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(54) **AEROSOL-GENERATING ARTICLE COMPRISING A FLAME-RETARDANT**

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ARTICLE DE GÉNÉRATION D'AÉROSOL COMPRENANT UN AGENT IGNIFUGE

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EP 4 152 971 B1

Description

[0001] The present invention relates to an aerosol-generating article comprising an aerosol-generating substrate and adapted to produce an inhalable aerosol upon heating.

[0002] Aerosol-generating articles in which an aerosol-generating substrate, such as a tobacco-containing substrate, is heated rather than combusted, are known in the art.

[0003] In a conventional cigarette, a consumer applies a flame to the distal end of the cigarette whilst drawing air through the proximal end. The heat generated locally by the flame and the oxygen in the air drawn through the cigarette causes ignition of the distal end of the cigarette, and combustion of the tobacco rod and the surrounding wrapper generates an inhalable smoke. By contrast, in heated aerosol-generating articles, an aerosol is generated by a more gentle transfer of heat from a heat source to a physically separate aerosol-generating substrate or material, which may be located in contact with, within, around, or downstream of the heat source. During use of the aerosol-generating article, volatile compounds are released from the aerosol-generating substrate by heat transfer from the heat source and are entrained in air drawn through the aerosol-generating article. As the released compounds cool, they condense to form an aerosol.

[0004] A number of prior art documents disclose aerosol-generating devices for consuming aerosol-generating articles. Such devices include, for example, electrically heated aerosol-generating devices in which an aerosol is generated by the transfer of heat from one or more electrical heater elements of the aerosol-generating device to the aerosol-generating substrate of a heated aerosol-generating article. For example, electrically heated aerosol-generating devices have been proposed that comprise an internal heater blade which is adapted to be inserted into the aerosol-generating substrate. As an alternative, inductively heatable aerosol-generating articles comprising an aerosol-generating substrate and a susceptor arranged within the aerosol-generating substrate have also been proposed.

[0005] US 2008/0202542 A1 discloses a smoking article 10 including a tobacco column 12 within a wrapper 14. The smoking article 10 may further include a filter 26. The filter 26 is attached to one end of the tobacco column 12. US 2008/0202542 A1 discloses that the packing density of the tobacco filler may vary depending upon the particular application. In general, for instance, the packing density of the tobacco filler may be from about 150 mg/cm^3 to about 350 mg/cm^3, such as from about 200 mg/cm^3 to about 320 mg/cm^3. The wrapper 14 comprises cellulosic fibers and a filler having a median particle size of at least about 3.2 microns. The wrapper 14 provides the smoking article 10 with improved ignition proclivity characteristics. Discrete areas on the wrapper may be treated with an ignition reducing composition to further reduce the ignition proclivity characteristics of the smoking article within the treated areas.

[0006] Aerosol-generating articles in which a tobacco-containing substrate is heated rather than combusted present a number of challenges that were not encountered with conventional smoking articles. The tobacco-containing substrates are typically heated to significantly lower temperatures compared with the temperatures reached by the combustion front in a conventional cigarette. However, heating temperatures cannot be too low, as this may have an impact on nicotine release from the tobacco-containing substrate and nicotine delivery to the consumer. Further, in order to maximise heat transfer efficiency, it is generally desirable that the heat source be located as close as possible to, and preferably in contact with the aerosol-generating substrate.

[0007] Therefore, in existing aerosol-generating articles designed to be heated by means of a heater blade inserted into the aerosol-generating substrate or by means of susceptor arranged within the aerosol-generating substrate, the aerosol-generating substrate is typically circumscribed by a wrapper combining a paper layer with a metallic foil, such as aluminium foil. Thus, the metallic layer interposed between the aerosol-generating substrate and the paper wrapper acts as a thermal shield and prevents the paper wrapper from becoming scorched or charred during use. This is desirable because it increases safety of use of the aerosol-generating article and prevents delivery of paper combustion products or paper pyrolysis products to the consumer during use. However, the inclusion of one such metallic shield makes the manufacturing process more complex and costly, and may lead to an increased environmental impact of the aerosol-generating article when this is disposed of after use. Further, as the original visual impact of the aerosol-generating article is substantively preserved during use, it may be difficult to tell whether an aerosol-generating article has effectively been used or not.

[0008] Accordingly, it would be desirable to provide a novel and improved aerosol-generating article that is easier to dispose of and has a reduced environmental impact, whilst at the same time being adapted to prevent scorching or charring of the article during use. Secondly, a need is generally felt for a novel and improved aerosol-generating article that substantially prevents misuse of the article, such that the article can only be correctly employed in an aerosol-generating device adapted to heat the aerosol-generating substrate and not used as a conventional cigarette. Further, it would be desirable to provide one such aerosol-generating article that can be manufactured efficiently and at high speed, preferably without the need for extensive modification of existing equipment.

[0009] Therefore, it would be desirable to provide a new and improved aerosol-generating article adapted to achieve at least one of the desirable results described above.

[0010] According to the present invention, there is pro-

vided an aerosol-generating article for producing an inhalable aerosol upon heating, the aerosol-generating article comprising: a rod of aerosol-generating substrate, the aerosol-generating substrate comprising at least an aerosol-former, wherein the aerosol-generating substrate has an aerosol former content of at least about 10 percent on a dry weight basis; a downstream section at a location downstream of the rod of aerosol-generating substrate; and a wrapper circumscribing at least the rod of aerosol-generating substrate. A density of the aerosol-generating substrate is greater than about 300 milligrams per cubic centimetre. Further, the wrapper comprises a flame retardant composition comprising one or more flame retardant compounds.

[0011] According to the present invention, there is further provided a method of manufacturing an aerosol-generating article for generating an inhalable aerosol upon heating, the method comprising: providing a continuous rod of aerosol-generating substrate, wherein a density of the aerosol-generating substrate is greater than about 300 milligrams per cubic centimetre, the aerosol-generating substrate comprising at least an aerosol-former, wherein the aerosol-generating substrate has an aerosol former content of at least about 10 percent on a dry weight basis; circumscribing the continuous rod of aerosol-generating substrate with a wrapper comprising a flame retardant composition; and cutting the circumscribed, continuous rod into discrete rods, each discrete rod being circumscribed by a portion of the wrapper comprising the flame retardant composition.

[0012] According to the present invention, there is additionally provided an aerosol-generating system comprising an electrically operated aerosol-generating device and an aerosol-generating article as described above, the aerosol-generating device comprising means for heating the rod of aerosol-generating substrate to a temperature sufficient to generate an aerosol from the aerosol-generating substrate.

[0013] As described briefly above, the present invention provides an aerosol-generating article for producing an inhalable aerosol upon heating, wherein the article comprises a rod of aerosol-generating substrate and a downstream section at a location downstream of the rod of aerosol-generating substrate. In more detail, the present invention provides an aerosol-generating article for producing an inhalable aerosol upon heating at a temperature from about 100 degrees Celsius to about 800 degrees Celsius, preferably from about 150 degrees Celsius to about 500 degrees Celsius, more preferably from about 200 degrees Celsius to about 300 degrees Celsius.

[0014] These temperatures are significantly lower than the temperatures reached in a conventional cigarette upon combustion of a tobacco-containing substrate, and even more significantly lower than the temperatures reached by commercially available cigarette lighters, which can be in the range from about 1000 degrees Celsius to 2000 degrees Celsius and even higher.

[0015] Further, the aerosol-generating article comprises a wrapper circumscribing the rod of aerosol-generating substrate or both the rod of aerosol-generating substrate and the downstream section. In contrast to existing articles, the aerosol-generating substrate has a density of more than about 300 milligrams per cubic centimetre, and the wrapper comprises a flame retardant composition.

[0016] The inventors have found that by circumscribing the aerosol-generating substrate with a wrapper comprising a flame retardant composition - that is, a wrapper comprising one or more flame retardant compound - it is advantageously possible to prevent the wrapper and the underlying aerosol-generating substrate from charring or scorching upon heating during use. In other words, it is advantageously possible to substantially prevent combustion and pyrolysis of components of aerosol-generating articles in accordance with the present invention.

[0017] In aerosol-generating articles in accordance with the present invention, this is desirably achieved without the need for an additional layer of metallic foil or other heat-shielding material to be included in the aerosol-generating article. This simplifies the manufacturing process and may therefore reduce manufacturing costs. It also becomes easier to dispose of an aerosol-generating article in accordance with the present invention, as there is no need to separate and recover a valuable recyclable material, such as for example aluminium foil, when a used aerosol-generating article is discarded. In addition, the inventors have found that by circumscribing the aerosol-generating substrate by means of a wrapper as described above, when the aerosol-generating substrate has been exposed, during use, to temperatures in the range from about 100 degrees Celsius to about 800 degrees Celsius, the aerosol-generating article appears significantly discoloured, the surface of the wrapper having turned dark brown or blackish. As such, it is immediately possible for the consumer to tell whether an aerosol-generating article has been used before and should be discarded.

[0018] By adjusting the amount of flame retardant compound in the wrapper (for example, in terms of amount per square metre of surface area of the treated portion), the extent to which the surface of wrapper is treated with the flame retardant composition, as well as the formulation of the flame retardant composition (that is, the nature of the flame retardant compound or compounds), it is advantageously possible to enhance the flame retardant properties of the wrapper and of the aerosol-generating article as a whole.

[0019] Thus, the present invention provides an improved aerosol-generating article that is capable of substantially preventing scorching and charring of the aerosol-generating substrate and wrapper during use. This is because by providing one or more flame retardant compounds on the wrapper or within the wrapper or both it is possible to substantially prevent that heat supplied to the article for generating an aerosol cause pyrolysis or combustion of the wrapper base material.

[0020] Aerosol-generating articles in accordance with

the present invention are advantageously easy to dispose of and have a reduced environmental impact, as there is no need for the articles to include a metallic foil layer as is commonly the case in existing aerosol-generating articles.

[0021] Further, an aerosol-generating article in accordance with the present invention has the additional benefit that it can only be correctly employed as intended, that is, in combination with a device adapted to heat the aerosol-generating substrate. In fact, unlike a conventional cigarette, an aerosol-generating article according to the invention essentially cannot be ignited and is unable to sustain combustion like a conventional cigarette.

[0022] In accordance with the present invention there is provided an aerosol-generating article for generating an inhalable aerosol upon heating.

[0023] The term "aerosol generating article" is used herein to denote an article wherein an aerosol generating substrate is heated to produce and deliver inhalable aerosol to a consumer. As used herein, the term "aerosol generating substrate" denotes a substrate capable of releasing volatile compounds upon heating to generate an aerosol.

[0024] A conventional cigarette is lit when a user applies a flame to one end of the cigarette and draws air through the other end. The localised heat provided by the flame and the oxygen in the air drawn through the cigarette causes the end of the cigarette to ignite, and the resulting combustion generates an inhalable smoke. By contrast, in heated aerosol generating articles, an aerosol is generated by heating a flavour generating substrate, such as tobacco. Known heated aerosol generating articles include, for example, electrically heated aerosol generating articles and aerosol generating articles in which an aerosol is generated by the transfer of heat from a combustible fuel element or heat source to a physically separate aerosol forming material. For example, aerosol generating articles according to the invention find particular application in aerosol generating systems comprising an electrically heated aerosol generating device having an internal heater blade which is adapted to be inserted into the rod of aerosol generating substrate. Aerosol generating articles of this type are described in the prior art, for example, in EP 0822670.

[0025] As used herein, the term "aerosol generating device" refers to a device comprising a heater element that interacts with the aerosol generating substrate of the aerosol generating article to generate an aerosol.

[0026] As used herein with reference to the present invention, the term "rod" is used to denote a generally cylindrical element of substantially circular, oval or elliptical cross-section.

[0027] As used herein, the term "longitudinal" refers to the direction corresponding to the main longitudinal axis of the aerosol-generating article, which extends between the upstream and downstream ends of the aerosol-generating article. As used herein, the terms "upstream" and "downstream" describe the relative positions of elements, or portions of elements, of the aerosol-generating article in relation to the direction in which the aerosol is transported through the aerosol-generating article during use.

[0028] During use, air is drawn through the aerosol-generating article in the longitudinal direction. The term "transverse" refers to the direction that is perpendicular to the longitudinal axis. Any reference to the "cross-section" of the aerosol-generating article or a component of the aerosol-generating article refers to the transverse cross-section unless stated otherwise.

[0029] The term "length" denotes the dimension of a component of the aerosol-generating article in the longitudinal direction. For example, it may be used to denote the dimension of the rod or of the elongate tubular elements in the longitudinal direction.

[0030] An aerosol-generating article in accordance with the present invention comprises a rod of aerosol-generating substrate. Further, the aerosol-generating article comprises a downstream section at a location downstream of the rod of aerosol-generating substrate.

[0031] In aerosol-generating articles in accordance with the present invention, at least the rod of aerosol-generating substrate is circumscribed by a wrapper. This means that in aerosol-generating articles in accordance with the present invention the same wrapper circumscribing the rod of aerosol-generating substrate may also circumscribe at least a portion of the downstream section or at least a portion of an optional additional component of the aerosol-generating article provided at a location upstream of the rod of aerosol-generating substrate or both.

[0032] The aerosol-generating article may have an overall length from about 35 millimetres to about 100 millimetres.

[0033] Preferably, an overall length of an aerosol-generating article in accordance with the invention is at least about 38 millimetres. More preferably, an overall length of an aerosol-generating article in accordance with the invention is at least about 40 millimetres. Even more preferably, an overall length of an aerosol-generating article in accordance with the invention is at least about 42 millimetres.

[0034] In some embodiments, an overall length of an aerosol-generating article in accordance with the invention is preferably less than or equal to 80 millimetres. More preferably, an overall length of an aerosol-generating article in accordance with the invention is less than or equal to 70 millimetres. Even more preferably, an overall length of an aerosol-generating article in accordance with the invention is preferably less than or equal to 60 millimetres. Most preferably, an overall length of an aerosol-generating article in accordance with the invention is preferably less than or equal to 50 millimetres.

[0035] In preferred embodiments, an overall length of the aerosol-generating article is from about 38 millimetres to about 70 millimetres, more preferably from about 40 millimetres to about 70 millimetres, even more pref-

erably from about 42 millimetres to about 70 millimetres. In other embodiments, an overall length of the aerosol-generating article is preferably from about 38 millimetres to about 60 millimetres, more preferably from about 40 millimetres to about 60 millimetres, even more preferably from about 42 millimetres to about 60 millimetres. In further embodiments, an overall length of the aerosol-generating article is preferably from about 38 millimetres to about 50 millimetres, more preferably from about 40 millimetres to about 50 millimetres, even more preferably from about 42 millimetres to about 50 millimetres. In an exemplary embodiment, an overall length of the aerosol-generating article is about 45 millimetres.

[0036] In other embodiments, an overall length of an aerosol-generating article in accordance with the invention is preferably at least about 40 millimetres, more preferably about 50 millimetres, even more preferably about 60 millimetres. In these embodiments, an overall length of the aerosol-generating is preferably less than or equal to about 95 millimetres, more preferably less than or equal to about 90 millimetres, even more preferably less than or equal to about 85 millimetres, most preferably less than or equal to about 80 millimetres.

