$.

**[0050]** In the present specification, "hard wrapping paper" refers to a wrapping paper having a basis weight greater than or equal to a certain value.

**[0051]** In some embodiments, "grease-resistant wrapping paper" may refer to wrapping paper that is surface-treated to be grease-resistant, and "grease-resistant hard wrapping paper" may refer to hard wrapping paper that is surface-treated to be grease-resistant.

**[0052]** In some embodiments, "general wrapping paper" may refer to wrapping paper that is not surface-treated to be grease-resistant, and "general hard wrapping paper" may refer to hard wrapping paper that is not surface-treated to be grease-resistant.

**[0053]** In the present specification, the "single fiber fineness" of lyocell tow or cellulose acetate tow refers to a fiber fineness of a single strand of monofilament separated from a multifilament of lyocell fibers or cellulose acetate fibers constituting the lyocell tow or cellulose acetate tow.

**[0054]** **In** the present specification, the "total fiber fineness" of lyocell tow or cellulose acetate tow refers to a fiber fineness of a multifilament of lyocell fibers or cellulose acetate fibers constituting the lyocell tow or cellulose acetate tow.

**[0055]** A filter of the smoking article according to one aspect of the present invention may collect at least a portion of smoke components generated when the smoking article is smoked. **In** some embodiments, the filter of the smoking article may collect the total particulate matter (hereinafter, may be abbreviated as "TPM") including at least a portion of at least one of nicotine (hereinafter, may be abbreviated as "Nic"), tar, propylene glycol (hereinafter, may be abbreviated as "PG"), and glycerin (hereinafter, may be abbreviated as "Gly") included in the smoke components generated when the smoking article is smoked.

**[0056]** **In** the present specification, "roundness" refers to a degree of deviation from a geometric circle. For example, the roundness of a filter may be defined as (radius of smaller circle/radius of larger circle) $\times$ 100% when two imaginary circles that come into contact with at least one point of the outer circumference of the filter in the cross-section of the filter and have the smallest distance from each other among concentric circles with different radii are drawn.

**[0057]** In the present specification, "resistance to draw" refers to a difference in static pressure between both ends of a sample when an airflow passes through the sample. **In** the present specification, "PDC" refers to a value obtained by measuring the resistance to draw in a state in which the tobacco rod is open, the perforations of the filter rod are blocked, and the inflow of outside air is blocked, and "PDO" refers to a value obtained by measuring the resistance to draw in a state in which the tobacco rod is open, the perforations of the filter rod are not blocked, and the inflow of outside air is allowed. For example, the resistance to draw may be measured using the method specified in ISO standard 6565:2015. According to ISO standard 6565:2015, the resistance to draw may refer to a difference in static pressure between both ends of the sample when an airflow passes through the sample under normal conditions (22 $\pm$ 2°C and 60 $\pm$ 5% relative humidity) with a volume flow rate of 17.5 mm/s at the discharge end.

**[0058]** In some embodiments, room temperature may refer to 20°C to 25°C.

**[0059]** In the present specification, when no separate physical quantity is indicated, the term "component %" and "component proportion" refer to the % by weight of the component and the weight proportion of the component, respectively.

**[0060]** In the present specification, "puff" refers to an action of drawing or inhaling the air through a smoking article to produce and inhale smoke or vapor. "Puff count" may refer to the total number of drawing and inhalation actions during use of the smoking article. Alternatively or additionally, the puff count may represent the maximum number of drawing and inhalation actions that the smoking article can provide before it is completely consumed or ceases to function.

**[0061]** In the present specification, Health Canada (HC) conditions may include a puff volume of 55 mL, a puff frequency of 30 seconds, and a puff duration of 2 seconds. Particularly, the HC conditions may be based on a state in which the perforations of a filter are blocked. In measurement under the HC conditions, the puff count may be 9.

**[0062]** In the present specification, the "ventilation rate (hereinafter, may be abbreviated as "Vent")" of a smoking article may be defined as the ratio (expressed as a percentage) of the total volume flow rate (e.g., mL/s) of air entering the smoking article without burning or heating through the front region, that is, the longitudinal upstream end, of the smoking article to

the total volume flow rate (e.g., mL/s) of air at the outlet, that is, the longitudinal downstream end, of the smoking article. For example, the ventilation rate may be measured according to ISO 9512:2019. For example, the total volume flow rate of air entering the smoking article without burning or heating through the front region of the smoking article may be the total volume flow rate of air entering in a direction perpendicular to the longitudinal direction of the smoking article. For example, the total volume flow rate of air entering the smoking article without burning or heating through the front region of the smoking article may be the total volume flow rate of air entering the smoking article through wrapping paper.

**[0063]** The contents of the components in the total particulate matter (TPM) of the collected smoke may be analyzed by gas chromatography-mass spectrometry (GC/MS). For example, in the case of tar or nicotine, a Cambridge filter (Cambridge filter pad (CFP)) on which the smoke components are collected is immersed in isopropyl alcohol (IPA) for a predetermined time (for example, 20 minutes to 16 hours), treated using a shaker device, and then passed through a polytetrafluoroethylene (PTFE) syringe filter to remove impurities. Thereafter, the contents of the components included in the total particulate matter (TPM) of the collected smoke may be measured using a GC/MS device. The immersion time may be 20 minutes or more, particularly for tar or nicotine.

**[0064]** The amount of components (particularly, the amount of nicotine components) remaining inside a filter (particularly, a lyocell filter and/or lyocell tow) and/or segments and the like constituting the tobacco rod after smoking may be measured by immersing the tobacco rod, the filter and/or segments, and the like in water after smoking to extract the residual components (particularly, the nicotine components) and analyzing the residual components using a GC/MS device. At this time, the tobacco rod, the filter and/or segments, and the like are immersed overnight (for example, for 12 to 16 hours) in a container containing distilled water, and a solution containing the components extracted thereby may be utilized for GC/MS analysis. The immersion time may be particularly 16 hours.

**[0065]** The GC/MS may be, for example, a measuring device from Agilent.

**[0066]** Hereinafter, various embodiments of the present disclosure will be described in detail with reference to the accompanying drawings.

**[0067]** FIGS. 1 to 3 are diagrams showing examples of smoking articles inserted into an aerosol generation device.

**[0068]** Referring to FIG. 1, an aerosol generation device 1 includes a battery 11, a controller 12, and a heater 13. Referring to FIGS. 2 and 3, the aerosol generation device 1 further includes a vaporizer 14. Also, a smoking article 3 may be inserted into the internal space of the aerosol generation device 1.

**[0069]** Components related to the present embodiment are shown in the aerosol generation device 1 shown in FIGS. 1 to 3. Accordingly, a person skilled in the art related to the present embodiment will understand that the aerosol generation device 1 may further include other general-purpose components in addition to the components shown in FIGS. 1 to 3.

**[0070]** Also, although FIGS. 2 and 3 show that the aerosol generation device 1 includes a heater 13, the heater 13 may be omitted when necessary. In some embodiments, the aerosol generation device 1 does not include a heater. In some embodiments, the battery 11, the controller 12, and the vaporizer 14 are arranged sequentially, that is, arranged in a row, along the longitudinal direction of the smoking article 3.