[0037] In preferred embodiments, an overall length of an aerosol-generating article is from about 40 millimetres to about 95 millimetres, preferably from about 40 millimetres to about 90 millimetres, more preferably from about 40 millimetres to about 85 millimetres, even more preferably from about 40 millimetres to about 80 millimetres. In other embodiments, an overall length of an aerosol-generating article is from about 50 millimetres to about 95 millimetres, preferably from about 50 millimetres to about 90 millimetres, more preferably from about 50 millimetres to about 85 millimetres, even more preferably from about 50 millimetres to about 80 millimetres. In further embodiments, an overall length of an aerosol-generating article is from about 60 millimetres to about 95 millimetres, preferably from about 60 millimetres to about 90 millimetres, more preferably from about 60 millimetres to about 85 millimetres, even more preferably from about 60 millimetres to about 80 millimetres. In yet further embodiments, an overall length of an aerosol-generating article is from about 70 millimetres to about 95 millimetres, preferably from about 70 millimetres to about 90 millimetres, more preferably from about 70 millimetres to about 85 millimetres, even more preferably from about 70 millimetres to about 80 millimetres. In an exemplary embodiment, an overall length of the aerosol-generating article is about 75 millimetres.

[0038] An aerosol-generating article in accordance with the present invention may have an external diameter of at least 4 millimetres. Preferably, the aerosol-generating article has an external diameter of at least 5 millimetres. More preferably, the aerosol-generating article has an external diameter of at least 6 millimetres. Even more preferably, the aerosol-generating article has an external diameter of at least 7 millimetres.

[0039] Preferably, the aerosol-generating article has an external diameter of less than or equal to about 12 millimetres. More preferably, the aerosol-generating article has an external diameter of less than or equal to about 10 millimetres. Even more preferably, the aerosol-generating article has an external diameter of less than or equal to about 8 millimetres.

[0040] In some embodiments, the aerosol-generating article has an external diameter from about 4 millimetres to about 12 millimetres, preferably from about 5 millimetres to about 12 millimetres, more preferably from about 6 millimetres to about 12 millimetres, even more preferably from about 7 millimetres to about 12 millimetres. In other embodiments, the aerosol-generating article has an external diameter from about 4 millimetres to about 10 millimetres, preferably from about 5 millimetres to about 10 millimetres, more preferably from about 6 millimetres to about 10 millimetres, even more preferably from about 7 millimetres to about 10 millimetres. In further embodiments, the aerosol-generating article has an external diameter from about 4 millimetres to about 8 millimetres, preferably from about 5 millimetres to about 8 millimetres, more preferably from about 6 millimetres to about 8 millimetres, even more preferably from about 7 millimetres to about 8 millimetres.

[0041] The rod of aerosol-generating substrate may have a length of between about 5 millimetres and about 100 mm.

[0042] In some embodiments, the rod of aerosol-generating substrate preferably has a length of at least about 6 millimetres, more preferably at least about 7 millimetres. In these embodiments, the rod of aerosol-generating substrate may have a length of less than about 90 millimetres and preferably has a length of less than about 70 millimetres, more preferably less than about 65 millimetres, more preferably less than about 50 millimetres, most preferably less than 40 millimetres. In particularly preferred embodiments, the rod of aerosol-generating substrate has a length of less than about 35 millimetres, more preferably less than 25 millimetres, even more preferably less than about 20 millimetres. In one embodiment, the rod of aerosol-generating substrate may have a length of about 10 millimetres. In a preferred embodiment, the rod of aerosol-generating substrate has a length of about 12 millimetres. This may be combined with an overall length of the aerosol-generating article of about 45 millimetres.

[0043] In other embodiments, the rod of aerosol-generating preferably has a length of at least about 10 millimetres, more preferably at least about 20 millimetres, even more preferably at least about 30 millimetres. In these embodiments, a length of the rod of aerosol-generating substrate is preferably less than or equal to about 60 millimetres, more preferably less than or equal to about 50 millimetres, even more preferably less than or equal to about 40 millimetres.

[0044] In preferred embodiments, a length of the rod of aerosol-generating substrate is from about 10 millimetres to about 60 millimetres, preferably from about 20

millimetres to about 60 millimetres, more preferably from about 30 millimetres to about 60 millimetres. In other embodiments, a length of the rod of aerosol-generating substrate is from about 10 millimetres to about 50 millimetres, preferably from about 20 millimetres to about 50 millimetres, more preferably from about 30 millimetres to about 50 millimetres. In further embodiments, a length of the rod of aerosol-generating substrate is from about 10 millimetres to about 40 millimetres, preferably from about 20 millimetres to about 40 millimetres, more preferably from about 40 millimetres to about 60 millimetres. In an exemplary embodiment, a length of the rod of aerosol-generating substrate is about 35 millimetres. This may be combined with an overall length of the aerosol-generating article of about 75 millimetres.

[0045] Preferably, the rod of aerosol generating substrate has a substantially uniform cross-section along the length of the rod. Particularly preferably, the rod of aerosol generating substrate has a substantially circular cross-section.

[0046] According to the present invention, a density of the aerosol-generating substrate is greater than about 300 milligrams per cubic centimetre. As used herein, with reference to the aerosol-generating substrate of aerosol-generating articles in accordance with the present invention, the term "density" refers to the "apparent density" or "volumetric density" of the substrate, and equals the total mass of the body of aerosol-generating substrate of given volume, which is the mass of the homogenised plant material, aerosol former, etc. or the mass of the gel composition of given volume, divided by said given volume of the rod of aerosol-generating substrate.

[0047] As such, for example, the density of the aerosol-generating substrate determines the mass of a body of homogenised tobacco material of given volume and the packing efficiency of a given surface area of homogenised tobacco material. The density of a homogenised tobacco material is normally largely determined by the type of process used for the manufacture thereof. A number of reconstitution processes for producing homogenised tobacco materials are known in the art. These include, but are not limited to: paper-making processes of the type described in, for example, US-A-5,724,998; casting processes of the type described in, for example, US-A-5,724,998; dough reconstitution processes of the type described in, for example, US-A-3,894,544; and extrusion processes of the type described in, for example, in GB-A-983,928.

[0048] Typically, the densities of homogenised tobacco materials produced by extrusion processes and dough reconstitution processes are greater than the densities of homogenised tobacco materials produced by casting processes. The densities of homogenised tobacco materials produced by extrusion processes can be greater than the densities of homogenised tobacco materials produced by dough reconstitution processes.

[0049] By way of example, a density of the aerosol-generating substrate is at least about 310 milligrams per cubic centimetre or at least about 320 milligrams per cubic centimetre or at least about 330 milligrams per cubic centimetre.

[0050] In some embodiments, a density of the aerosol-generating substrate is preferably at least about 350 milligrams per cubic centimetre. More preferably, a density of the aerosol-generating substrate is at least about 400 milligrams per cubic centimetre. Even more preferably, a density of the aerosol-generating substrate is at least about 450 milligrams per cubic centimetre. In particularly preferred embodiments, a density of the aerosol-generating substrate is at least about 500 milligrams per cubic centimetre. Preferably, a density of the aerosol-generating substrate is less than or equal to about 1000 milligrams per cubic centimetre, more preferably less than or equal to about 900 milligrams per cubic centimetre, even more preferably less than or equal to about 800 milligrams per cubic centimetre. By way of example, a density of the aerosol-generating substrate may be from about 350 milligrams per cubic centimetre to about 1000 milligrams per cubic centimetre, preferably from about 400 milligrams per cubic centimetre to about 1000 milligrams per cubic centimetre, more preferably from about 450 milligrams per cubic centimetre to about 1000 milligrams per cubic centimetre, even more preferably from about 500 milligrams per cubic centimetre to about 1000 milligrams per cubic centimetre. As another example, a density of the aerosol-generating substrate may be from about 350 milligrams per cubic centimetre to about 900 milligrams per cubic centimetre, preferably from about 400 milligrams per cubic centimetre to about 900 milligrams per cubic centimetre, more preferably from about 450 milligrams per cubic centimetre to about 900 milligrams per cubic centimetre, even more preferably from about 500 milligrams per cubic centimetre to about 900 milligrams per cubic centimetre. As a further example, a density of the aerosol-generating substrate may be from about 350 milligrams per cubic centimetre to about 800 milligrams per cubic centimetre, preferably from about 400 milligrams per cubic centimetre to about 800 milligrams per cubic centimetre, more preferably from about 450 milligrams per cubic centimetre to about 800 milligrams per cubic centimetre, even more preferably from about 500 milligrams per cubic centimetre to about 800 milligrams per cubic centimetre.

[0051] In other embodiments, a density of the aerosol-generating substrate is at least about 600 milligrams per cubic centimetre, preferably at least about 700 milligrams per cubic centimetre, more preferably at least about 800 milligrams per cubic centimetre, even more preferably at least about 900 milligrams per cubic centimetre. In some particularly preferred embodiments, a density of the aerosol-generating substrate is at least about 1 gram per cubic centimetre, preferably at least about 1.1 grams per cubic centimetre, more preferably at least about 1.2 grams per cubic centimetre, even more preferably at least about 1.3 grams per cubic centimetre. Preferably, a density of the aerosol-generating substrate is less than

or equal to about 2.0 grams per cubic centimetre, more preferably less than or equal to about 1.9 grams per cubic centimetre, even more preferably less than or equal to 1.8 grams per cubic centimetre. In preferred embodiments, a density of the aerosol-generating substrate is less than or equal to about 1.7 grams per cubic centimetre, more preferably less than or equal to about 1.6 grams per cubic centimetre, even more preferably less than or equal to about 1.5 grams per cubic centimetre.

[0052] As an example, a density of the aerosol-generating substrate is from about 1 gram per cubic centimetre to about 1.7 grams per cubic centimetre, preferably from about 1.1 grams per cubic centimetre to about 1.7 grams per cubic centimetre, more preferably from about 1.2 grams per cubic centimetre to about 1.7 grams per cubic centimetre, even more preferably from about 1.3 grams per cubic centimetre to about 1.7 grams per cubic centimetre. As another example, a density of the aerosol-generating substrate is from about 1 gram per cubic centimetre to about 1.6 grams per cubic centimetre, preferably from about 1.1 grams per cubic centimetre to about 1.6 grams per cubic centimetre, more preferably from about 1.2 grams per cubic centimetre to about 1.6 grams per cubic centimetre, even more preferably from about 1.3 grams per cubic centimetre to about 1.6 grams per cubic centimetre. As a further example, a density of the aerosol-generating substrate is from about 1 gram per cubic centimetre to about 1.5 grams per cubic centimetre, preferably from about 1.1 grams per cubic centimetre to about 1.5 grams per cubic centimetre, more preferably from about 1.2 grams per cubic centimetre to about 1.5 grams per cubic centimetre, even more preferably from about 1.3 grams per cubic centimetre to about 1.5 grams per cubic centimetre.

[0053] The aerosol-generating substrate may be a solid aerosol-generating substrate.

[0054] In certain preferred embodiments, the aerosol-generating substrate comprises homogenised plant material, preferably a homogenised tobacco material.

[0055] As used herein, the term "homogenised plant material" encompasses any plant material formed by the agglomeration of particles of plant. For example, sheets or webs of homogenised tobacco material for the aerosol-generating substrates of the present invention may be formed by agglomerating particles of tobacco material obtained by pulverising, grinding or comminuting plant material and optionally one or more of tobacco leaf lamina and tobacco leaf stems. The homogenised plant material may be produced by casting, extrusion, paper making processes or other any other suitable processes known in the art.

[0056] The homogenised plant material can be provided in any suitable form. For example, the homogenised plant material may be in the form of one or more sheets. As used herein with reference to the invention, the term "sheet" describes a laminar element having a width and length substantially greater than the thickness thereof.

[0057] Alternatively or in addition, the homogenised plant material may be in the form of a plurality of pellets or granules.

[0058] Alternatively or in addition, the homogenised plant material may be in the form of a plurality of strands, strips or shreds. As used herein, the term "strand" describes an elongate element of material having a length that is substantially greater than the width and thickness thereof. The term "strand" should be considered to encompass strips, shreds and any other homogenised plant material having a similar form. The strands of homogenised plant material may be formed from a sheet of homogenised plant material, for example by cutting or shredding, or by other methods, for example, by an extrusion method.

[0059] In some embodiments, the strands may be formed *in situ* within the aerosol-generating substrate as a result of the splitting or cracking of a sheet of homogenised plant material during formation of the aerosol-generating substrate, for example, as a result of crimping. The strands of homogenised plant material within the aerosol-generating substrate may be separate from each other. Alternatively, each strand of homogenised plant material within the aerosol-generating substrate may be at least partially connected to an adjacent strand or strands along the length of the strands. For example, adjacent strands may be connected by one or more fibres. This may occur, for example, where the strands have been formed due to the splitting of a sheet of homogenised plant material during production of the aerosol-generating substrate, as described above.

[0060] Preferably, the aerosol-generating substrate is in the form of one or more sheets of homogenised plant material. In various embodiments of the invention, the one or more sheets of homogenised plant material may be produced by a casting process. In various embodiments of the invention, the one or more sheets of homogenised plant material may be produced by a paper-making process. The one or more sheets as described herein may each individually have a thickness of between 100 micrometres and 600 micrometres, preferably between 150 micrometres and 300 micrometres, and most preferably between 200 micrometres and 250 micrometres. Individual thickness refers to the thickness of the individual sheet, whereas combined thickness refers to the total thickness of all sheets that make up the aerosol-generating substrate. For example, if the aerosol-generating substrate is formed from two individual sheets, then the combined thickness is the sum of the thickness of the two individual sheets or the measured thickness of the two sheets where the two sheets are stacked in the aerosol-generating substrate.

[0061] The one or more sheets as described herein may each individually have a grammage of between about 100 g/m^2 and about 300 g/m^2.

[0062] The one or more sheets as described herein may each individually have a density of from about 0.3 g/cm^3 to about 1.3 g/cm^3, and preferably from about 0.7 g/cm^3 to about 1.0 g/cm^3.

[0063] In embodiments of the present invention in which the aerosol-generating substrate comprises one or more sheets of homogenised plant material, the sheets are preferably in the form of one or more gathered sheets. As used herein, the term "gathered" denotes that the sheet of homogenised plant material is convoluted, folded, or otherwise compressed or constricted substantially transversely to the cylindrical axis of a plug or a rod.

[0064] The one or more sheets of homogenised plant material may be gathered transversely relative to the longitudinal axis thereof and circumscribed with a wrapper to form a continuous rod or a plug.

[0065] The one or more sheets of homogenised plant material may advantageously be crimped or similarly treated. As used herein, the term "crimped" denotes a sheet having a plurality of substantially parallel ridges or corrugations. Alternatively or in addition to being crimped, the one or more sheets of homogenised plant material may be embossed, debossed, perforated or otherwise deformed to provide texture on one or both sides of the sheet.

[0066] Preferably, each sheet of homogenised plant material may be crimped such that it has a plurality of ridges or corrugations substantially parallel to the cylindrical axis of the plug. This treatment advantageously facilitates gathering of the crimped sheet of homogenised plant material to form the plug. Preferably, the one or more sheets of homogenised plant material may be gathered. It will be appreciated that crimped sheets of homogenised plant material may alternatively or in addition have a plurality of substantially parallel ridges or corrugations disposed at an acute or obtuse angle to the cylindrical axis of the plug. The sheet may be crimped to such an extent that the integrity of the sheet becomes disrupted at the plurality of parallel ridges or corrugations causing separation of the material, and results in the formation of shreds, strands or strips of homogenised plant material.