**[0071]** FIG. 1 shows that the battery 11, the controller 12, and the heater 13 are arranged in a row. In some embodiments, the battery 11, the controller 12, and the heater 13 are arranged sequentially along the longitudinal direction of the smoking article 3. Also, FIG. 2 shows that the battery 11, the controller 12, the vaporizer 14, and the heater 13 are arranged in a row along the longitudinal direction of the smoking article 3. In some embodiments, the battery 11, the controller 12, the vaporizer 14, and the heater 13 are arranged sequentially, that is, arranged in a row, along the longitudinal direction of the smoking article 3. In addition, FIG. 3 shows that the vaporizer 14 and the heater 13 are arranged in parallel. However, the internal structure of the aerosol generation device 1 is not limited to those shown in FIGS. 1 to 3. In other words, the arrangement of the battery 11, the controller 12, the heater 13, and the vaporizer 14 may vary depending on the design of the aerosol generation device 1. In some embodiments, the battery 11, the controller 12, and the heater 13 are arranged sequentially along the longitudinal direction of the smoking article 3.

**[0072]** When the smoking article 3 is inserted into the aerosol generation device 1, the aerosol generation device 1 may operate the heater 13 and/or vaporizer 14 to generate an aerosol. The aerosol generated by the heater 13 and/or vaporizer 14 is delivered to a user through the smoking article 3.

**[0073]** When necessary, the aerosol generation device 1 may heat the heater 13 even when the smoking article 3 is not inserted into the aerosol generation device 1.

**[0074]** The battery 11 supplies the power used to operate the aerosol generation device 1. For example, the battery 11 may supply power to heat the heater 13 or the vaporizer 14 and may supply the power required for the controller 12 to operate. Also, the battery 11 may supply the power required for the displays, sensors, motors, and the like installed in the aerosol generation device 1 to operate.

**[0075]** The controller 12 may control the overall operation of the aerosol generation device 1. In particular, the controller 12 may control the operation of not only the battery 11, the heater 13, and the vaporizer 14, but also other components that may be included in the aerosol generation device 1. Also, the controller 12 may also check the status of each of the components of the aerosol generation device 1 to determine whether the aerosol generation device 1 is in an operable state.

**[0076]** The controller 12 may include at least one processor. The processor may be implemented as an array of multiple logic gates, or may also be implemented as a combination of a general-purpose microprocessor and a memory in which a program that may be executed by the microprocessor is stored. Also, it will be understood by those skilled in the art to which the present disclosure pertains that the processor may be implemented as other types of hardware.

**[0077]** The heater 13 may be heated by power supplied from the battery 11. For example, when the smoking article 3 is inserted into the aerosol generation device 1, the heater 13 may be located outside the smoking article 3. Accordingly, the heated heater 13 may increase the temperature of an aerosol-generating material in the smoking article 3.

**[0078]** The heater 13 may be an electrical resistance heater. For example, the heater 13 may include an electrically conductive track, and the heater 13 may be heated when current flows through the electrically conductive track. However, the heater 13 is not limited to the example described above, and a heater that can be heated to a desired temperature may be used without limitation as the heater. Here, the desired temperature may be preset in the aerosol generation device 1 or may be set by the user.

**[0079]** Meanwhile, as another example, the heater 13 may be an induction heating heater. In particular, the heater 13 may include an electrically conductive coil configured to heat the smoking article 3 in an induction heating manner, and the smoking article 3 may include a susceptor that may be heated by the induction heating heater.

**[0080]** For example, the heater 13 may include a tubular heating element, a plate-shaped heating element, a needle-shaped heating element, and/or a rod-shaped heating element, and may heat the inside and/or outside of the smoking article 3 depending on the shape of the heating element.

**[0081]** Also, a plurality of heaters 13 may also be arranged in the aerosol generation device 1. At this time, the plurality of heaters 13 may be arranged to be inserted into the interior of the smoking article 3, or may be arranged outside the smoking article 3. In addition, some of the plurality of heaters 13 may be arranged to be inserted into the interior of the smoking article 3, and the remainder may be arranged outside the smoking article 3. In some embodiments, the heater 13 may heat the interior and the exterior of the smoking article 3. Also, the shape of the heater 13 is not limited to the shapes shown in FIGS. 1 to 3, and may be manufactured in various shapes. In some embodiments, the heater 13 may include an electrical resistance heater and an induction heating heater.

**[0082]** The vaporizer 14 may generate an aerosol by heating the liquid composition, and the generated aerosol may be delivered to the user through the smoking article 3. In other words, the aerosol generated by the vaporizer 14 may move along an airflow passage of the aerosol generation device 1, and the airflow passage may be configured such that the aerosol generated by the vaporizer 14 may be delivered to the user through the smoking article 3. The vaporizer 14 may generate an aerosol by heating the liquid composition, and may discharge the aerosol toward the smoking article such that the aerosol passes through the smoking article inserted into a smoking article insertion portion.

**[0083]** For example, the vaporizer 14 may include, but is not limited to, a liquid storage portion, a liquid delivery means, and a heating element. For example, the liquid storage portion, the liquid delivery means, and the heating element may also be included as separate modules in the aerosol generation device 1.

**[0084]** The liquid storage portion may store a liquid composition. For example, the liquid composition may be a liquid containing a tobacco-containing material including a volatile tobacco flavor component, or may be a liquid containing a non-tobacco material. The liquid storage portion may be manufactured to be detachable from/attachable to the vaporizer 14, or may be manufactured integrally with the vaporizer 14.

**[0085]** For example, the liquid composition may include water, a solvent, ethanol, a plant extract, a flavoring, a flavoring agent, and/or a vitamin mixture. The flavoring may include menthol, peppermint, spearmint oil, and/or various fruit flavor components, but the present invention is not limited thereto. The flavoring agent may include components that may provide a variety of flavors or tastes to the user. The vitamin mixture may be a mixture of at least one of vitamin A, vitamin B, vitamin C, and vitamin E, but the present invention is not limited thereto. Also, the liquid composition may include an aerosol forming agent such as glycerin and propylene glycol.

**[0086]** The liquid delivery means may deliver the liquid composition of the liquid storage portion to the heating element. For example, the liquid delivery means may be, but is not limited to, a wick such as cotton fiber, ceramic fiber, glass fiber, or a porous ceramic.

**[0087]** The heating element is an element configured to heat the liquid composition delivered by the liquid delivery means. For example, the heating element may be a metal heating wire, a metal heating plate, a ceramic heater, and the like, but the present invention is not limited thereto. Also, the heating element may be composed of a conductive filament such as a nichrome wire, and may be arranged in a structure that is wound around the liquid delivery means. The heating element may be heated by the current supply, and may transfer heat to the liquid composition in contact with the heating element to heat the liquid composition. As a result, an aerosol may be generated.

**[0088]** For reference, the vaporizer 14 may be referred to as a cartomizer or an atomizer, but the present invention is not limited thereto.