[0067] Alternatively, the one or more sheets of homogenised plant material may be cut into strands as referred to above. In such embodiments, the aerosol-generating substrate comprises a plurality of strands of the homogenised plant material. The strands may be used to form a plug. Typically, the width of such strands is about 5 millimetres, or about 4 millimetres, or about 3 millimetres, or about 2 millimetres or less. The length of the strands may be greater than about 5 millimetres, between about 5 millimetres to about 15 millimetres, about 8 millimetres to about 12 millimetres, or about 12 millimetres. Preferably, the strands have substantially the same length as each other. The length of the strands may be determined by the manufacturing process whereby a rod is cut into shorter plugs and the length of the strands corresponds to the length of the plug. The strands may be fragile which may result in breakage especially during transit. In such cases, the length of some of the strands may be less than the length of the plug.

[0068] The plurality of strands preferably extend substantially longitudinally along the length of the aerosol-generating substrate, aligned with the longitudinal axis. Preferably, the plurality of strands are therefore aligned substantially parallel to each other.

[0069] The homogenised plant material may comprise up to about 95 percent by weight of plant particles, on a dry weight basis. Preferably, the homogenised plant material comprises up to about 90 percent by weight of plant particles, more preferably up to about 80 percent by weight of plant particles, more preferably up to about 70 percent by weight of plant particles, more preferably up to about 60 percent by weight of plant particles, more preferably up to about 50 percent by weight of plant particles, on a dry weight basis.

[0070] For example, the homogenised plant material may comprise between about 2.5 percent and about 95 percent by weight of plant particles, or about 5 percent and about 90 percent by weight of plant particles, or between about 10 percent and about 80 percent by weight of plant particles, or between about 15 percent and about 70 percent by weight of plant particles, or between about 20 percent and about 60 percent by weight of plant particles, or between about 30 percent and about 50 percent by weight of plant particles, on a dry weight basis.

[0071] In certain embodiments of the invention, the homogenised plant material is a homogenised tobacco material comprising tobacco particles. Sheets of homogenised tobacco material for use in such embodiments of the invention may have a tobacco content of at least about 40 percent by weight on a dry weight basis, more preferably of at least about 50 percent by weight on a dry weight basis, more preferably at least about 70 percent by weight on a dry weight basis and most preferably at least about 90 percent by weight on a dry weight basis.

[0072] With reference to the present invention, the term "tobacco particles" describes particles of any plant member of the genus *Nicotiana.* The term "tobacco particles" encompasses ground or powdered tobacco leaf lamina, ground or powdered tobacco leaf stems, tobacco dust, tobacco fines, and other particulate tobacco by-products formed during the treating, handling and shipping of tobacco. In a preferred embodiment, the tobacco particles are substantially all derived from tobacco leaf lamina. By contrast, isolated nicotine and nicotine salts are compounds derived from tobacco but are not considered tobacco particles for purposes of the invention and are not included in the percentage of particulate plant material.

[0073] The tobacco particles may be prepared from one or more varieties of tobacco plants. Any type of tobacco may be used in a blend. Examples of tobacco types that may be used include, but are not limited to, sun-cured tobacco, flue-cured tobacco, Burley tobacco, Maryland tobacco, Oriental tobacco, Virginia tobacco, and other speciality tobaccos.

[0074] Flue-curing is a method of curing tobacco, which is particularly used with Virginia tobaccos. During the flue-curing process, heated air is circulated through densely packed tobacco. During a first stage, the tobacco

leaves turn yellow and wilt. During a second stage, the laminae of the leaves are completely dried. During a third stage, the leaf stems are completely dried.

[0075] Burley tobacco plays a significant role in many tobacco blends. Burley tobacco has a distinctive flavour and aroma and also has an ability to absorb large amounts of casing.

[0076] Oriental is a type of tobacco which has small leaves, and high aromatic qualities. However, Oriental tobacco has a milder flavour than, for example, Burley. Generally, therefore, Oriental tobacco is used in relatively small proportions in tobacco blends.

[0077] Kasturi, Madura and Jatim are subtypes of sun-cured tobacco that can be used. Preferably, Kasturi tobacco and flue-cured tobacco may be used in a blend to produce the tobacco particles. Accordingly, the tobacco particles in the particulate plant material may comprise a blend of Kasturi tobacco and flue-cured tobacco.

[0078] The tobacco particles may have a nicotine content of at least about 2.5 percent by weight, based on dry weight. More preferably, the tobacco particles may have a nicotine content of at least about 3 percent, even more preferably at least about 3.2 percent, even more preferably at least about 3.5 percent, most preferably at least about 4 percent by weight, based on dry weight.

[0079] In certain other embodiments of the invention, the homogenised plant material comprises tobacco particles in combination with non-tobacco plant flavour particles. Preferably, the non-tobacco plant flavour particles are selected from one or more of: ginger particles, eucalyptus particles, clove particles and star anise particles. Preferably, in such embodiments, the homogenised plant material comprises at least about 2.5 percent by weight of the non-tobacco plant flavour particles, on a dry weight basis, with the remainder of the plant particles being tobacco particles. Preferably, the homogenised plant material comprises at least about 4 percent by weight of non-tobacco plant flavour particles, more preferably at least about 6 percent by weight of non-tobacco plant flavour particles, more preferably at least about 8 percent by weight of non-tobacco plant flavour particles and more preferably at least about 10 percent by weight of non-tobacco plant flavour particles, on a dry weight basis. Preferably, the homogenised plant material comprises up to about 20 percent by weight of non-tobacco plant flavour particles, more preferably up to about 18 percent by weight of non-tobacco plant flavour particles, more preferably up to about 16 percent by weight of non-tobacco plant flavour particles.

[0080] The weight ratio of the non-tobacco plant flavour particles and the tobacco particles in the particulate plant material forming the homogenised plant material may vary depending on the desired flavour characteristics and composition of the aerosol produced from the aerosol-generating substrate during use. Preferably, the homogenised plant material comprises at least a 1:30 weight ratio of non-tobacco plant flavour particles to tobacco particles, more preferably at least a 1:20 weight ratio of non-tobacco plant flavour particles to tobacco particles, more preferably at least a 1:10 weight ratio of non-tobacco plant flavour particles to tobacco particles and most preferably at least a1:5 weight ratio of non-tobacco plant flavour particles to tobacco particles, on a dry weight basis.

[0081] Alternatively or in addition to the inclusion of tobacco particles into the homogenised plant material of the aerosol-generating substrate according to the invention, the homogenised plant material may comprise cannabis particles. The term "cannabis particles" refers to particles of a cannabis plant, such as the species *Cannabis sativa, Cannabis indica,* and *Cannabis ruderalis.*

[0082] The homogenised plant material preferably comprises no more than 95 percent by weight of the particulate plant material, on a dry weight basis. The particulate plant material is therefore typically combined with one or more other components to form the homogenised plant material.

[0083] The homogenised plant material may further comprise a binder to alter the mechanical properties of the particulate plant material, wherein the binder is included in the homogenised plant material during manufacturing as described herein. Suitable exogenous binders would be known to the skilled person and include but are not limited to: gums such as, for example, guar gum, xanthan gum, arabic gum and locust bean gum; cellulosic binders such as, for example, hydroxypropyl cellulose, carboxymethyl cellulose, hydroxyethyl cellulose, methyl cellulose and ethyl cellulose; polysaccharides such as, for example, starches, organic acids, such as alginic acid, conjugate base salts of organic acids, such as sodium-alginate, agar and pectins; and combinations thereof. Preferably, the binder comprises guar gum.

[0084] The binder may be present in an amount of from about 1 percent to about 10 percent by weight, based on the dry weight of the homogenised plant material, preferably in an amount of from about 2 percent to about 5 percent by weight, based on the dry weight of the homogenised plant material.

[0085] Alternatively or in addition, the homogenised plant material may further comprise one or more lipids to facilitate the diffusivity of volatile components (for example, aerosol formers, gingerols and nicotine), wherein the lipid is included in the homogenised plant material during manufacturing as described herein. Suitable lipids for inclusion in the homogenised plant material include, but are not limited to: medium-chain triglycerides, cocoa butter, palm oil, palm kernel oil, mango oil, shea butter, soybean oil, cottonseed oil, coconut oil, hydrogenated coconut oil, candellila wax, carnauba wax, shellac, sunflower wax, sunflower oil, rice bran, and Revel A; and combinations thereof.

[0086] Alternatively or in addition, the homogenised plant material may further comprise a pH modifier.

[0087] Alternatively or in addition, the homogenised plant material may further comprise fibres to alter the mechanical properties of the homogenised plant material, wherein the fibres are included in the homogenised

plant material during manufacturing as described herein. Suitable exogenous fibres for inclusion in the homogenised plant material are known in the art and include fibres formed from non-tobacco material and non-ginger material, including but not limited to: cellulose fibres; softwood fibres; hard-wood fibres; jute fibres and combinations thereof. Exogenous fibres derived from tobacco and/or ginger can also be added. Any fibres added to the homogenised plant material are not considered to form part of the "particulate plant material" as defined above. Prior to inclusion in the homogenised plant material, fibres may be treated by suitable processes known in the art including, but not limited to: mechanical pulping; refining; chemical pulping; bleaching; sulphate pulping; and combinations thereof. A fibre typically has a length greater than its width.

[0088] Suitable fibres typically have lengths of greater than 400 micrometres and less than or equal to 4 millimetres, preferably within the range of 0.7 millimetres to 4 millimetres. Preferably, the fibres are present in an amount of about 2 percent to about 15 percent by weight, most preferably at about 4 percent by weight, based on the dry weight of the substrate.

[0089] Alternatively or in addition, the homogenised plant material may further comprise one or more aerosol formers. Upon volatilisation, an aerosol former can convey other vaporised compounds released from the aerosol-generating substrate upon heating, such as nicotine and flavourants, in an aerosol. Suitable aerosol formers for inclusion in the homogenised plant material are known in the art and include, but are not limited to: polyhydric alcohols, such as triethylene glycol, propylene glycol, 1,3-butanediol and glycerol; esters of polyhydric alcohols, such as glycerol mono-, di- or triacetate; and aliphatic esters of mono-, di- or polycarboxylic acids, such as dimethyl dodecanedioate and dimethyl tetradecanedioate.

[0090] The homogenised plant material may have an aerosol former content of between about 5 percent and about 30 percent by weight on a dry weight basis, such as between about 10 percent and about 25 percent by weight on a dry weight basis, or between about 15 percent and about 20 percent by weight on a dry weight basis.

[0091] For example, if the substrate is intended for use in an aerosol-generating article for an electrically-operated aerosol-generating system having a heating element, it may preferably include an aerosol former content of between about 10 percent to about 30 percent by weight on a dry weight basis. If the substrate is intended for use in an aerosol-generating article for an electrically-operated aerosol-generating system having a heating element, the aerosol former is preferably glycerol.

[0092] In other embodiments, the homogenised plant material may have an aerosol former content of about 30 percent by weight to about 45 percent by weight. This relatively high level of aerosol former is particularly suitable for aerosol-generating substrates that are intended to be heated at a temperature of less than 275 degrees Celsius. In such embodiments, the homogenised plant material preferably further comprises between about 2 percent by weight and about 10 percent by weight of cellulose ether, on a dry weight basis and between about 5 percent by weight and about 50 percent by weight of additional cellulose, on a dry weight basis. The use of the combination of cellulose ether and additional cellulose has been found to provide a particularly effective delivery of aerosol when used in an aerosol-generating substrate having an aerosol former content of between 30 percent by weight and 45 percent by weight.

[0093] Suitable cellulose ethers include but are not limited to methyl cellulose, hydroxypropyl methyl cellulose, ethyl cellulose, hydroxyl ethyl cellulose, hydroxyl propyl cellulose, ethyl hydroxyl ethyl cellulose and carboxymethyl cellulose (CMC). In particularly preferred embodiments, the cellulose ether is carboxymethyl cellulose.

[0094] As used herein, the term "additional cellulose" encompasses any cellulosic material incorporated into the homogenised plant material which does not derive from the non-tobacco plant particles or tobacco particles provided in the homogenised plant material. The additional cellulose is therefore incorporated in the homogenised plant material in addition to the non-tobacco plant material or tobacco material, as a separate and distinct source of cellulose to any cellulose intrinsically provided within the non-tobacco plant particles or tobacco particles. The additional cellulose will typically derive from a different plant to the non-tobacco plant particles or tobacco particles. Preferably, the additional cellulose is in the form of an inert cellulosic material, which is sensorially inert and therefore does not substantially impact the organoleptic characteristics of the aerosol generated from the aerosol-generating substrate. For example, the additional cellulose is preferably a tasteless and odourless material.

[0095] The additional cellulose may comprise cellulose powder, cellulose fibres, or a combination thereof.

[0096] The aerosol former may act as a humectant in the aerosol-generating substrate.

[0097] In certain preferred embodiments of the present invention, the aerosol-generating substrate comprises a gel composition that includes an alkaloid compound, or a cannabinoid compound, or both an alkaloid compound and a cannabinoid compound. In particularly preferred embodiments, the aerosol-generating substrate comprises a gel composition that includes nicotine.

[0098] Preferably, the gel composition comprises an alkaloid compound, or a cannabinoid compound, or both an alkaloid compound and a cannabinoid compound; an aerosol former; and at least one gelling agent. Preferably, the at least one gelling agent forms a solid medium and the glycerol is dispersed in the solid medium, with the alkaloid or cannabinoid dispersed in the glycerol. Preferably, the gel composition is a stable gel phase.

[0099] Advantageously, a stable gel composition comprising nicotine provides predictable composition form

upon storage or transit from manufacture to the consumer. The stable gel composition comprising nicotine substantially maintains its shape. The stable gel composition comprising nicotine substantially does not release a liquid phase upon storage or transit from manufacture to the consumer. The stable gel composition comprising nicotine may provide for a simple consumable design. This consumable may not have to be designed to contain a liquid, thus a wider range of materials and container constructions may be contemplated.

[0100] The gel composition described herein may be combined with an aerosol-generating device to provide a nicotine aerosol to the lungs at inhalation or air flow rates that are within conventional smoking regime inhalation or air flow rates. The aerosol-generating device may continuously heat the gel composition. A consumer may take a plurality of inhalations or "puffs" where each "puff" delivers an amount of nicotine aerosol. The gel composition may be capable of delivering a high nicotine/low total particulate matter (TPM) aerosol to a consumer when heated, preferably in a continuous manner.

[0101] The phrase "stable gel phase" or "stable gel" refers to gel that substantially maintains its shape and mass when exposed to a variety of environmental conditions. The stable gel may not substantially release (sweat) or absorb water when exposed to a standard temperature and pressure while varying relative humidity from about 10 percent to about 60 percent. For example, the stable gel may substantially maintain its shape and mass when exposed to a standard temperature and pressure while varying relative humidity from about 10 percent to about 60 percent.