**[0089]** Meanwhile, the aerosol generation device 1 may further include general-purpose components in addition to the battery 11, the controller 12, the heater 13, and the vaporizer 14. For example, the aerosol generation device 1 may include a display capable of outputting visual information and/or a motor configured to output tactile information. Also, the aerosol

generation device 1 may include at least one sensor (such as a puff detection sensor, a temperature detection sensor, and/or a smoking article insertion detection sensor). In addition, the aerosol generation device 1 may be manufactured to have a structure in which outside air may be introduced or an internal gas may be discharged in a state in which the smoking article 3 is inserted.

**[0090]** Although not shown in FIGS. 1 to 3, the aerosol generation device 1 may be configured as a system with a separate cradle. For example, the cradle may be used to charge the battery 11 of the aerosol generation device 1. Alternatively or additionally, the heater 13 may be heated in a state in which the cradle is combined with the aerosol generation device 1.

**[0091]** The smoking article 3 may be similar to a typical combustion-type smoking article. For example, the smoking article 3 may be divided into a tobacco rod 31 including a tobacco material and an aerosol-generating material and a filter rod 32 including a filter or the like. Alternatively, the filter rod 32 of the smoking article 3 may also include an aerosol-generating material. For example, an aerosol-generating material manufactured in the form of a granule or capsule may be inserted into the tobacco rod 31 and optionally into some region of the filter rod 32.

**[0092]** The entire tobacco rod 31 may be inserted into the interior of the aerosol generation device 1, and the filter rod 32 may be exposed to the outside. Alternatively, only a portion of the tobacco rod 31 may be inserted into the interior of the aerosol generation device 1, or the entire tobacco rod 31 and a portion of the filter rod 32 may be inserted into the interior of the aerosol generation device 1. The user may inhale an aerosol while holding the filter rod 32 in his or her mouth. At this time, the aerosol is generated as the outside air passes through the tobacco rod 31, and the generated aerosol is delivered to the user's mouth through the filter rod 32.

**[0093]** In some embodiments, the outside air may be introduced through at least one air passage formed in the aerosol generation device 1. For example, the opening/closing and/or the size of the air passage formed in the aerosol generation device 1 may be controlled by the user. Accordingly, the amount of vapor, the smoking sensation, and the like may be controlled by the user. As another example, the outside air may be introduced into the interior of the smoking article 3 through at least one hole formed in the surface of the smoking article 3.

**[0094]** Hereinafter, the structure of the smoking article will be described with reference to FIG. 4.

**[0095]** Referring to FIG. 4, the smoking article 3 includes a tobacco rod 31, a filter rod 32, and a front-end plug 33. The tobacco rod 31 includes a medium substrate (or a tobacco material) and an aerosol-generating material. The tobacco material may be tobacco.

**[0096]** In some embodiments, in the smoking article, the filter rod 32, the tobacco rod 31, and the front-end plug 33 are arranged sequentially along the longitudinal direction of the smoking article 3.

**[0097]** The filter rod 32 may be adjacent to one side of the tobacco rod 31 or to the rear end of the tobacco rod 31. The filter rod 32 may include a first segment 321 configured to cool the aerosol and a second segment 322 configured to filter certain components contained in the aerosol. In some embodiments, the first segment 321 is arranged between the tobacco rod 31 and the second segment 322.

**[0098]** In the present specification, the first segment 321 and the second segment 322 may also be referred to as the cooling structure 321 and the mouthpiece portion 322 to emphasize the function of the first and second segments 321 and 322 as filters.

**[0099]** The front-end plug 33 may be located on one side of the tobacco rod 31 facing the filter rod 32 or located on the other side opposite to the one side of the tobacco rod 31. The front-end plug 33 may be adjacent to the front end of the tobacco rod 31. The front-end plug 33 may prevent the tobacco rod 31 from separating to the outside, and may prevent a liquefied aerosol from being introduced from the tobacco rod 31 into the aerosol generation device (the reference numeral '1' in FIGS. 1 to 3) during smoking.

**[0100]** The smoking article 3 may be wrapped with at least one wrapper 35. The wrapper 35 may surround the smoking article 3. In some embodiments, the smoking article 3 may be wrapped with at least one wrapper 35 by surrounding at least a portion of the smoking article 3. For example, the front-end plug 33 may be wrapped with a first wrapper 351, the tobacco rod 31 may be wrapped with a second wrapper 352, the first segment 321 may be wrapped with a third wrapper 353, and the second segment 322 may be wrapped with a fourth wrapper 354. Optionally, the entire smoking article 3 may be rewrapped with a fifth wrapper 355. The fifth wrapper 355 may be referred to as an outer wrapper, and the first wrapper 351, the second wrapper 352, the third wrapper 353, and the fourth wrapper 354, which are surrounded by the fifth wrapper 355, may be referred to as inner wrappers.

**[0101]** The diameter of the smoking article 3 may be in the range of 5 mm to 9 mm, but the present invention is not limited thereto. For example, the front-end plug 33 may have a length of approximately 4 mm to 20 mm (for example, 7 mm), the tobacco rod 31 may have a length of approximately 13 mm to 17 mm(for example, 15 mm), the first segment 321 may have a length of approximately 7 mm to 20 mm (for example, 12 mm), and the second segment 322 may have a length of approximately 4 mm to 20 mm (for example, 14 mm), but the present invention is not limited thereto.

**[0102]** In some embodiments, the tobacco rod 31 may include lyocell tow including a plurality of lyocell fibers and a plurality of medium substrates filled inside the lyocell tow. In particular, the tobacco rod 31 may include a lyocell filter that includes or is composed of lyocell tow, and a medium substrate inserted so as to be uniformly or randomly distributed along

the interior of the lyocell filter in the entire region or a portion of the lyocell filter.

**[0103]** In the present invention, the lyocell fibers included in the tobacco rod 31 may be environmentally-friendly fibers made of cellulose extracted from wood pulp. The lyocell tow may refer to a bundle formed by cross-linking adjacent lyocell fibers.

**[0104]** In some embodiments, the lyocell fibers may have a non-circular cross-section. The non-circular cross-section is defined as a cross-section whose shape is not circular but includes a plurality of protrusions. For example, a cross-section having a shape in which a plurality of protrusions extend from the center thereof may be referred to as a non-circular cross-section.

**[0105]** In some embodiments, the lyocell fibers may have a Y-shaped cross-section with three protrusions branching from the center thereof, a cross-shaped cross-section with four protrusions, and/or a star-shaped cross-section with five protrusions, or may also have an O-shaped cross-section, but the present invention is not limited thereto. The terms mentioned herein have the same meanings as described above.

**[0106]** When the tobacco rod 31 is manufactured, the medium substrate may be filled so as to be inserted into the lyocell tow. A plurality of lyocell fibers, which are included in or constitute the lyocell tow, may have spaces between the fibers, and the medium substrate may settle in the spaces between the lyocell fibers. That is, the medium substrate may be filled in a dispersed form in the lyocell tow. Accordingly, since the medium substrate is located in the spaces between the plurality of lyocell fibers included in or constituting the lyocell tow, the medium substrate may settle in the lyocell tow. Therefore, the medium substrate may be filled or settled in the lyocell filter so as not to leak out to the outside in a form in which the medium substrate is surrounded by the lyocell filter.