[0102] The gel composition includes an alkaloid compound, or a cannabinoid compound, or both an alkaloid compound and a cannabinoid compound. The gel composition may include one or more alkaloids. The gel composition may include one or more cannabinoids. The gel composition may include a combination of one or more alkaloids and one or more cannabinoids.

[0103] The term "alkaloid compound" refers to any one of a class of naturally occurring organic compounds that contain one or more basic nitrogen atoms. Generally, an alkaloid contains at least one nitrogen atom in an amine-type structure. This or another nitrogen atom in the molecule of the alkaloid compound can be active as a base in acid-base reactions. Most alkaloid compounds have one or more of their nitrogen atoms as part of a cyclic system, such as for example a heterocylic ring. In nature, alkaloid compounds are found primarily in plants, and are especially common in certain families of flowering plants. However, some alkaloid compounds are found in animal species and fungi. In this disclosure, the term "alkaloid compound" refers to both naturally derived alkaloid compounds and synthetically manufactured alkaloid compounds.

[0104] The gel composition may preferably include an alkaloid compound selected from the group consisting of nicotine, anatabine, and combinations thereof.

[0105] Preferably the gel composition includes nicotine.

[0106] The term "nicotine" refers to nicotine and nicotine derivatives such as free-base nicotine, nicotine salts and the like.

[0107] The term "cannabinoid compound" refers to any one of a class of naturally occurring compounds that are found in parts of the cannabis plant - namely the species *Cannabis sativa, Cannabis indica,* and *Cannabis ruderalis.* Cannabinoid compounds are especially concentrated in the female flower heads. Cannabinoid compounds naturally occurring in the cannabis plant include cannabidiol (CBD) and tetrahydrocannabinol (THC). In this disclosure, the term "cannabinoid compounds" is used to describe both naturally derived cannabinoid compounds and synthetically manufactured cannabinoid compounds.

[0108] The gel may include a cannabinoid compound selected from the group consisting of cannabidiol (CBD), tetrahydrocannabinol (THC), tetrahydrocannabinolic acid (THCA), cannabidiolic acid (CBDA), cannabinol (CBN), cannabigerol (CBG), cannabichromene (CBC), cannabicyclol (CBL), cannabivarin (CBV), tetrahydrocannabivarin (THCV), cannabidivarin (CBDV), cannabichromevarin (CBCV), cannabigerovarin (CBGV), cannabigerol monomethyl ether (CBGM), cannabielsoin (CBE),cannabicitran (CBT), and combinations thereof.

[0109] The gel composition may preferably include a cannabinoid compound selected from the group consisting of cannabidiol (CBD), THC (tetrahydrocannabinol) and combinations thereof.

[0110] The gel may preferably include cannabidiol (CBD).

[0111] The gel composition may include nicotine and cannabidiol (CBD).

[0112] The gel composition may include nicotine, cannabidiol (CBD), and THC (tetrahydrocannabinol).

[0113] The gel composition preferably includes about 0.5 percent by weight to about 10 percent by weight of an alkaloid compound, or about 0.5 percent by weight to about 10 percent by weight. of a cannabinoid compound, or both an alkaloid compound and a cannabinoid compound in a total amount from about 0.5 percent by weight to about 10 percent by weight. The gel composition may include about 0.5 percent by weight to about 5 percent by weight of an alkaloid compound, or about 0.5 percent by weight to about 5 percent by weight of a cannabinoid compound, or both an alkaloid compound and a cannabinoid compound in a total amount from about 0.5 percent by weight to about 5 percent by weight. Preferably the gel composition includes about 1 percent by weight to about 3 percent by weight of an alkaloid compound, or about 1 percent by weight to about 3 percent by weight of a cannabinoid compound, or both an alkaloid compound and a cannabinoid compound in a total amount from about 1 percent by weight to about 3 percent by weight. The gel composition may preferably include about 1.5 percent by weight to about 2.5 percent by

weight of an alkaloid compound, or about 1.5 percent by weight to about 2.5 percent by weight of a cannabinoid compound, or both an alkaloid compound and a cannabinoid compound in a total amount from about 1.5 percent by weight to about 2.5 percent by weight. The gel composition may preferably include about 2 percent by weight of an alkaloid compound, or about 2 percent by weight of a cannabinoid compound, or both an alkaloid compound and a cannabinoid compound in a total amount of about 2 percent by weight. The alkaloid compound component of the gel formulation may be the most volatile component of the gel formulation. In some aspects water may be the most volatile component of the gel formulation and the alkaloid compound component of the gel formulation may be the second most volatile component of the gel formulation. The cannabinoid compound component of the gel formulation may be the most volatile component of the gel formulation. In some aspects water may be the most volatile component of the gel formulation and the alkaloid compound component of the gel formulation may be the second most volatile component of the gel formulation.

[0114] Preferably nicotine is included in the gel compositions. The nicotine may be added to the composition in a free base form or a salt form. The gel composition includes about 0.5 percent by weight to about 10 percent by weight nicotine, or about 0.5 percent by weight to about 5 percent by weight nicotine. Preferably the gel composition includes about 1 percent by weight to about 3 percent by weight nicotine, or about 1.5 percent by weight to about 2.5 percent by weight nicotine, or about 2 percent by weight nicotine. The nicotine component of the gel formulation may be the most volatile component of the gel formulation. In some aspects water may be the most volatile component of the gel formulation and the nicotine component of the gel formulation may be the second most volatile component of the gel formulation.

[0115] The gel composition includes an aerosol-former. Ideally the aerosol-former is substantially resistant to thermal degradation at the operating temperature of the associated aerosol-generating device. Suitable aerosol-formers include, but are not limited to: polyhydric alcohols, such as triethylene glycol, 1, 3-butanediol and glycerine; esters of polyhydric alcohols, such as glycerol mono-, di- or triacetate; and aliphatic esters of mono-, di- or polycarboxylic acids, such as dimethyl dodecanedioate and dimethyl tetradecanedioate. Polyhydric alcohols or mixtures thereof, may be one or more of triethylene glycol, 1, 3-butanediol and, glycerine (glycerol or propane-1,2,3-triol) or polyethylene glycol. The aerosol-former is preferably glycerol.

[0116] The gel composition may include a majority of an aerosol-former. The gel composition may include a mixture of water and the aerosol-former where the aerosol-former forms a majority (by weight) of the gel composition. The aerosol-former may form at least about 50 percent by weight of the gel composition. The aerosol-former may form at least about 60 percent by weight or at least about 65 percent by weight or at least about 70 percent by weight of the gel composition. The aerosol-former may form about 70 percent by weight to about 80 percent by weight of the gel composition. The aerosol-former may form about 70 percent by weight to about 75 percent by weight of the gel composition.

[0117] The gel composition may include a majority of glycerol. The gel composition may include a mixture of water and the glycerol where the glycerol forms a majority (by weight) of the gel composition. The glycerol may form at least about 50 percent by weight of the gel composition. The glycerol may form at least about 60 percent by weight or at least about 65 percent by weight or at least about 70 percent by weight of the gel composition. The glycerol may form about 70 percent by weight to about 80 percent by weight of the gel composition. The glycerol may form about 70 percent by weight to about 75 percent by weight of the gel composition.

[0118] The gel composition preferably includes at least one gelling agent. Preferably, the gel composition includes a total amount of gelling agents in a range from about 0.4 percent by weight to about 10 percent by weight. More preferably, the composition includes the gelling agents in a range from about 0.5 percent by weight to about 8 percent by weight. More preferably, the composition includes the gelling agents in a range from about 1 percent by weight to about 6 percent by weight. More preferably, the composition includes the gelling agents in a range from about 2 percent by weight to about 4 percent by weight. More preferably, the composition includes the gelling agents in a range from about 2 percent by weight to about 3 percent by weight.

[0119] The term "gelling agent" refers to a compound that homogeneously, when added to a 50 percent by weight water/50 percent by weight glycerol mixture, in an amount of about 0.3 percent by weight, forms a solid medium or support matrix leading to a gel. Gelling agents include, but are not limited to, hydrogen-bond crosslinking gelling agents, and ionic crosslinking gelling agents.

[0120] The gelling agent may include one or more biopolymers. The biopolymers may be formed of polysaccharides.

[0121] Biopolymers include, for example, gellan gums (native, low acyl gellan gum, high acyl gellan gums with low acyl gellan gum being preferred), xanthan gum, alginates (alginic acid), agar, guar gum, and the like. The composition may preferably include xanthan gum. The composition may include two biopolymers. The composition may include three biopolymers. The composition may include the two biopolymers in substantially equal weights. The composition may include the three biopolymers in substantially equal weights.

[0122] Preferably, the gel composition comprises at least about 0.2 percent by weight hydrogen-bond crosslinking gelling agent. Alternatively or in addition, the gel composition preferably comprises at least about 0.2 percent by weight ionic crosslinking gelling agent. Most preferably, the gel composition comprises at least about

0.2 percent by weight hydrogen-bond crosslinking gelling agent and at least about 0.2 percent by weight ionic crosslinking gelling agent. The gel composition may comprise about 0.5 percent by weight to about 3 percent by weight hydrogen-bond crosslinking gelling agent and about 0.5 percent by weight to about 3 percent by weight ionic crosslinking gelling agent, or about 1 percent by weight to about 2 percent by weight hydrogen-bond crosslinking gelling agent and about 1 percent by weight to about 2 percent by weight ionic crosslinking gelling agent. The hydrogen-bond crosslinking gelling agent and ionic crosslinking gelling agent may be present in the gel composition in substantially equal amounts by weight.

[0123] The term "hydrogen-bond crosslinking gelling agent" refers to a gelling agent that forms non-covalent crosslinking bonds or physical crosslinking bonds via hydrogen bonding. Hydrogen bonding is a type of electrostatic dipole-dipole attraction between molecules, not a covalent bond to a hydrogen atom. It results from the attractive force between a hydrogen atom covalently bonded to a very electronegative atom such as a N, O, or F atom and another very electronegative atom.

[0124] The hydrogen-bond crosslinking gelling agent may include one or more of a galactomannan, gelatin, agarose, or konjac gum, or agar. The hydrogen-bond crosslinking gelling agent may preferably include agar.

[0125] The gel composition preferably includes the hydrogen-bond crosslinking gelling agent in a range from about 0.3 percent by weight to about 5 percent by weight. Preferably the composition includes the hydrogen-bond crosslinking gelling agent in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the composition includes the hydrogen-bond crosslinking gelling agent in a range from about 1 percent by weight to about 2 percent by weight.

[0126] The gel composition may include a galactomannan in a range from about 0.2 percent by weight to about 5 percent by weight. Preferably the galactomannan may be in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the galactomannan may be in a range from about 0.5 percent by weight to about 2 percent by weight. Preferably the galactomannan may be in a range from about 1 percent by weight to about 2 percent by weight.

[0127] The gel composition may include a gelatin in a range from about 0.2 percent by weight to about 5 percent by weight. Preferably the gelatin may be in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the gelatin may be in a range from about 0.5 percent by weight to about 2 percent by weight. Preferably the gelatin may be in a range from about 1 percent by weight to about 2 percent by weight.

[0128] The gel composition may include agarose in a range from about 0.2 percent by weight to about 5 percent by weight. Preferably the agarose may be in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the agarose may be in a range from about 0.5 percent by weight to about 2 percent by weight. Preferably the agarose may be in a range from about 1 percent by weight to about 2 percent by weight.

[0129] The gel composition may include konjac gum in a range from about 0.2 percent by weight to about 5 percent by weight. Preferably the konjac gum may be in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the konjac gum may be in a range from about 0.5 percent by weight to about 2 percent by weight. Preferably the konjac gum may be in a range from about 1 percent by weight to about 2 percent by weight.

[0130] The gel composition may include agar in a range from about 0.2 percent by weight to about 5 percent by weight. Preferably the agar may be in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the agar may be in a range from about 0.5 percent by weight to about 2 percent by weight. Preferably the agar may be in a range from about 1 percent by weight to about 2 percent by weight.

[0131] The term "ionic crosslinking gelling agent" refers to a gelling agent that forms non-covalent crosslinking bonds or physical crosslinking bonds via ionic bonding. Ionic crosslinking involves the association of polymer chains by noncovalent interactions. A crosslinked network is formed when multivalent molecules of opposite charges electrostatically attract each other giving rise to a crosslinked polymeric network.

[0132] The ionic crosslinking gelling agent may include low acyl gellan, pectin, kappa carrageenan, iota carrageenan or alginate. The ionic crosslinking gelling agent may preferably include low acyl gellan.

[0133] The gel composition may include the ionic crosslinking gelling agent in a range from about 0.3 percent by weight to about 5 percent by weight. Preferably the composition includes the ionic crosslinking gelling agent in a range from about 0.5 percent by weight to about 3 percent by weight by weight. Preferably the composition includes the ionic crosslinking gelling agent in a range from about 1 percent by weight to about 2 percent by weight.

[0134] The gel composition may include low acyl gellan in a range from about 0.2 percent by weight to about 5 percent by weight. Preferably the low acyl gellan may be in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the low acyl gellan may be in a range from about 0.5 percent by weight to about 2 percent by weight. Preferably the low acyl gellan may be in a range from about 1 percent by weight to about 2 percent by weight.

[0135] The gel composition may include pectin in a range from about 0.2 percent by weight to about 5 percent by weight. Preferably the pectin may be in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the pectin may be in a range from about 0.5 percent by weight to about 2 percent by weight. Preferably the pectin may be in a range from about 1 percent by weight to about 2 percent by weight.

[0136] The gel composition may include kappa carra-

geenan in a range from about 0.2 percent by weight to about 5 percent by weight. Preferably the kappa carrageenan may be in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the kappa carrageenan may be in a range from about 0.5 percent by weight to about 2 percent by weight. Preferably the kappa carrageenan may be in a range from about 1 percent by weight to about 2 percent by weight.

[0137] The gel composition may include iota carrageenan in a range from about 0.2 percent by weight to about 5 percent by weight. Preferably the iota carrageenan may be in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the iota carrageenan may be in a range from about 0.5 percent by weight to about 2 percent by weight. Preferably the iota carrageenan may be in a range from about 1 percent by weight to about 2 percent by weight.

[0138] The gel composition may include alginate in a range from about 0.2 percent by weight to about 5 percent by weight. Preferably the alginate may be in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the alginate may be in a range from about 0.5 percent by weight to about 2 percent by weight. Preferably the alginate may be in a range from about 1 percent by weight to about 2 percent by weight.

[0139] The gel composition may include the hydrogen-bond crosslinking gelling agent and ionic crosslinking gelling agent in a ratio of about 3:1 to about 1:3. Preferably the gel composition may include the hydrogen-bond crosslinking gelling agent and ionic crosslinking gelling agent in a ratio of about 2:1 to about 1:2. Preferably the gel composition may include the hydrogen-bond crosslinking gelling agent and ionic crosslinking gelling agent in a ratio of about 1:1.

[0140] The gel composition may further include a viscosifying agent. The viscosifying agent combined with the hydrogen-bond crosslinking gelling agent and the ionic crosslinking gelling agent appears to surprisingly support the solid medium and maintain the gel composition even when the gel composition comprises a high level of glycerol.

[0141] The term "viscosifying agent" refers to a compound that, when added homogeneously into a 25°C, 50 percent by weight water/50 percent by weight glycerol mixture, in an amount of 0.3 percent by weight., increases the viscosity without leading to the formation of a gel, the mixture staying or remaining fluid. Preferably the viscosifying agent refers to a compound that when added homogeneously into a 25°C 50 percent by weight water/50 percent by weight glycerol mixture, in an amount of 0.3 percent by weight, increases the viscosity to at least 50 cPs, preferably at least 200 cPs, preferably at least 500 cPs, preferably at least 1000 cPs at a shear rate of 0.1 s^{-1}, without leading to the formation of a gel, the mixture staying or remaining fluid. Preferably the viscosifying agent refers to a compound that when added homogeneously into a 25°C 50 percent by weight water/50 percent by weight glycerol mixture, in an amount of 0.3 percent by weight, increases the viscosity at least 2 times, or at least 5 times, or at least 10 times, or at least 100 times higher than before addition, at a shear rate of 0.1 s^{-1}, without leading to the formation of a gel, the mixture staying or remaining fluid.

[0142] The viscosity values recited herein can be measured using a Brookfield RVT viscometer rotating a disc type RV#2 spindle at 25°C at a speed of 6 revolutions per minute (rpm).

[0143] The gel composition preferably includes the viscosifying agent in a range from about 0.2 percent by weight to about 5 percent by weight. Preferably the composition includes the viscosifying agent in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the composition includes the viscosifying agent in a range from about 0.5 percent by weight to about 2 percent by weight. Preferably the composition includes the viscosifying agent in a range from about 1 percent by weight to about 2 percent by weight.

[0144] The viscosifying agent may include one or more of xanthan gum, carboxymethyl-cellulose, microcrystalline cellulose, methyl cellulose, gum Arabic, guar gum, lambda carrageenan, or starch. The viscosifying agent may preferably include xanthan gum.

[0145] The gel composition may include xanthan gum in a range from about 0.2 percent by weight to about 5 percent by weight. Preferably the xanthan gum may be in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the xanthan gum may be in a range from about 0.5 percent by weight to about 2 percent by weight. Preferably the xanthan gum may be in a range from about 1 percent by weight to about 2 percent by weight.

[0146] The gel composition may include carboxymethyl-cellulose in a range from about 0.2 percent by weight to about 5 percent by weight. Preferably the carboxymethyl-cellulose may be in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the carboxymethyl-cellulose may be in a range from about 0.5 percent by weight to about 2 percent by weight. Preferably the carboxymethyl-cellulose may be in a range from about 1 percent by weight to about 2 percent by weight.

[0147] The gel composition may include microcrystalline cellulose in a range from about 0.2 percent by weight to about 5 percent by weight. Preferably the microcrystalline cellulose may be in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the microcrystalline cellulose may be in a range from about 0.5 percent by weight to about 2 percent by weight. Preferably the microcrystalline cellulose may be in a range from about 1 percent by weight to about 2 percent by weight.

[0148] The gel composition may include methyl cellulose in a range from about 0.2 percent by weight to about 5 percent by weight. Preferably the methyl cellulose may be in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the methyl cellulose may

be in a range from about 0.5 percent by weight to about 2 percent by weight. Preferably the methyl cellulose may be in a range from about 1 percent by weight to about 2 percent by weight.

[0149] The gel composition may include gum Arabic in a range from about 0.2 percent by weight to about 5 percent by weight. Preferably the gum Arabic may be in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the gum Arabic may be in a range from about 0.5 percent by weight to about 2 percent by weight. Preferably the gum Arabic may be in a range from about 1 percent by weight to about 2 percent by weight.

[0150] The gel composition may include guar gum in a range from about 0.2 percent by weight to about 5 percent by weight. Preferably the guar gum may be in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the guar gum may be in a range from about 0.5 percent by weight to about 2 percent by weight. Preferably the guar gum may be in a range from about 1 percent by weight to about 2 percent by weight.

[0151] The gel composition may include lambda carrageenan in a range from about 0.2 percent by weight to about 5 percent by weight. Preferably the lambda carrageenan may be in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the lambda carrageenan may be in a range from about 0.5 percent by weight to about 2 percent by weight. Preferably the lambda carrageenan may be in a range from about 1 percent by weight to about 2 percent by weight.

[0152] The gel composition may include starch in a range from about 0.2 percent by weight to about 5 percent by weight. Preferably the starch may be in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the starch may be in a range from about 0.5 percent by weight to about 2 percent by weight. Preferably the starch may be in a range from about 1 percent by weight to about 2 percent by weight.

[0153] The gel composition may further include a divalent cation. Preferably the divalent cation includes calcium ions, such as calcium lactate in solution. Divalent cations (such as calcium ions) may assist in the gel formation of compositions that include gelling agents such as the ionic crosslinking gelling agent, for example. The ion effect may assist in the gel formation. The divalent cation may be present in the gel composition in a range from about 0.1 to about 1 percent by weight, or about 0.5 percent by weight.

[0154] The gel composition may further include an acid. The acid may comprise a carboxylic acid. The carboxylic acid may include a ketone group. Preferably the carboxylic acid may include a ketone group having less than about 10 carbon atoms, or less than about 6 carbon atoms or less than about 4 carbon atoms, such as levulinic acid or lactic acid. Preferably this carboxylic acid has three carbon atoms (such as lactic acid). Lactic acid surprisingly improves the stability of the gel composition even over similar carboxylic acids. The carboxylic acid may assist in the gel formation. The carboxylic acid may reduce variation of the alkaloid compound concentration, or the cannabinoid compound concentration, or both the alkaloid compound concentration and the cannabinoid compound within the gel composition during storage. The carboxylic acid may reduce variation of the nicotine concentration within the gel composition during storage.

[0155] The gel composition may include a carboxylic acid in a range from about 0.1 percent by weight to about 5 percent by weight. Preferably the carboxylic acid may be in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the carboxylic acid may be in a range from about 0.5 percent by weight to about 2 percent by weight. Preferably the carboxylic acid may be in a range from about 1 percent by weight to about 2 percent by weight.

[0156] The gel composition may include lactic acid in a range from about 0.1 percent by weight to about 5 percent by weight. Preferably the lactic acid may be in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the lactic acid may be in a range from about 0.5 percent by weight to about 2 percent by weight. Preferably the lactic acid may be in a range from about 1 percent by weight to about 2 percent by weight.

[0157] The gel composition may include levulinic acid in a range from about 0.1 percent by weight to about 5 percent by weight. Preferably the levulinic acid may be in a range from about 0.5 percent by weight to about 3 percent by weight. Preferably the levulinic acid may be in a range from about 0.5 percent by weight to about 2 percent by weight. Preferably the levulinic acid may be in a range from about 1 percent by weight to about 2 percent by weight.

[0158] The gel composition preferably comprises some water. The gel composition is more stable when the composition comprises some water. Preferably the gel composition comprises at least about 1 percent by weight, or at least about 2 percent by weight., or at least about 5 percent by weight of water. Preferably the gel composition comprises at least about 10 percent by weight or at least about 15 percent by weight water.

[0159] Preferably the gel composition comprises between about 8 percent by weight to about 32 percent by weight water. Preferably the gel composition comprises from about 15 percent by weight to about 25 percent by weight water. Preferably the gel composition comprises from about 18 percent by weight to about 22 percent by weight water. Preferably the gel composition comprises about 20 percent by weight water.

[0160] Preferably, the aerosol-generating substrate comprises between about 150 mg and about 350 mg of the gel composition.

[0161] Preferably, the aerosol-generating substrate comprises a porous medium loaded with the gel composition. Advantages of a porous medium loaded with the gel composition is that the gel composition is retained within the porous medium, and this may aid manufacturing, storage or transport of the gel composition. It may assist in keeping the desired shape of the gel composi-

tion, especially during manufacture, transport, or use.

[0162] The porous medium may be any suitable porous material able to hold or retain the gel composition. Ideally the porous medium can allow the gel composition to move within it. In specific embodiments the porous medium comprises natural materials, synthetic, or semi-synthetic, or a combination thereof. In specific embodiments the porous medium comprises sheet material, foam, or fibres, for example loose fibres; or a combination thereof. In specific embodiments the porous medium comprises a woven, non-woven, or extruded material, or combinations thereof. Preferably the porous medium comprises, cotton, paper, viscose, PLA, or cellulose acetate, of combinations thereof. Preferably the porous medium comprises a sheet material, for example, cotton or cellulose acetate. In a particularly preferred embodiment, the porous medium comprises a sheet made from cotton fibres.

[0163] The porous medium used in the present invention may be crimped or shredded. In preferred embodiments, the porous medium is crimped. In alternative embodiments the porous medium comprises shredded porous medium. The crimping or shredding process can be before or after loading with the gel composition.

[0164] Crimping of the sheet material has the benefit of improving the structure to allow passageways through the structure. The passageways though the crimped sheet material assist in loading up gel, retaining gel and also for fluid to pass through the crimped sheet material. Therefore there are advantages of using crimped sheet material as the porous medium.

[0165] Shredding gives a high surface area to volume ratio to the medium thus able to absorb gel easily.

[0166] In specific embodiments the sheet material is a composite material. Preferably the sheet material is porous. The sheet material may aid manufacture of the tubular element comprising a gel. The sheet material may aid introducing an active agent to the tubular element comprising a gel. The sheet material may help stabilise the structure of the tubular element comprising a gel. The sheet material may assist transport or storage of the gel. Using a sheet material enables, or aids, adding structure to the porous medium for example by crimping of the sheet material.

[0167] The porous medium may be a thread. The thread may comprise for example cotton, paper or acetate tow. The thread may also be loaded with gel like any other porous medium. An advantage of using a thread as the porous medium is that it may aid ease of manufacturing.

[0168] The thread may be loaded with gel by any known means. The thread may be simply coated with gel, or the thread may be impregnated with gel. In the manufacture, the threads may be impregnated with gel and stored ready for use to be included in the assembly of a tubular element.

[0169] The porous medium loaded with the gel composition is preferably provided within a tubular element that forms a part of the aerosol-generating article. The term "tubular element" is used to describe a component suitable for use in an aerosol generating article. Ideally the tubular element may be longer in longitudinal length then in width but not necessarily as it may be one part of a multi- component item that ideally will be longer in its longitudinal length then its width. Typically, the tubular element is cylindrical but not necessarily. For example, the tubular element may have an oval, polygonal like triangular or rectangular or random cross section.

[0170] The tubular element preferably comprises a first longitudinal passageway. The tubular element is preferably formed of a wrapper that defines the first longitudinal passageway. The wrapper is preferably a water-resistant wrapper. This water-resistant property the wrapper may be achieved by using a water-resistant material, or by treating the material of the wrapper. It may be achieved by treating one side or both sides of the wrapper. Being water-resistant would assist in not losing structure, stiffness or rigidity. It may also assist in preventing leaks of gel or liquid, especially when gels of a fluid structure are used.

[0171] In some embodiments, the rod of aerosol-generating substrate further comprises a susceptor element arranged within the aerosol-generating substrate. In practice, in some embodiments of the aerosol-generating article in accordance with the present invention a susceptor element, such as for example an elongate susceptor, is arranged substantially the rod of aerosol-generating substrate such that the susceptor element is in thermal contact with the aerosol-generating substrate.

[0172] As used herein with reference to the present invention, the term "susceptor" refers to a material that can convert electromagnetic energy into heat. When located within a fluctuating electromagnetic field, eddy currents induced in the susceptor cause heating of the susceptor. As the elongate susceptor is located in thermal contact with the aerosol-generating substrate, the aerosol-generating substrate is heated by the susceptor.

[0173] Preferably, the susceptor element is in the form of an elongate susceptor. When used for describing the susceptor, the term "elongate" means that the susceptor has a length dimension that is greater than its width dimension or its thickness dimension, for example greater than twice its width dimension or its thickness dimension.

[0174] The elongate susceptor is preferably arranged substantially longitudinally within the rod. This means that the length dimension of the elongate susceptor is arranged to be approximately parallel to the longitudinal direction of the rod, for example within plus or minus 10 degrees of parallel to the longitudinal direction of the rod. In preferred embodiments, the elongate susceptor may be positioned in a radially central position within the rod, and extends along the longitudinal axis of the rod.

[0175] Preferably, the elongate susceptor extends all the way to a downstream end of the rod of aerosol-generating article. In some embodiments, the susceptor may extend all the way to an upstream end of the rod of aerosol-generating article. In particularly preferred embod-

iments, the susceptor has substantially the same length as the rod of aerosol-generating substrate, and extends from the upstream end of the rod to the downstream end of the rod.

[0176] The susceptor is preferably in the form of a pin, rod, strip or blade.

[0177] The susceptor preferably has a length from about 5 millimetres to about 15 millimetres, for example from about 6 millimetres to about 12 millimetres, or from about 8 millimetres to about 10 millimetres.

[0178] A ratio between the length of the susceptor and the overall length of the aerosol-generating article may be from about 0.2 to about 0.35.

[0179] In some embodiments, a ratio between the length of the susceptor and the overall length of the aerosol-generating article is at least about 0.22, more preferably at least about 0.24, even more preferably at least about 0.26. A ratio between the length of the susceptor and the overall length of the aerosol-generating article is preferably less than about 0.34, more preferably less than about 0.32, even more preferably less than about 0.3. In other embodiments, a ratio between the length of the susceptor and the overall length of the aerosol-generating article is preferably from about 0.22 to about 0.34, more preferably from about 0.24 to about 0.34, even more preferably from about 0.26 to about 0.34. In further embodiments, a ratio between the length of the susceptor and the overall length of the aerosol-generating article is preferably from about 0.22 to about 0.32, more preferably from about 0.24 to about 0.32, even more preferably from about 0.26 to about 0.32. In yet further embodiments, a ratio between the length of the susceptor and the overall length of the aerosol-generating article is preferably from about 0.22 to about 0.3, more preferably from about 0.24 to about 0.3, even more preferably from about 0.26 to about 0.3.

[0180] In a particularly preferred embodiment, a ratio between the length of the susceptor and the overall length of the aerosol-generating article is about 0.27.

[0181] The susceptor preferably has a width from about 1 millimetres to about 5 millimetres.

[0182] The susceptor may generally have a thickness from about 0.01 millimetres to about 2 millimetres, for example from about 0.5 millimetres to about 2 millimetres. In some embodiments, the susceptor preferably has a thickness from about 10 micrometres to about 500 micrometres, more preferably from about 10 micrometres to about 100 micrometres.

[0183] If the susceptor has a constant cross-section, for example a circular cross-section, it has a preferable width or diameter from about 1 millimetre to about 5 millimetres.

[0184] If the susceptor has the form of a strip or blade, the strip or blade preferably has a rectangular shape having a width of preferably from about 2 millimetres to about 8 millimetres, more preferably from about 3 millimetres to about 5 millimetres. By way of example, a susceptor in the form of a strip of blade may have a width of about 4 millimetres.

[0185] If the susceptor has the form of a strip or blade, the strip or blade preferably has a rectangular shape and a thickness from about 0.03 millimetres to about 0.15 millimetres, more preferably from about 0.05 millimetres to about 0.09 millimetres. By way of example, a susceptor in the form of a strip of blade may have a thickness of about 0.07 millimetres.