**[0107]** The tobacco rod 31 may be manufactured by injecting a medium substrate into or onto the tow, for example, using a method, such as free fall and the like, while the tow constituting the filter is spread out, and wrapping or rolling the tow into which the medium substrate has been injected to form a predetermined shape, such as a cylindrical shape, during the process of manufacturing the tobacco rod 31. Accordingly, the medium substrate may be inserted and filled so as to be randomly or uniformly distributed along the entire region or part of the region of the lyocell tow. In other words, since the medium substrate is located in the spaces between the lyocell fibers included in or constituting the lyocell tow, the medium substrate may be filled in a dispersed form in the lyocell tow.

**[0108]** Since the tow for filling the medium substrate into the tobacco rod 31 according to the present invention includes or is composed of lyocell tow including a plurality of lyocell fibers having spaces formed therein, the settling rate of the medium substrate may be improved without a separate additive for adhesion compared to cellulose acetate plasticized by a plasticizer, thereby improving manufacturing process efficiency and medium substrate retention. Also, when the tow for filling the medium substrate into the tobacco rod 31 is composed of lyocell tow including a plurality of lyocell fibers having spaces formed therein, in the case of paper, the phenomenon of the medium substrate bouncing off the paper surface during insertion due to the grain of the paper is prevented, thereby improving manufacturing process efficiency.

**[0109]** Also, since the tobacco rod 31 is composed of lyocell tow, the excellent heat resistance of the lyocell tow may effectively prevent the shape of the tobacco rod 31 from being deformed by the heat transferred from a heater configured to heat the tobacco rod 31.

**[0110]** In some embodiments, the medium substrate may be a certain type of tobacco material. For example, the medium substrate may take the form of tobacco cut filler, tobacco particles, tobacco sheets, tobacco beads, tobacco granules, tobacco powder, and/or tobacco extracts. In particular, the tobacco material may include, for example, one or more of tobacco leaves, tobacco veins, expanded tobacco, shredded cut filler, reconstituted tobacco leaf cut filler, and reconstituted tobacco.

**[0111]** For example, the tobacco rod 31 may further include at least one of aerosol-generating materials such as glycerin, propylene glycol, ethylene glycol, dipropylene glycol, diethylene glycol, triethylene glycol, tetraethylene glycol, and oleyl alcohol, but the present invention is not limited thereto. In particular, the tobacco rod 31 may further contain other additives, such as a flavoring agent, a humectant, and/or an organic acid. In particular, a flavoring liquid, such as menthol and/or a humectant, may be added to the tobacco rod 31. In particular, a flavoring liquid including menthol and/or a humectant may be added by being sprayed onto the tobacco rod 31.

**[0112]** There is no limitation on the shape of the filter rod 32. For example, the filter rod 32 may be a cylindrical rod, or may also be a tubular rod including a hollow formed therein. Also, the filter rod 32 may be a recessed rod. When the filter rod 32 is composed of a plurality of segments, at least one of the plurality of segments may be manufactured in a different shape from the other segments.

**[0113]** Hereinafter, each of the segments of filter rod 32 will be described in detail.

**[0114]** The first segment 321 of the filter rod 32 may cool the aerosol generated when the heater 13 heats the tobacco rod 31. Accordingly, the user may inhale the aerosol cooled to an appropriate temperature.

**[0115]** In some embodiments, the first segment 321 of the filter rod 32 may include any one or more of a cellulose acetate filter, a paper tube, and a lyocell filter including lyocell tow including a plurality of lyocell fibers. When the first segment 321 is a cellulose acetate filter and/or a lyocell filter, the first segment 321 may be a tubular structure including a hollow formed therein. The hollow may extend along the longitudinal direction of the first segment 321. The hollow may be located at the

center of the cross-section perpendicular to the longitudinal direction of the first segment 321, and may extend along the longitudinal direction of the first segment 321. The hollow 120H and the first segment 321 may have a coaxial structure along the longitudinal direction. The length or diameter of the first segment 321 may vary depending on the shape of the smoking article 3. For example, the length of the first segment 321 may be appropriately adjusted in the range of 7 mm to 20 mm. Preferably, the first segment 321 may have a length of approximately 12 mm, but the present invention is not limited thereto.

**[0116]** When the tobacco rod 31 is inserted into the heater 13, the first segment 321 may prevent the internal material of the tobacco rod 31 from being pushed backward *(i.e.,* in a direction opposite to the insertion direction) and also provide an aerosol cooling effect. When the first segment 321 is a cellulose acetate filter including a hollow formed therein, the diameter of the hollow of the first segment 321 may be appropriately adjusted in the range of 2 mm to 4.5 mm. When the first segment 321 is a lyocell filter including a hollow formed therein, the diameter of the hollow of the first segment 321 may be appropriately adjusted in the range of 2 mm to 5.5 mm, and an appropriate value in the range of 2 mm to 5.5 mm, preferably 2.1 mm to 5 mm, more preferably 2.2 mm to 4.5 mm, and even more preferably 2.5 mm to 4 mm may be selected, but the present invention is not limited thereto. When the first segment 321 is a paper tube filter, the inner diameter of the hollow may be appropriately adjusted in the range of 5 mm to 7.5 mm, and more preferably 6 mm to 7 mm, but the present invention is not limited thereto.

**[0117]** When the first segment 321 is composed of lyocell tow, the excellent heat resistance of the lyocell tow may effectively prevent the first segment 321 from being deformed due to heat transferred from a heater configured to heat the smoking article 3 or an aerosol generated in the smoking article 3.

**[0118]** The second segment 322 of the filter rod 32 may cool the aerosol generated when the heater 13 heats the tobacco rod 31. Accordingly, the user may inhale the aerosol cooled to an appropriate temperature. Also, the second segment 322 may serve as a mouthpiece that comes into contact with the user's oral region and as a filter that ultimately delivers the aerosol delivered from the upstream side to the user.

**[0119]** The length of the second segment 322 may be appropriately adjusted in the range of 4 mm to 20 mm. For example, the second segment 322 may have a length of approximately 14 mm, but the present invention is not limited thereto.

**[0120]** The second segment 322 of the filter rod 32 may be a cellulose acetate filter or a lyocell filter. That is, the second segment 322 may be manufactured using cellulose acetate fibers (particularly, cellulose acetate tow) as a filter material or a lyocell fiber (particularly, lyocell tow) as a filter material. Although not shown herein, the second segment 322 may also be manufactured as a recessed filter.

**[0121]** During the process of manufacturing the second segment 322, the second segment 322 may be manufactured so that a flavor is generated by spraying a flavoring liquid onto the second segment 322. Alternatively or additionally, separate fibers coated with the flavoring liquid may be inserted into the interior of the second segment 322. The aerosol generated in the tobacco rod 31 is cooled as it passes through the first segment 321, and the cooled aerosol is delivered to the user through the second segment 322. Therefore, when a flavoring element is added to the second segment 322, an effect of enhancing the persistence of the flavor delivered to the user may be achieved.