[0186] In a preferred embodiment, the elongate susceptor is provided in the form of a strip or blade, preferably has a rectangular shape, and has a thickness from about 55 micrometres to about 65 micrometres.

[0187] More preferably, the elongate susceptor has a thickness from about 57 micrometres to about 63 micrometres. Even more preferably, the elongate susceptor has a thickness from about 58 micrometres to about 62 micrometres. In a particularly preferred embodiment, the elongate susceptor has a thickness of about 60 micrometres.

[0188] Without wishing to be bound by theory, the inventors consider that, as a whole, the selection of a given thickness for the susceptor is also impacted by constraints set by the selected length and width of the susceptor, as well as by constraints set by the geometry and dimensions of the rod of aerosol-generating substrate. By way of example, the length of the susceptor is preferably selected such as to match the length of the rod of aerosol-generating substrate. The width of the susceptor should preferably be chosen such that displacement of the susceptor within the substrate is prevented, whilst also enabling easy insertion during manufacturing.

[0189] The inventors have found that in an aerosol-generating article wherein a susceptor having a thickness within the range described above is provided for supplying heat inductively during use, it is advantageously possibly to generate and distribute heat throughout the aerosol-generating substrate in an especially effective and efficient way. Without wishing to be bound by theory, the inventors believe that this is because one such susceptor is adapted to provide optimal heat generation and heat transfer, by virtue of susceptor surface area and inductive power. By contrast, a thinner susceptor may be too easy to deform and may not maintain the desired shape and orientation within the rod of aerosol-generating substrate during manufacture of the aerosol-generating article, which may result in a less homogenous and less finely tuned heat distribution during use. At the same time, a thicker susceptor may be more difficult to cut to length with precision and consistency, and this may also impact how precisely the susceptor can be provided in longitudinal alignment within the rod of aerosol-generating substrate, thus also potentially impacting the homogeneity of heat distribution within the rod. These advantageous effects are felt especially when the susceptor extends all the way to the downstream end of the rod of aerosol-generating article. This is thought to be because the resistance to draw (RTD) downstream of the susceptor can thus basically be minimised, as there is no aerosol-gen-

erating substrate within the rod at a location downstream of the susceptor that can contribute to the RTD. This is achieved particularly effectively in embodiments wherein the aerosol-generating article comprises a downstream section comprising a hollow intermediate section. One such hollow intermediate section does not substantially contribute to the overall RTD of the aerosol-generating article and does not directly contact a downstream end of the susceptor.

[0190] Without wishing to be bound by theory, the inventors consider that the most downstream portion of the rod of aerosol-generating substrate may act, to an extent, as a filter with respect to more upstream portions of the rod of aerosol-generating substrate. Thus, the inventors believe it is desirable to be able to heat homogeneously also the most downstream portion of the rod of aerosol-generating substrate, such that this is actively involved in the release of volatile aerosol species and contributes to the overall aerosol generation and delivery, and any possible filtration effect - which may hinder the delivery of aerosol to the consumer - is positively countered by the release of volatile aerosol species throughout the whole of the aerosol-generating substrate.

[0191] Preferably, the elongate susceptor has a length which is the same or shorter than the length of the aerosol-generating substrate. Preferably, the elongate susceptor has a same length as the aerosol-generating substrate.

[0192] The susceptor may be formed from any material that can be inductively heated to a temperature sufficient to generate an aerosol from the aerosol-generating substrate. Preferred susceptors comprise a metal or carbon.

[0193] A preferred susceptor may comprise or consist of a ferromagnetic material, for example a ferromagnetic alloy, ferritic iron, or a ferromagnetic steel or stainless steel. A suitable susceptor may be, or comprise, aluminium. Preferred susceptors may be formed from 400 series stainless steels, for example grade 410, or grade 420, or grade 430 stainless steel. Different materials will dissipate different amounts of energy when positioned within electromagnetic fields having similar values of frequency and field strength.

[0194] Thus, parameters of the susceptor such as material type, length, width, and thickness may all be altered to provide a desired power dissipation within a known electromagnetic field. Preferred susceptors may be heated to a temperature in excess of 250 degrees Celsius.

[0195] Suitable susceptors may comprise a non-metallic core with a metal layer disposed on the non-metallic core, for example metallic tracks formed on a surface of a ceramic core. A susceptor may have a protective external layer, for example a protective ceramic layer or protective glass layer encapsulating the susceptor. The susceptor may comprise a protective coating formed by a glass, a ceramic, or an inert metal, formed over a core of susceptor material.

[0196] The susceptor is arranged in thermal contact with the aerosol-generating substrate. Thus, when the susceptor heats up the aerosol-generating substrate is heated up and an aerosol is formed. Preferably the susceptor is arranged in direct physical contact with the aerosol-generating substrate, for example within the aerosol-generating substrate.

[0197] The susceptor may be a multi-material susceptor and may comprise a first susceptor material and a second susceptor material. The first susceptor material is disposed in intimate physical contact with the second susceptor material. The second susceptor material preferably has a Curie temperature that is lower than 500 degrees Celsius. The first susceptor material is preferably used primarily to heat the susceptor when the susceptor is placed in a fluctuating electromagnetic field. Any suitable material may be used. For example the first susceptor material may be aluminium, or may be a ferrous material such as a stainless steel. The second susceptor material is preferably used primarily to indicate when the susceptor has reached a specific temperature, that temperature being the Curie temperature of the second susceptor material. The Curie temperature of the second susceptor material can be used to regulate the temperature of the entire susceptor during operation. Thus, the Curie temperature of the second susceptor material should be below the ignition point of the aerosol-generating substrate. Suitable materials for the second susceptor material may include nickel and certain nickel alloys.

[0198] By providing a susceptor having at least a first and a second susceptor material, with either the second susceptor material having a Curie temperature and the first susceptor material not having a Curie temperature, or first and second susceptor materials having first and second Curie temperatures distinct from one another, the heating of the aerosol-generating substrate and the temperature control of the heating may be separated. The first susceptor material is preferably a magnetic material having a Curie temperature that is above 500 degrees Celsius. It is desirable from the point of view of heating efficiency that the Curie temperature of the first susceptor material is above any maximum temperature that the susceptor should be capable of being heated to. The second Curie temperature may preferably be selected to be lower than 400 degrees Celsius, preferably lower than 380 degrees Celsius, or lower than 360 degrees Celsius. It is preferable that the second susceptor material is a magnetic material selected to have a second Curie temperature that is substantially the same as a desired maximum heating temperature. That is, it is preferable that the second Curie temperature is approximately the same as the temperature that the susceptor should be heated to in order to generate an aerosol from the aerosol-generating substrate. The second Curie temperature may, for example, be within the range of 200 degrees Celsius to 400 degrees Celsius, or between 250 degrees Celsius and 360 degrees Celsius. The second Curie temperature of the second susceptor material may, for example, be selected such that, upon being heated

by a susceptor that is at a temperature equal to the second Curie temperature, an overall average temperature of the aerosol-generating substrate does not exceed 240 degrees Celsius.

[0199] As described briefly above, in aerosol-generating articles in accordance with the present invention the wrapper circumscribing at least the rod of aerosol-generating substrate comprises a flame retardant composition. In practice, the wrapper circumscribing at least the rod of aerosol-generating substrate comprises a wrapping base material and the flame retardant composition is applied on the wrapping base material or the wrapping base material is impregnated with the flame retardant composition or both.

[0200] As used herein, the term "flame retardant composition" denotes a composition comprising one or more flame retardant compounds.

[0201] The term "flame retardant compounds" is used herein to describe chemical compounds that, when added to or otherwise incorporated into a substrate, such as paper or plastic compounds, provide the substrate with varying degrees of flammability protection. In practice, flame retardant compounds may be activated by the presence of an ignition source and are adapted to prevent or slow the further development of ignition by a variety of different physical and chemical mechanisms.

[0202] A flame retardant composition may typically further comprise one of more non-flame retardant compounds, that is, one or more compound - such as a solvent, an excipient, a filler - that does not actively contribute to providing the substrate with flammability protection, but is used to facilitate the application of the flame retardant compound or compounds onto or into the wrapper or both.

[0203] Some of the non-flame retardant compounds of a flame retardant composition - such as solvents - are volatile and may evaporate from the wrapper upon drying after the flame retardant composition has been applied onto or into the wrapping base material or both. As such, although such non-flame retardant compounds form part of the formulation of the flame retardant composition, they may no longer be present or they may only be detectable in trace amounts in the wrapper of an aerosol-generating article in accordance with the invention.

[0204] To incorporate a flame retardant composition into a paper-based or polymer-based wrapper, the flame retardant composition may be added to the pulp or polymeric mixture during the wrapper manufacturing process, or added to the wrapper at a later stage by an application process based on size pressing, spraying, printing, coating, etc. The flame retardant composition may be applied, for example as a coating layer, onto one side of the wrapper or on both sides of the wrapper.

[0205] A number of suitable flame retardant compounds are known. Some flame retardant compounds, such as mineral flame retardants mainly act as additive flame retardants, and do not become chemically attached to the surrounding system. Most of the organohalogen and organophosphate compounds also do not react permanently to attach themselves into their surroundings. Reactive flame retardant compounds, such as certain non-halogenated products, are reactive in that they become integrated in the surrounding system without losing their retardant efficiency. This makes these materials advantageously non-emissive into the environment.

[0206] The wrapping base material of the wrapper circumscribing at least the rod of aerosol-generating substrate may be a paper wrapping base material or a non-paper wrapping base material. In preferred embodiments, the wrapping base material of the wrapper circumscribing at least the rod of aerosol-generating substrate comprises paper. Suitable paper wrapping base materials for use in specific embodiments of the invention are known in the art and include, but are not limited to: cigarette papers; and filter plug wraps. Suitable non-paper wrapping base materials for use in specific embodiments of the invention are known in the art and include, but are not limited to sheets of homogenised tobacco materials and sheets of certain polymeric materials. In certain embodiments, the wrapping base material may be formed of a laminate material comprising a plurality of layers.

[0207] By way of example, the wrapping base material may have a basis weight of at least about 20 grams per square metre. Preferably, the wrapping base material has a basis weight of at least about 25 grams per square metre. More preferably, the wrapping base material has a basis weight of at least about 30 grams per square metre. Even more preferably, the wrapping base material has a basis weight of at least about 40 grams per square metre or at least about 50 grams per square metre. In some embodiments, the wrapping base material has a basis weight of at least about 70 grams per square metre.

[0208] The wrapping base material may have a basis weight of up to about 220 grams per square metre. Preferably, the wrapping base material has a basis weight of less than or equal to about 200 grams per square metre. More preferably, the wrapping base material has a basis weight of less than or equal to about 180 grams per square metre. Even more preferably, the wrapping base material has a basis weight of less than or equal to about 160 grams per square metre.

[0209] In preferred embodiments, the wrapping base material has a basis weight of less than or equal to about 150 grams per square metre, preferably less than or equal to about 140 grams per square metre, even more preferably less than or equal to about 130 grams per square metre, most preferably less than or equal to about 120 grams per square metre.

[0210] In some embodiments, the wrapping base material may have a basis weight from about 30 grams per square metre to about 220 grams per square metre, preferably from about 40 grams per square metre to about 220 grams per square metre, more preferably from about 50 grams per square metre to about 220 grams per square metre, even more preferably from about 60 grams

per square metre to about 220 grams per square metre. In other embodiments, the wrapping base material may have a basis weight from about 30 grams per square metre to about 200 grams per square metre, preferably from about 40 grams per square metre to about 200 grams per square metre, more preferably from about 50 grams per square metre to about 200 grams per square metre, even more preferably from about 60 grams per square metre to about 200 grams per square metre. In further embodiments, the wrapping base material may have a basis weight from about 30 grams per square metre to about 180 grams per square metre, preferably from about 40 grams per square metre to about 180 grams per square metre, more preferably from about 50 grams per square metre to about 180 grams per square metre, even more preferably from about 60 grams per square metre to about 180 grams per square metre. In yet other embodiments, the wrapping base material may have a basis weight from about 30 grams per square metre to about 160 grams per square metre, preferably from about 40 grams per square metre to about 160 grams per square metre, more preferably from about 50 grams per square metre to about 160 grams per square metre, even more preferably from about 60 grams per square metre to about 160 grams per square metre.

[0211] In particularly preferred embodiments, the wrapping base material may have a basis weight from about 70 grams per square metre to about 110 grams per square metre, and more preferably from about 80 grams per square metre to about 110 grams per square metre. In even more preferred embodiments, the wrapping base material may have a basis weight from about 70 grams per square metre to about 100 grams per square metre, even more preferably from about 80 grams per square metre to about 100 grams per square metre.

[0212] In other embodiments, the wrapping base material may have a basis weight from about 20 grams per square metre to about 120 grams per square metre, preferably from about 25 grams per square metre to about 120 grams per square metre, more preferably from about 30 grams to about 120 grams per square metre, even more preferably from about 40 grams per square metre to about 120 grams per square metre, most preferably from about 50 grams per square metre to about 120 grams per square metre. In further embodiments, the wrapping base material may have a basis weight from about 20 grams per square metre to about 100 grams per square metre, preferably from about 25 grams per square metre to about 100 grams per square metre, more preferably from about 30 grams to about 100 grams per square metre, even more preferably from about 40 grams per square metre to about 100 grams per square metre, most preferably from about 50 grams per square metre to about 100 grams per square metre. In yet further embodiments, the wrapping base material may have a basis weight from about 20 grams per square metre to about 80 grams per square metre, preferably from about 25 grams per square metre to about 80 grams per square metre, more preferably from about 30 grams to about 80 grams per square metre, even more preferably from about 40 grams per square metre to about 80 grams per square metre, most preferably from about 50 grams per square metre to about 80 grams per square metre. In alternative embodiments, the wrapping base material may have a basis weight from about 20 grams per square metre to about 70 grams per square metre, preferably from about 25 grams per square metre to about 70 grams per square metre, more preferably from about 30 grams to about 70 grams per square metre, even more preferably from about 40 grams per square metre to about 70 grams per square metre, most preferably from about 50 grams per square metre to about 70 grams per square metre.

[0213] In other embodiments, the wrapping base material may have a basis weight from about 20 grams per square metre to about 50 grams per square metre, preferably from about 25 grams per square metre to about 50 grams per square metre, more preferably from about 30 grams to about 50 grams per square metre, even more preferably from about 40 grams per square metre to about 50 grams per square metre.

[0214] The wrapper circumscribing at least the rod of aerosol-generating substrate has an overall dry basis weight which is the sum of the basis weight of the wrapping base material and the weight of flame retardant composition components that are present on a surface of the wrapping base material or within the wrapping base material or both. The weight of flame retardant composition components present on or in the wrapper is the sum of the total weight of flame retardant compound or compounds and the weight of any residual non-flame retardant compounds. Within the context of the present invention, the weight of flame retardant composition components is also expressed in grams of components per square metre of wrapping base material.

[0215] The ratio of total weight of flame retardant compound(s) to overall dry basis weight of the wrapper may be regarded as an indication of the concentration of flame retardant compound(s) in the wrapper.