**[0122]** At least one capsule 34 may be included in the second segment 322. Here, the capsule 34 may be a structure in which a liquid including a flavoring is wrapped with a film. For example, the capsule 34 may have a spherical or cylindrical shape.

**[0123]** The front-end plug 33 may serve to prevent a liquefied aerosol from flowing into the aerosol generation device (the reference numeral '1' in FIGS. 1 to 3) from the tobacco rod 31 during smoking.

**[0124]** The length or diameter of the front-end plug 33 may vary depending on the shape of the smoking article 3. For example, the length of the front-end plug 33 may be appropriately adjusted in the range of 4 mm to 20 mm. Preferably, the front-end plug 33 may have a length of approximately 7 mm, but the present invention is not limited thereto.

**[0125]** The front-end plug 33 may be manufactured to include cellulose acetate and/or lyocell. Also, the front-end plug 33 may include at least one channel formed therein, and the cross-sectional shape of the channel may be manufactured in various shapes. For example, the cross-sectional shape of the channel formed in the front-end plug 33 may be formed in various shapes such as a trilobal shape, a tetralobal shape, a multilobal shape, a polygonal shape, a hard shape, and the like.

**[0126]** Hereinafter, the wrapper 35 will be described in detail.

**[0127]** The first wrapper 351 may be general filter wrapping paper combined with metal foil. In some embodiments, the first wrapper 351 may be general filter wrapping paper combined with aluminum foil. The second wrapper 352 and the third wrapper 353 may be made of general filter wrapping paper. For example, the second wrapper 352 and the third wrapper 353 may each independently be porous wrapping paper or non-porous wrapping paper.

**[0128]** In some embodiments, the third wrapper 353 configured to wrap the first segment 321 has a basis weight greater than or equal to a certain value, and may include grease-resistant hard wrapping paper treated to be grease-resistant and/or general hard wrapping paper not treated to be grease-resistant, or may be composed *(i.e.,* made) of grease-resistant hard wrapping paper treated to be grease-resistant and/or general hard wrapping paper not treated to be grease-

resistant. Meanwhile, since the third wrapper 353 includes or is composed of hard wrapping paper having a basis weight greater than or equal to a predetermined value, the third wrapper 353 may not only function as a packaging material configured to wrap the first segment 321 including lyocell tow, but also perform a function of imparting a certain level of hardness or higher to the filter rod 32 according to the present invention. The third wrapper 353 may include grease-resistant hard wrapping paper, and/or general hard wrapping paper other than grease-resistant hard wrapping paper. In particular, the third wrapper 353 may include grease-resistant hard wrapping paper and/or general hard wrapping paper other than grease-resistant hard wrapping paper having a basis weight of 30 gsm to 180 gsm, preferably 35 gsm to 170 gsm, more preferably 40 gsm to 160 gsm, even more preferably 50 gsm to 158 gsm, even more preferably 60 gsm to 155 gsm, even more preferably 70 gsm to 150 gsm, and most preferably 75 gsm to 150 gsm, but the present invention is not limited thereto.

**[0129]** Hereinafter, the configurations of the present invention and the advantageous effects according thereto will be described in more detail with reference to examples and comparative examples. However, it should be understood that these examples are merely for describing the present invention in more detail, and are not intended to limit the scope of the present invention.

Example 1 and Comparative Example **1**

**[0130]** A lyocell filter was manufactured using lyocell tow having a single fiber fineness of 3.33 dtex (a mono denier of 3.0) and a total fiber fineness of 3,889 tex (a total denier of 35,000) under the conditions shown in Example 1 in Table 1, and a cellulose acetate filter, in which a plasticizer was added to cellulose acetate tow having a single fiber fineness of 3.00 dtex (a mono denier of 2.7) and a total fiber fineness of 3,889 tex (a total denier of 35,000), was manufactured under the conditions shown in Comparative Example 1 in Table 1.

[Table 1]

| Classification | Weight (mg) | Circumference (mm) | Resistance to draw ($mmH_20$) |
|---|---|---|---|
| **Example 1** | 570 | 21.96 | 350 |
| **Comparative Example 1** | 540 | 21.94 | 387 |

**Experimental Example 1: Evaluation of heat resistance according to filter material**

**[0131]** To evaluate the heat resistance according to the filter material, the filters of Example 1 and Comparative Example 1 were heated to 250°C or higher using an external heating method under the internal conditions of an internal temperature of approximately 22 ± 2°C and an internal relative humidity of approximately 60 ± 5%. Thereafter, the filters before heating were photographed and shown in FIG. 5A, and the filters after heating were photographed and shown in FIG. 5B.

**[0132]** In FIG. 5A, the left side shows the filter of Comparative Example 1 before heating, and the right side shows the filter of Example 1 before heating. In FIG. 5B, the left side shows the filter of Comparative Example 1 after heating, and the right side shows the filter of Example 1 after heating.

**[0133]** Referring to FIG. 5, it can be seen that the cellulose acetate filter of Comparative Example 1 has a significantly different shape before and after heating, and melts due to the heat after heating, and thus has no substantial shape. On the other hand, it can be seen that the lyocell filter of Example 1 generates only some soot after heating, and has a substantially similar shape before and after heating. This confirms that cellulose acetate is a fiber having an amorphous structure and completely melts due to its weak heat resistance characteristics, but lyocell has strong heat resistance characteristics.

**Example 2 and Comparative Example 2**

**[0134]** Tobacco granules were filled into lyocell tow having a single fiber fineness of 3.33 dtex (a mono denier of 3.0) and a total fiber fineness of 3,889 tex (a total denier of 35,000), and the lyocell tow was then wrapped with a paper wrapper to manufacture a tobacco granule/lyocell filter having a length of 84 mm under the conditions shown in Example 2 in Table 2. Thereafter, a plasticizer was added to cellulose acetate tow having a single fiber fineness of 3.00 dtex (a mono denier of 2.7) and a total fiber fineness of 3,889 tex (a total denier of 35,000), and the cellulose acetate tow was then wrapped with a paper wrapper to manufacture a cellulose acetate filter having a length of 84 mm under the conditions shown in Comparative Example 2 in Table 2. Wrapping paper having a basis weight of 75 gsm was used as the wrapper used to manufacture the filters.

[Table 2]

| Classification | Weight (mg) | Circumference (mm) | Roundness (%) | Resistance to draw ($mmH_20$) |
|---|---|---|---|---|
| **Example 2** | 900.7 | 23.86 | 93.35 | 518.4 |
| **Comparative Example 2** | 901.5 | 21.96 | 91.70 | 576.4 |

**Experimental Example 2: Evaluation of physical properties according to filter material filled with medium substrate**

**[0135]** Next, the lyocell filter of Example 2 and the cellulose acetate filter of Comparative Example 2 were cut to a length of 15 mm to manufacture the smoking article 3 shown in FIG. 4. In particular, a heating-type cigarette (a smoking article) having a front-end plug having a length of 7 mm, the tobacco rod of Example 2 or Comparative Example 2, a first segment including a paper tube filter having a length of 12 mm and an inner diameter of 6 mm, and a second segment having a length of 14 mm and composed of cellulose acetate was manufactured, as in the smoking article 3 shown in FIG. 4.

**[0136]** To analyze the material deformation caused by heat when heating the tobacco rod of the smoking article according to the filter material filled with the tobacco granules, the tobacco rods of the smoking articles according to Example 2 and Comparative Example 2 were heated to a heating temperature of 190°C to 280°C (for example, 250°C) using an external heating method in a smoking room having an internal temperature of approximately 22 ± 2°C and an internal relative humidity of approximately 60 ± 5% (specifically, a temperature of approximately 21.9°C and a relative humidity of 64.3%). Thereafter, the images of the disassembled tobacco rod before and after heating are shown in FIG. 6.

**[0137]** Meanwhile, in FIG. 6, FIG. 6A is an image obtained by photographing the disassembled tobacco rods of Comparative Example 2 and Example 2 before heating. Here, the left side of FIG. 6A is the tobacco rod of Comparative Example 2 before heating, and the right side of FIG. 6A is the tobacco rod of Example 2 after heating. Also, in FIG. 6, FIG. 6B is an image of the disassembled tobacco rods of Comparative Example 2 and Example 2 after heating. Here, the left side of FIG. 6B is the tobacco rod of Comparative Example 2 before heating, and the right side of FIG. 6B is the tobacco rod of Example 2 after heating.

**[0138]** Referring to FIG. 6A in FIG. 6, it can be seen that the appearances of Comparative Example 2 (a tobacco rod including cellulose acetate) and Example 2 (a tobacco rod including lyocell) before heating are substantially the same.

**[0139]** Referring to FIG. 6B in FIG. 6, after heating *(i.e.,* after heating to a temperature of 190°C to 280°C), it can be seen that the tobacco rod of Comparative Example 2 experienced significant shrinkage due to melting and fixation of the cellulose acetate tow. It can be seen that the cellulose acetate material shrinks and melts due to the heat applied to the tobacco rod during heating.

**[0140]** On the other hand, referring to FIG. 6B, it can be seen that after heating (i.e., after heating to a temperature of 190°C to 280°C), soot is generated due to heat in the case of Example 2, but the tobacco rod maintains a generally similar shape compared to that before heating. Also, it can be seen that the tobacco granules filled in the tow are condensed in Comparative Example 2 (left), which is composed of cellulose acetate tow, but are stably settled and dispersed over the entire region of the lyocell tow in Example 2 (right).

**[0141]** Meanwhile, since a tobacco rod is composed of a medium substrate filled with lyocell tow rather than cellulose acetate tow, the shape of the tobacco rod is maintained due to the excellent heat resistance of the lyocell tow even when the tobacco rod is heated with a heater. Therefore, the transfer of smoke components during smoking may be uniform, and the problem of the smoking article breaking or having its appearance quality deteriorating may be prevented.

Experimental Example 3: Analysis of smoke components

**[0142]** A smoking article including the tobacco rod of Example 2 and satisfying the conditions of Table 3 below was manufactured, and an experiment was conducted to analyze the smoke components. In particular, the tobacco rod of the smoking article of Example 2 was heated to a heating temperature of 190°C to 280°C using an external heating method, and the total particulate matter (TPM) and nicotine components in the aerosol and the nicotine components in the tobacco rod were measured. The results are shown in Table 4 below.

**[0143]** In particular, the experiment was conducted on the smoking article according to Example 2 in a smoking room having an internal temperature of approximately 22 ± 2°C and an internal relative humidity of approximately 60 ± 5% (specifically, a temperature of approximately 21.9°C and an internal relative humidity of 64.3%). In this case, the experiment was conducted under smoking conditions, that is, HC conditions (Puff volume: 55 mL/Puff frequency: 30 s/Puff duration: 2 s/Puff count: 9 puffs). The generated smoke was collected on a Cambridge filter (*i.e.,* a Cambridge filter pad (CFP)) and analyzed . The total particulate matter (TPM) is a value obtained by measuring the change in weight of the Cambridge filter before and after smoking using the smoking device, and the remaining components in the smoke

collected on the pad were analyzed by gas chromatography (GC). Also, the amount of the nicotine components remaining in the lyocell filter (specifically, lyocell tow) constituting the tobacco rod was measured by immersing the tobacco rod in water after smoking, extracting the nicotine components, and analyzing the extracted components using a GC/MS device. At this time, the tobacco rod was immersed overnight in a container containing distilled water, and the solution containing the extracted components was used for GC/MS analysis.

[Table 3]

| Classification | Weight (mg) | Circumference (mm) | Vent (%) | PDO ($mmH_20$) | PDC ($mmH_20$) |
|---|---|---|---|---|---|
| **Smoking article of Example 2** | 530.5 | 22.629 | 14.64 | 98.5 | 107.9 |

[Table 4]

| | Components in smoke | | | Nicotine content in tobacco rod (mg) | |
|---|---|---|---|---|---|
| **Classification** | **TPM (mg)** | **Tar (mg)** | **Nic (mg)** | **Before smoking** | **After smoking** |
| **Example 2** | 20.46 | 11.43 | 0.33 | 0.74 | 0.32 |

**[0144]** Referring to Table 4, in the case of Example 2 in which the tobacco rod is composed of lyocell tow filled with tobacco granules, due to the heat resistance and nicotine retention effects of lyocell tow, the nicotine content in the tobacco rod remains at 0.32 mg even after smoking, which is 40% of the nicotine content before smoking, which also indicates that nicotine retention is also stable.

**[0145]** Although the embodiments of the present disclosure have been described above with reference to the accompanying drawings, those of ordinary skill in the art to which the present disclosure pertains should understand that the present disclosure may be embodied in other specific forms without changing the technical spirit or essential features of the present disclosure. Therefore, the embodiments described above should be understood as being illustrative, instead of limiting, in all aspects. The scope of protection of the present disclosure should be interpreted by the claims below, and all technical ideas within the scope equivalent to the claims should be interpreted as falling within the scope of rights of the technical spirit defined by the present disclosure.

[EXPLANATION OF DRAWING SYMBOLS]

**[0146]**

3: smoking article
31: tobacco rod
32: filter rod
321: first segment
322: second segment
33: front-end plug

## Claims

**1.** A smoking article comprising:

a tobacco rod;
a front-end plug arranged on one side of the tobacco rod and having at least one channel formed therein;
a first segment arranged on the other side opposite to the one side of the tobacco rod; and
a second segment arranged on the other side of the first segment,
wherein the tobacco rod includes lyocell tow including a plurality of lyocell fibers, and a medium substrate.

**2.** The smoking article of claim 1, wherein the medium substrate is filled in a dispersed form in the lyocell tow.

**3.** The smoking article of claim 1, wherein the medium substrate is located in a space between the plurality of lyocell fibers.