[0216] In aerosol-generating articles in accordance with the present invention, a ratio of total weight of flame retardant compound(s) to overall dry basis weight of the wrapper may be at least about 0.02. Preferably, a ratio of total weight of flame retardant compound(s) to overall dry basis weight of the wrapper is at least about 0.03. More preferably, a ratio of total weight of flame retardant compound(s) to overall dry basis weight of the wrapper is at least about 0.04. Even more preferably, a ratio of total weight of flame retardant compound(s) to overall dry basis weight of the wrapper is at least about 0.05.

[0217] Preferably, a ratio of total weight of flame retardant compound(s) to overall dry basis weight of the wrapper is less than or equal to about 0.20. More preferably, a ratio of total weight of flame retardant compound(s) to overall dry basis weight of the wrapper is less than or equal to about 0.15. Even more preferably, a ratio

of total weight of flame retardant compound(s) to overall dry basis weight of the wrapper is less than or equal to about 0.10.

[0218] In some embodiments, a ratio of total weight of flame retardant compound(s) to overall dry basis weight of the wrapper may be from about 0.02 to about 0.20, preferably from about 0.03 to about 0.20, more preferably from about 0.04 to about 0.20, even more preferably from about 0.05 to about 0.20. In other embodiments, a ratio of total weight of flame retardant compound(s) to overall dry basis weight of the wrapper may be from about 0.02 to about 0.15, preferably from about 0.03 to about 0.15, more preferably from about 0.04 to about 0.15, even more preferably from about 0.05 to about 0.15. In further embodiments, a ratio of total weight of flame retardant compound(s) to overall dry basis weight of the wrapper may be from about 0.02 to about 0.10, preferably from about 0.03 to about 0.10, more preferably from about 0.04 to about 0.10, even more preferably from about 0.05 to about 0.10.

[0219] In an aerosol-generating article in accordance with the present invention, the flame retardant composition is provided in a treated portion of the wrapper. This means that the flame retardant composition has been applied onto or into a corresponding portion of the wrapping base material or both. Thus, in the treated portion, the wrapper has an overall dry basis weight that is greater than the dry basis weight of the wrapping base material.

[0220] The treated portion of the wrapper may extend over at least about 10 percent of an outer surface area of the rod of aerosol-generating substrate circumscribed by the wrapper. Preferably, the treated portion of the wrapper extends over at least about 20 percent of an outer surface area of the rod of aerosol-generating substrate circumscribed by the wrapper. More preferably, the treated portion of the wrapper extends over at least about 40 percent of an outer surface area of the rod of aerosol-generating substrate. Even more preferably, the treated portion of the wrapper extends over at least about 60 percent of an outer surface area of the rod of aerosol-generating substrate. Most preferably, the treated portion of the wrapper extends over at least about 80 percent of an outer surface area of the rod of aerosol-generating substrate.

[0221] In particularly preferred embodiments, the treated portion of the wrapper extends over at least about 90 percent of an outer surface area of the rod of aerosol-generating substrate. Even more preferably, the treated portion of the wrapper extends over at least about 95 percent of an outer surface area of the rod of aerosol-generating substrate. Most preferably, the treated portion of the wrapper extends substantially over the entire outer surface area of the rod of aerosol-generating substrate.

[0222] A length of the treated area may be at least about 10 percent of a length of the rod of aerosol-generating substrate. Preferably, a length of the treated area is at least about 20 percent of a length of the rod of aerosol-generating substrate. More preferably, a length of the treated area is at least about 40 percent of a length of the rod of aerosol-generating substrate. Even more preferably, a length of the treated area is at least about 60 percent of a length of the rod of aerosol-generating substrate. Most preferably, a length of the treated area is at least about 80 percent of a length of the rod of aerosol-generating substrate.

[0223] In particularly preferred embodiments, a length of the treated area is at least about 90 percent of a length of the rod of aerosol-generating substrate. Even more preferably, a length of the treated area is at least about 95 percent of a length of the rod of aerosol-generating substrate. Most preferably, a length of the treated area is substantially equal to a length of the rod of aerosol-generating substrate.

[0224] At least about 10 grams of the flame retardant composition may be applied onto the treated portion per square metre of surface area of the treated portion. Preferably, at least about 12 grams of the flame retardant composition are applied onto the treated portion per square metre of surface area of the treated portion. More preferably, at least about 14 grams of the flame retardant composition are applied onto the treated portion per square metre of surface area of the treated portion. Even more preferably, at least about 16 grams of the flame retardant composition are applied onto the treated portion per square metre of surface area of the treated portion. In particularly preferred embodiments, at least about 18 grams or at least about 20 grams of the flame retardant composition are applied onto the treated portion per square metre of surface area of the treated portion.

[0225] Preferably, less than or equal to about 35 grams of the flame retardant composition are applied onto the treated portion per square metre of surface area of the treated portion. More preferably, less than or equal to about 30 grams of the flame retardant composition are applied onto the treated portion per square metre of surface area of the treated portion. Even more preferably, less than or equal to about 25 grams of the flame retardant composition are applied onto the treated portion per square metre of surface area of the treated portion.

[0226] In some embodiments, from about 10 grams to about 35 grams of the flame retardant composition are applied onto the treated portion per square metre of surface area of the treated portion. Preferably, from about 12 grams to about 35 grams of the flame retardant composition are applied onto the treated portion per square metre of surface area of the treated portion. More preferably, from about 14 grams to about 35 grams of the flame retardant composition are applied onto the treated portion per square metre of surface area of the treated portion. Even more preferably, from about 16 grams to about 35 grams of the flame retardant composition are applied onto the treated portion per square metre of surface area of the treated portion. In particularly preferred embodiments, from about 18 grams to about 35 grams or from about 20 grams to about 35 grams of the flame retardant composition are applied onto the treated por-

tion per square metre of surface area of the treated portion.

[0227] In other embodiments, from about 10 grams to about 30 grams of the flame retardant composition are applied onto the treated portion per square metre of surface area of the treated portion. Preferably, from about 12 grams to about 30 grams of the flame retardant composition are applied onto the treated portion per square metre of surface area of the treated portion. More preferably, from about 14 grams to about 30 grams of the flame retardant composition are applied onto the treated portion per square metre of surface area of the treated portion. Even more preferably, from about 16 grams to about 30 grams of the flame retardant composition are applied onto the treated portion per square metre of surface area of the treated portion. In particularly preferred embodiments, from about 18 grams to about 30 grams or from about 20 grams to about 30 grams of the flame retardant composition are applied onto the treated portion per square metre of surface area of the treated portion.

[0228] In further embodiments, from about 10 grams to about 25 grams of the flame retardant composition are applied onto the treated portion per square metre of surface area of the treated portion. Preferably, from about 12 grams to about 25 grams of the flame retardant composition are applied onto the treated portion per square metre of surface area of the treated portion. More preferably, from about 14 grams to about 25 grams of the flame retardant composition are applied onto the treated portion per square metre of surface area of the treated portion. Even more preferably, from about 16 grams to about 25 grams of the flame retardant composition are applied onto the treated portion per square metre of surface area of the treated portion. In particularly preferred embodiments, from about 18 grams to about 25 grams or from about 20 grams to about 25 grams of the flame retardant composition are applied onto the treated portion per square metre of surface area of the treated portion.

[0229] The treated portion of the wrapper may comprise at least about 0.1 grams of the flame retardant compound or compounds per square metre of surface area of the treated portion. Preferably, the treated portion of the wrapper comprises at least about 0.5 grams of the flame retardant compound or compounds per square metre of surface area of the treated portion. More preferably, the treated portion of the wrapper comprises at least about 1.0 grams of the flame retardant compound or compounds per square metre of surface area of the treated portion. Even more preferably, the treated portion of the wrapper comprises at least about 2.0 grams of the flame retardant compound or compounds per square metre of surface area of the treated portion. In particularly preferred embodiments, the treated portion of the wrapper comprises at least about 3.0 grams of the flame retardant compound or compounds per square metre of surface area of the treated portion or at least about 4.0 grams of the flame retardant compound or compounds per square metre of surface area of the treated portion or at least about 5.0 grams of the flame retardant compound or compounds per square metre of surface area of the treated portion.

[0230] Preferably, the treated portion of the wrapper comprises less than or equal to about 12 grams of the flame retardant compound or compounds per square metre of surface area of the treated portion. More preferably, the treated portion of the wrapper comprises less than or equal to about 10 grams of the flame retardant compound or compounds per square metre of surface area of the treated portion. Even more preferably, the treated portion of the wrapper comprises less than or equal to about 8 grams of the flame retardant compound or compounds per square metre of surface area of the treated portion.

[0231] In some embodiments, the treated portion of the wrapper comprises from about 0.5 grams to about 12 grams of the flame retardant compound or compounds per square metre of surface area of the treated portion, preferably from about 1.0 grams to about 12 grams of the flame retardant compound or compounds per square metre of surface area of the treated portion, more preferably from about 2.0 grams to about 12 grams of the flame retardant compound or compounds per square metre of surface area of the treated portion, even more preferably from about 3.0 grams to about 12 grams of the flame retardant compound or compounds per square metre of surface area of the treated portion.

[0232] In other embodiments, the treated portion of the wrapper comprises from about 0.5 grams to about 10 grams of the flame retardant compound or compounds per square metre of surface area of the treated portion, preferably from about 1.0 grams to about 10 grams of the flame retardant compound or compounds per square metre of surface area of the treated portion, more preferably from about 2.0 grams to about 10 grams of the flame retardant compound or compounds per square metre of surface area of the treated portion, even more preferably from about 3.0 grams to about 120 grams of the flame retardant compound or compounds per square metre of surface area of the treated portion.

[0233] In further embodiments, the treated portion of the wrapper comprises from about 0.5 grams to about 8 grams of the flame retardant compound or compounds per square metre of surface area of the treated portion, preferably from about 1.0 grams to about 12 grams of the flame retardant compound or compounds per square metre of surface area of the treated portion, more preferably from about 2.0 grams to about 8 grams of the flame retardant compound or compounds per square metre of surface area of the treated portion, even more preferably from about 3.0 grams to about 8 grams of the flame retardant compound or compounds per square metre of surface area of the treated portion.

[0234] In aerosol-generating articles in accordance with the present invention, a content of the flame retard-

ant compound or compounds in the treated portion is preferably such that, when the aerosol-generating article is heated at 500 degrees Celsius using a resistively heated coil for at least 5 seconds, preferably for 30 seconds the aerosol-generating article does not ignite. The term "does not ignite" is used here to mean in particular that combustion of the wrapper circumscribing the aerosol-generating substrate is not initiated, and no flame is detected.

[0235] Preferably, the aerosol-generating articles in accordance with the present invention do not ignite when submitted to the Health Canada Intense regime, which comprises a pre-lighting step using a resistively heated coil, and at a puffing regime of one puff of 55 millilitres and 2 seconds duration every 30 seconds with 100 percent of the ventilation zone on the aerosol-generating article (if present) blocked. Further details about the "smoking" parameters and standard testing conditions to are provided in ISO 3308:2000 (Routine analytical cigarette-smoking machine - Definitions and standard conditions).

[0236] In some embodiments, the wrapper comprises a wrapping base material and a layer comprising the flame retardant compound or compounds is provided on a surface of the wrapping base material facing the aerosol-generating substrate. In other embodiments, the wrapper comprises a wrapping base material and a layer comprising the flame retardant compound or compounds is provided on a surface of the wrapping base material facing away from the aerosol-generating substrate. In further embodiments, the wrapper comprises a wrapping base material, and layers comprising the flame retardant compounds or compounds are provided on both surfaces of the wrapping base material.

[0237] A number of suitable flame retardant compounds will be known to the skilled person. In particular, several flame retardant compounds and formulations suitable for treating cellulosic materials are known and have been disclosed and may find use in the manufacture of wrappers for aerosol-generating articles in accordance with the present invention.

[0238] In some embodiments, the flame retardant composition comprises a polymer and a mixed salt based on at least one mono, di- and/or tri-carboxylic acid, at least one polyphosphoric, pyrophosphoric and/or phosphoric acid, and a hydroxide or a salt of an alkali or an alkaline earth metal, where the at least one mono, di- and/or tri-carboxylic acid and the hydroxide or salt form a carboxylate and the at least one polyphosphoric, pyrophosphoric and/or phosphoric acid and the hydroxide or salt form a phosphate.

[0239] Preferably, in such embodiments the flame retardant composition further comprises a carbonate of an alkali or an alkaline earth metal.

[0240] In other embodiments, the flame retardant composition comprises cellulose modified with at least one C_{10} or higher fatty acid, tall oil fatty acid (TOFA), phosphorylated linseed oil, phosphorylated downstream corn oil. Preferably, the at least one C_{10} or higher fatty acid is selected from the group consisting of capric acid, myristic acid, palmitic acid, and combinations thereof.

[0241] As described briefly above, the aerosol-generating article of the invention further comprises a downstream section at a location downstream of the rod of aerosol-generating substrate. The downstream section may comprise one or more downstream elements.

[0242] According to the invention, the downstream section of the aerosol-generating article may comprise, in particular, a mouthpiece element positioned downstream of the rod of aerosol-generating substrate and in longitudinal alignment with the rod of aerosol-generating substrate.

[0243] The mouthpiece element is preferably located at the downstream end or mouth end of the aerosol-generating article, and extends all the way to the mouth end of the aerosol-generating article.

[0244] Preferably, the mouthpiece element comprises at least one mouthpiece filter segment of a fibrous filtration material for filtering the aerosol that is generated from the aerosol-generating substrate. Suitable fibrous filtration materials would be known to the skilled person. Particularly preferably, the at least one mouthpiece filter segment comprises a cellulose acetate filter segment formed of cellulose acetate tow.

[0245] In certain preferred embodiments, the mouthpiece element consists of a single mouthpiece filter segment. In alternative embodiments, the mouthpiece element includes two or more mouthpiece filter segments axially aligned in an abutting end to end relationship with each other.

[0246] In certain embodiments of the invention, the downstream section may comprise a mouth end cavity at the downstream end, downstream of the mouthpiece element as described above. The mouth end cavity may be defined by a hollow tubular element provided at the downstream end of the mouthpiece. Alternatively, the mouth end cavity may be defined by the outer wrapper of the mouthpiece element, wherein the outer wrapper extends in a downstream direction from the mouthpiece element.

[0247] The mouthpiece element may optionally comprise a flavourant, which may be provided in any suitable form. For example, the mouthpiece element may comprise one or more capsules, beads or granules of a flavourant, or one or more flavour loaded threads or filaments.

[0248] In certain preferred embodiments, the downstream section of the aerosol-generating article further comprises a support element located immediately downstream of the rod of aerosol-generating substrate. The mouthpiece element is preferably located downstream of the support element.

[0249] The support element may be formed from any suitable material or combination of materials. For example, the support element may be formed from one or more materials selected from the group consisting of: cellulose

acetate; cardboard; crimped paper, such as crimped heat resistant paper or crimped parchment paper; and polymeric materials, such as low density polyethylene (LDPE). In a preferred embodiment, the support element is formed from cellulose acetate. Other suitable materials include polyhydroxyalkanoate (PHA) fibres.

[0250] The support element may comprise a first hollow tubular segment. In a preferred embodiment, the support element comprises a hollow cellulose acetate tube.