4. The smoking article of claim 1, wherein the medium substrate includes a tobacco material, and is in the form of at least one of tobacco particles, tobacco sheets, tobacco beads, tobacco granules, and tobacco powder.

5. The smoking article of claim 1, wherein the medium substrate includes a plurality of tobacco granules in the form of granules including a tobacco material.

6. The smoking article of claim 1, wherein the first segment has a tube shape having a hollow formed therein, and the second segment includes at least one of cellulose acetate or lyocell.

7. The smoking article of claim 6, wherein the first segment includes at least one of a cellulose acetate filter, a lyocell filter, or a paper tube filter.

8. The smoking article of claim 1, further comprising a wrapper configured to wrap at least one of the tobacco rod, the front-end plug, the first segment, and the second segment.

FIG. 1

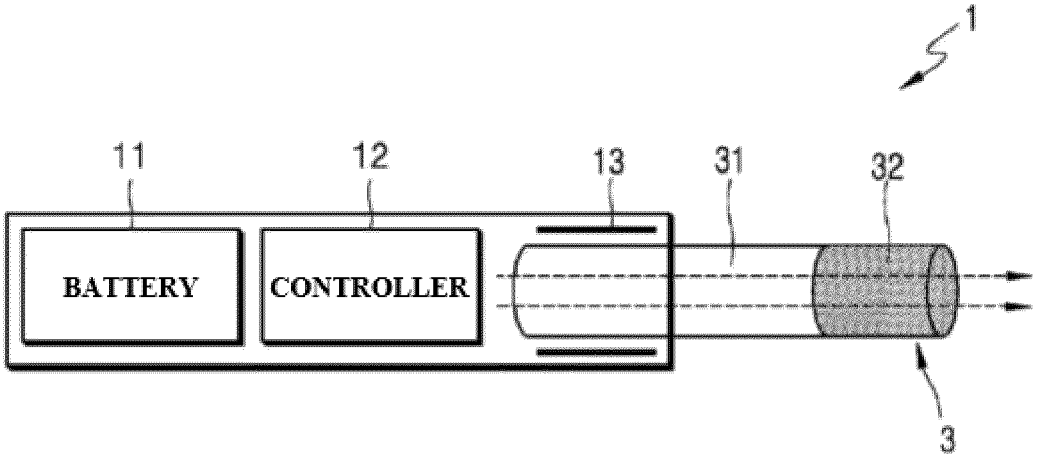
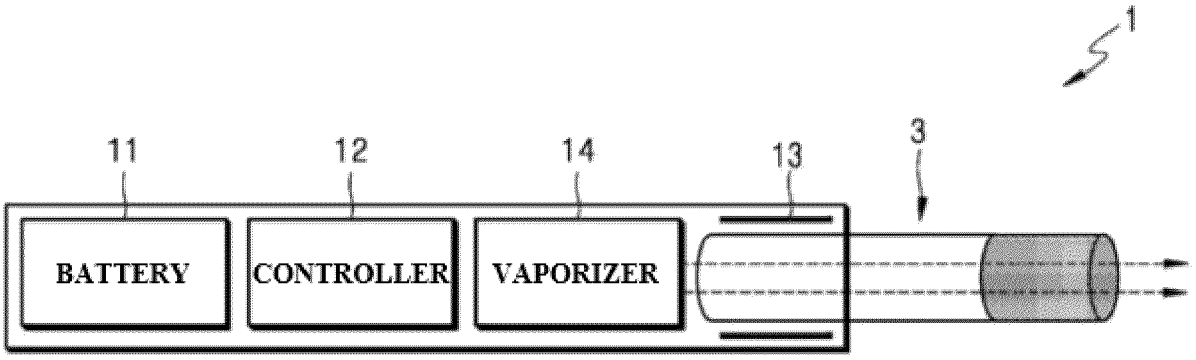

1
11
12
13
31
32
BATTERY
CONTROLLER
3

FIG. 2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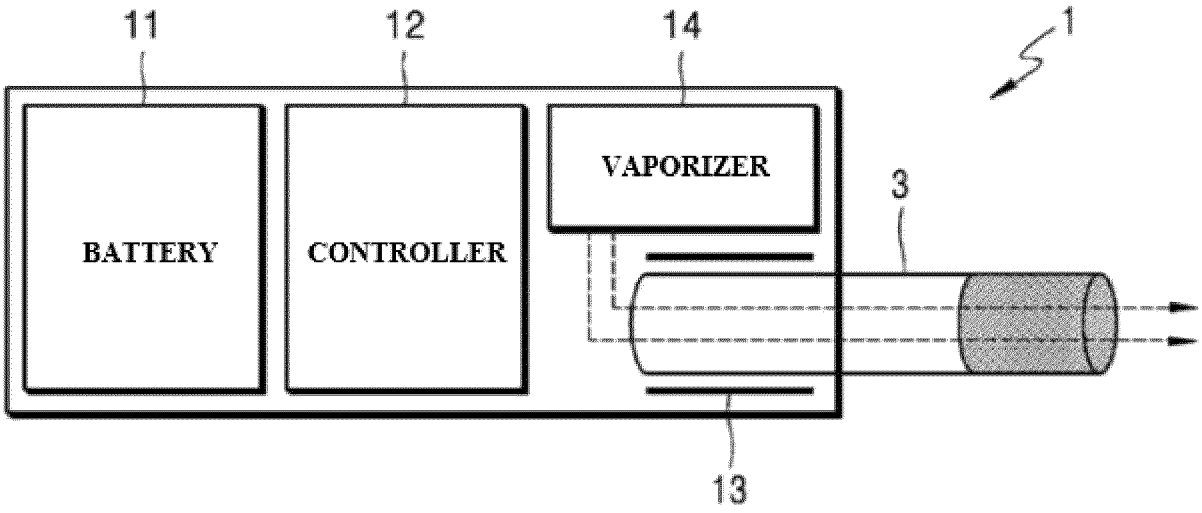
BATTERY
CONTROLLER
VAPORIZER

FIG. 3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VAPORIZER
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FIG. 4

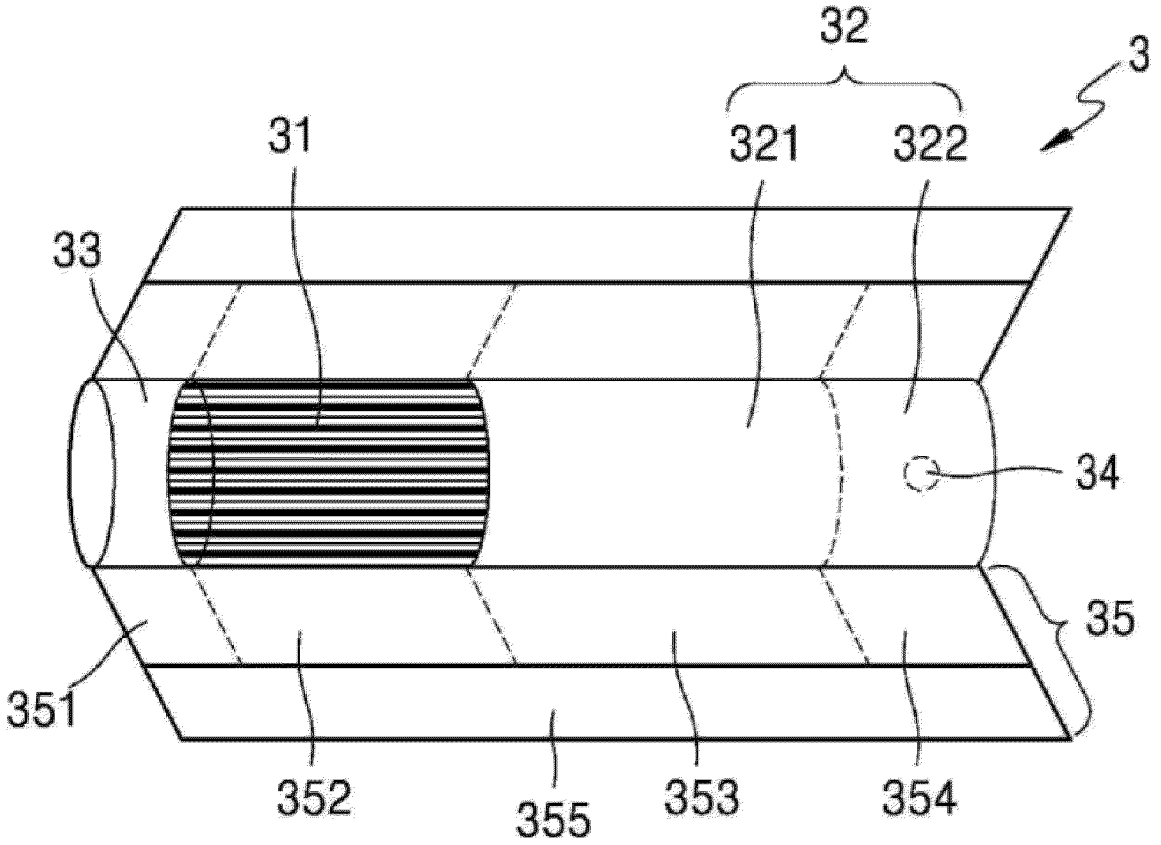
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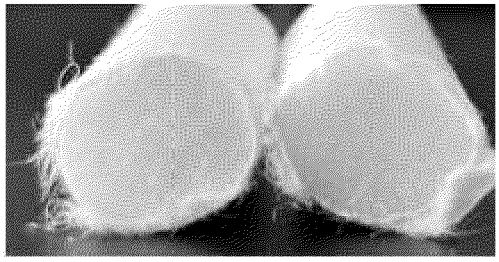
FIG. 5

(A)



(B)

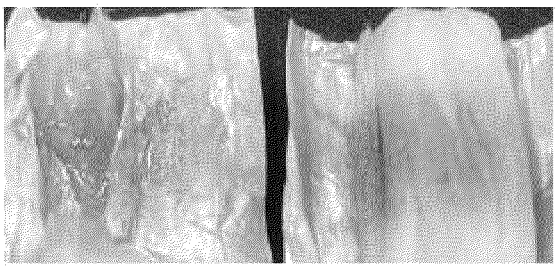
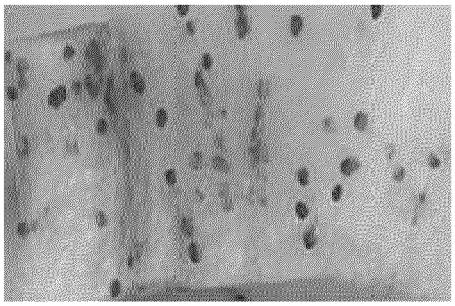
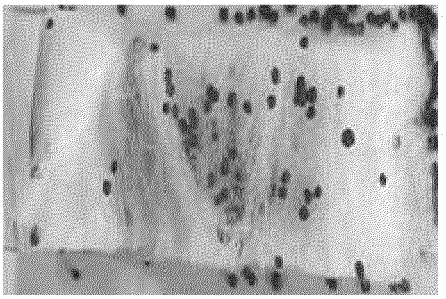


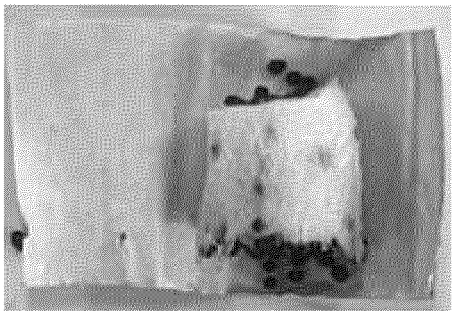
FIG. 6

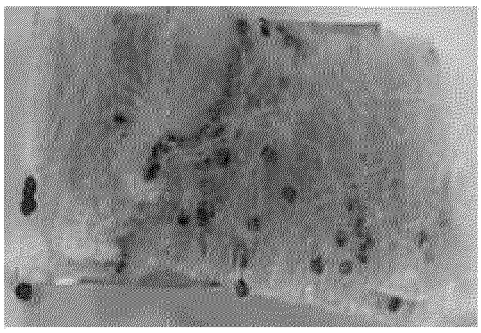
(A)





(B)





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# EUROPEAN SEARCH REPORT

Application Number
EP 25 15 1956

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| Y | WO 2023/112267 A1 (JAPAN TOBACCO INC [JP]) 22 June 2023 (2023-06-22) * paragraph [0001] - paragraph [0107]; claims; figures * | 1-8 | INV. A24B15/12 A24B15/14 A24B15/16 A24B15/30 A24D1/20 A24D3/04 A24D3/06 A24D3/10 |
| Y | WO 2023/140594 A1 (KT & G CORP [KR]; KOLON INC [KR]) 27 July 2023 (2023-07-27) * paragraph [0001] - paragraph [0108]; figures * | 1-8 | |
| Y | US 2021/251287 A1 (EMMETT ROBERT [CH] ET AL) 19 August 2021 (2021-08-19) * paragraph [0001] - paragraph [0130]; figures * | 1-8 | |

TECHNICAL FIELDS SEARCHED (IPC)

A24B
A24F
A24D

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 19 May 2025 | Alevisopoulos, S |

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19-05-2025

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| WO 2023112267 A1 | 22-06-2023 | NONE | |
| WO 2023140594 A1 | 27-07-2023 | EP 4430964 A1 | 18-09-2024 |
| | | JP 2024541694 A | 08-11-2024 |
| | | US 2025098736 A1 | 27-03-2025 |
| | | WO 2023140594 A1 | 27-07-2023 |
| US 2021251287 A1 | 19-08-2021 | BR 112021000797 A2 | 11-05-2021 |
| | | CN 112638183 A | 09-04-2021 |
| | | EP 3843570 A1 | 07-07-2021 |
| | | JP 7472105 B2 | 22-04-2024 |
| | | JP 2021534771 A | 16-12-2021 |
| | | KR 20210047302 A | 29-04-2021 |
| | | US 2021251287 A1 | 19-08-2021 |
| | | WO 2020044181 A1 | 05-03-2020 |

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