[0251] The support element is arranged substantially in alignment with the rod. This means that the length dimension of the support element is arranged to be approximately parallel to the longitudinal direction of the rod and of the article, for example within plus or minus 10 degrees of parallel to the longitudinal direction of the rod. In preferred embodiments, the support element extends along the longitudinal axis of the rod.

[0252] The support element preferably has an outer diameter that is approximately equal to the outer diameter of the rod of aerosol-generating substrate and to the outer diameter of the aerosol-generating article.

[0253] A peripheral wall of the support element may have a thickness of at least 1 millimetre, preferably at least about 1.5 millimetres, more preferably at least about 2 millimetres.

[0254] The support element may have a length of between about 5 millimetres and about 15 millimetres.

[0255] Preferably, the support element has a length of at least about 6 millimetres, more preferably at least about 7 millimetres.

[0256] In preferred embodiments, the support element has a length of less than about 12 millimetres, more preferably less than about 10 millimetres.

[0257] In some embodiments, the support element has a length from about 5 millimetres to about 15 millimetres, preferably from about 6 millimetres to about 15 millimetres, more preferably from about 7 millimetres to about 15 millimetres. In other embodiments, the support element has a length from about 5 millimetres to about 12 millimetres, preferably from about 6 millimetres to about 12 millimetres, more preferably from about 7 millimetres to about 12 millimetres. In further embodiments, the support element has a length from about 5 millimetres to about 10 millimetres, preferably from about 6 millimetres to about 10 millimetres, more preferably from about 7 millimetres to about 10 millimetres.

[0258] In a preferred embodiment, the support element has a length of about 8 millimetres.

[0259] In some embodiments, the downstream section further comprises an aerosol-cooling element located immediately downstream of the support element. The mouthpiece element is preferably located downstream of both the support element and the aerosol-cooling element. Particularly preferably, the mouthpiece element is located immediately downstream of the aerosol-cooling element. By way of example, the mouthpiece element may abut the downstream end of the aerosol-cooling element.

[0260] The aerosol-cooling element is arranged substantially in alignment with the rod. This means that the length dimension of the aerosol-cooling element is arranged to be approximately parallel to the longitudinal direction of the rod and of the article, for example within plus or minus 10 degrees of parallel to the longitudinal direction of the rod. In preferred embodiments, the aerosol-cooling element extends along the longitudinal axis of the rod.

[0261] The aerosol-cooling element preferably has an outer diameter that is approximately equal to the outer diameter of the rod of aerosol-generating substrate and to the outer diameter of the aerosol-generating article.

[0262] In some embodiments, the aerosol-cooling element is in the form of a hollow tubular segment that defines a cavity extending all the way from an upstream end of the aerosol-cooling element to a downstream end of the aerosol-cooling element and a ventilation zone is provided at a location along the hollow tubular segment.

[0263] As used herein, the term "hollow tubular segment" is used to denote a generally elongate element defining a lumen or airflow passage along a longitudinal axis thereof. In particular, the term "tubular" will be used in the following with reference to a tubular element having a substantially cylindrical cross-section and defining at least one airflow conduit establishing an uninterrupted fluid communication between an upstream end of the tubular element and a downstream end of the tubular element. However, it will be understood that alternative geometries (for example, alternative cross-sectional shapes) of the tubular element may be possible.

[0264] A hollow tubular segment provides an unrestricted flow channel. This means that the hollow tubular segment provides a negligible level of resistance to draw (RTD). The flow channel should therefore be free from any components that would obstruct the flow of air in a longitudinal direction. Preferably, the flow channel is substantially empty.

[0265] When used for describing an aerosol-cooling element, the term "elongate" means that the aerosol-cooling element has a length dimension that is greater than its width dimension or its diameter dimension, for example twice or more its width dimension or its diameter dimension.

[0266] A peripheral wall of the aerosol-cooling element may have a thickness of less than about 2.5 millimetres, preferably less than about 1.5 millimetres, more preferably less than about 1250 micrometres, even more preferably less than about 1000 micrometres. In particularly preferred embodiments, the peripheral wall of the aerosol-cooling element has a thickness of less than about 900 micrometres, preferably less than about 800 micrometres.

[0267] The aerosol-cooling element may have a length of between 5 millimetres and 15 millimetres.

[0268] Preferably, the aerosol-cooling element has a length of at least about 6 millimetres, more preferably at least about 7 millimetres.

[0269] In preferred embodiments, the aerosol-cooling element has a length of less than about 12 millimetres, more preferably less than about 10 millimetres.

[0270] In some embodiments, the aerosol-cooling element has a length from about 5 millimetres to about 15 millimetres, preferably from about 6 millimetres to about 15 millimetres, more preferably from about 7 millimetres to about 15 millimetres. In other embodiments, the aerosol-cooling element has a length from about 5 millimetres to about 12 millimetres, preferably from about 6 millimetres to about 12 millimetres, more preferably from about 7 millimetres to about 12 millimetres. In further embodiments, the aerosol-cooling element has a length from about 5 millimetres to about 10 millimetres, preferably from about 6 millimetres to about 10 millimetres, more preferably from about 7 millimetres to about 10 millimetres.

[0271] In particularly preferred embodiments of the invention, the aerosol-cooling element has a length of less than 10 millimetres. For example, in one particularly preferred embodiment, the aerosol-cooling element has a length of 8 millimetres. In such embodiments, the aerosol-cooling element therefore has a relatively short length compared to the aerosol-cooling elements of prior art aerosol-generating articles. A reduction in the length of the aerosol-cooling element is possible due to the optimised effectiveness of the hollow tubular segment forming the aerosol-cooling element in the cooling and nucleation of the aerosol. The reduction of the length of the aerosol-cooling element advantageously reduces the risk of deformation of the aerosol-generating article due to compression during use, since the aerosol-cooling element typically has a lower resistance to deformation than the mouthpiece. Furthermore, the reduction of the length of the aerosol-cooling element may provide a cost benefit to the manufacturer since the cost of a hollow tubular segment is typically higher per unit length than the cost of other elements such as a mouthpiece element.

[0272] A ratio between the length of the aerosol-cooling element and the length of the rod of aerosol-generating substrate may be from about 0.25 to about 1.

[0273] The aerosol-cooling element may be formed from any suitable material or combination of materials. For example, the aerosol-cooling element may be formed from one or more materials selected from the group consisting of: cellulose acetate; cardboard; crimped paper, such as crimped heat resistant paper or crimped parchment paper; and polymeric materials, such as low density polyethylene (LDPE). Other suitable materials include polyhydroxyalkanoate (PHA) fibres.

[0274] In a preferred embodiment, the aerosol-cooling element is formed from cellulose acetate.

[0275] The ventilation zone comprises a plurality of perforations through the peripheral wall of the aerosol-cooling element. Preferably, the ventilation zone comprises at least one circumferential row of perforations. In some embodiments, the ventilation zone may comprise two circumferential rows of perforations. For example, the perforations may be formed online during manufacturing of the aerosol-generating article. Preferably, each circumferential row of perforations comprises from 8 to 30 perforations.

[0276] An aerosol-generating article in accordance with the present invention may have a ventilation level of at least about 5 percent.

[0277] The term "ventilation level" is used throughout the present specification to denote a volume ratio between of the airflow admitted into the aerosol-generating article via the ventilation zone (ventilation airflow) and the sum of the aerosol airflow and the ventilation airflow. The greater the ventilation level, the higher the dilution of the aerosol flow delivered to the consumer.

[0278] Preferably, an aerosol-generating article in accordance with the present invention may have a ventilation level of at least about 10 percent, more preferably at least about 15 percent, even more preferably at least about 20 percent. In particularly preferred embodiments, an aerosol-generating article in accordance with the present invention has a ventilation level of at least about 25 percent. Without wishing to be bound by theory, the inventors have found that the temperature drop caused by the admission of cooler, external air into the hollow tubular segment via the ventilation zone may have an advantageous effect on the nucleation and growth of aerosol particles. The rapid cooling induced by the admission of external air into the hollow tubular segment via the ventilation zone can be favourably used to favour nucleation and growth of aerosol droplets. However, at the same time, the admission of external air into the hollow tubular segment has the immediate drawback of diluting the aerosol stream delivered to the consumer. The inventors have surprisingly found that the diluting effect on the aerosol - which can be assessed by measuring, in particular, the effect on the delivery of aerosol former (such as glycerol) included in the aerosol-generating substrate) is advantageously minimised when the ventilation level is within the ranges described above.

[0279] In some embodiments, the aerosol-generating article may further comprise an additional cooling element defining a plurality of longitudinally extending channels such as to make a high surface area available for heat exchange. In other words, one such additional cooling element is adapted to function substantially as a heat exchanger. The plurality of longitudinally extending channels may be defined by a sheet material that has been pleated, gathered or folded to form the channels. The plurality of longitudinally extending channels may be defined by a single sheet that has been pleated, gathered or folded to form multiple channels. The sheet may also have been crimped prior to being pleated, gathered or folded. Alternatively, the plurality of longitudinally extending channels may be defined by multiple sheets that have been crimped, pleated, gathered or folded to form multiple channels. In some embodiments, the plurality of longitudinally extending channels may be defined by multiple sheets that have been crimped, pleated, gathered or

folded together - that is by two or more sheets that have been brought into overlying arrangement and then crimped, pleated, gathered or folded as one. As used herein, the term sheet denotes a laminar element having a width and length substantially greater than the thickness thereof.

[0280] In other embodiments, the aerosol-cooling element may be provided in the form of one such cooling element comprising a plurality of longitudinally extending channels.

[0281] One such additional cooling element defines a and may have a total surface area of between about 300 square millimetre per millimetre length and about 1000 square millimetres per millimetre length.

[0282] The additional cooling element preferably comprises a sheet material selected from the group comprising a metallic foil, a polymeric sheet, and a substantially non-porous paper or cardboard. In some embodiments, the aerosol-cooling element may comprise a sheet material selected from the group consisting of polyethylene (PE), polypropylene (PP), polyvinylchloride (PVC), polyethylene terephthalate (PET), polylactic acid (PLA), cellulose acetate (CA), and aluminium foil. In a particularly preferred embodiment, the additional cooling element comprises a sheet of PLA.

[0283] The aerosol-generating article may further comprise an upstream section at a location upstream of the rod of aerosol-generating substrate. The upstream section may comprise one or more upstream elements. In some embodiments, the upstream section may comprise an upstream element arranged immediately upstream of the rod of aerosol-generating substrate.

[0284] The aerosol-generating article of the present invention preferably comprise an upstream element located upstream of and adjacent to the aerosol-generating substrate, wherein the upstream section comprises at least one upstream element. The upstream element advantageously prevents direct physical contact with the upstream end of the aerosol-generating substrate. In particular, where the aerosol-generating substrate comprises a susceptor element, the upstream element may prevent direct physical contact with the upstream end of the susceptor element. This helps to prevent the displacement or deformation of the susceptor element during handling or transport of the aerosol-generating article. This in turn helps to secure the form and position of the susceptor element. Furthermore, the presence of an upstream element helps to prevent any loss of the substrate.

[0285] The upstream element may also provide an improved appearance to the upstream end of the aerosol-generating article. Furthermore, if desired, the upstream element may be used to provide information on the aerosol-generating article, such as information on brand, flavour, content, or details of the aerosol-generating device that the article is intended to be used with.

[0286] The upstream element may be a porous plug element. Preferably, a porous plug element does not alter the resistance to draw of the aerosol-generating article. Preferably, the upstream element has a porosity of at least about 50 percent in the longitudinal direction of the aerosol-generating article. More preferably, the upstream element has a porosity of between about 50 percent and about 90 percent in the longitudinal direction. The porosity of the upstream element in the longitudinal direction is defined by the ratio of the cross-sectional area of material forming the upstream element and the internal cross-sectional area of the aerosol-generating article at the position of the upstream element.

[0287] The upstream element may be made of a porous material or may comprise a plurality of openings. This may, for example, be achieved through laser perforation. Preferably, the plurality of openings is distributed homogeneously over the cross-section of the upstream element.

[0288] The porosity or permeability of the upstream element may advantageously be varied in order to provide a desirable overall resistance to draw of the aerosol-generating article.

[0289] Preferably, the RTD of the upstream element is at least about 5 millimetres H_2O. More preferably, the RTD of the upstream element is at least about 10 millimetres H_2O. Even more preferably, the RTD of the upstream element is at least about 15 millimetres H_2O. In particularly preferred embodiments, the RTD of the upstream element is at least about 20 millimetres H_2O.

[0290] The RTD of the upstream element is preferably less than or equal to about 80 millimetres H_2O. More preferably, the RTD of the upstream element is less than or equal to about 60 millimetres H_2O. Even more preferably, the RTD of the upstream element is less than or equal to about 40 millimetres H_2O.

[0291] In alternative embodiments, the upstream element may be formed from a material that is impermeable to air. In such embodiments, the aerosol-generating article may be configured such that air flows into the rod of aerosol-generating substrate through suitable ventilation means provided in a wrapper.

[0292] The upstream element may be made of any material suitable for use in an aerosol-generating article. The upstream element may, for example, be made of a same material as used for one of the other components of the aerosol-generating article, such as the mouthpiece, the cooling element or the support element. Suitable materials for forming the upstream element include filter materials, ceramic, polymer material, cellulose acetate, cardboard, zeolite or aerosol-generating substrate. Preferably, the upstream element is formed from a plug of cellulose acetate.

[0293] Preferably, the upstream element is formed of a heat resistant material. For example, preferably the upstream element is formed of a material that resists temperatures of up to 350 degrees Celsius. This ensures that the upstream element is not adversely affected by the heating means for heating the aerosol-generating substrate.

[0294] Preferably, the upstream element has a diam-

eter that is approximately equal to the diameter of the aerosol-generating article.

[0295] Preferably, the upstream element has a length of between about 1 millimetre and about 10 millimetres, more preferably between about 3 millimetres and about 8 millimetres, more preferably between about 4 millimetres and about 6 millimetres. In a particularly preferred embodiment, the upstream element has a length of about 5 millimetres. The length of the upstream element can advantageously be varied in order to provide the desired total length of the aerosol-generating article. For example, where it is desired to reduce the length of one of the other components of the aerosol-generating article, the length of the upstream element may be increased in order to maintain the same overall length of the article.

[0296] The upstream element is preferably circumscribed by a wrapper. The wrapper circumscribing the upstream element is preferably a stiff plug wrap, for example, a plug wrap having a basis weight of at least about 80 grams per square metre (gsm), or at least about 100 gsm, or at least about 110 gsm. This provides structural rigidity to the upstream element.

[0297] Preferably, in an aerosol-generating article in accordance with the present invention the wrapper does not contain metal. As used herein, with reference to the present invention, the term "metal" denotes the content of metals in an oxidation state of 0, that is, the content of metals in the wrapper as elements in free form. Thus, the content of metals, such as for example alkali metals or alkali earth metals, that may be present in ion form or bound to another element in the one or more flame retardant compounds of the flame retardant composition is not encompassed by the term "metal" as used herein.

[0298] In other words, , the wrapper of an aerosol-generating article in accordance with the present invention preferably does not contain any metal in an oxidation state of 0.

[0299] Thus, aerosol-generating articles in accordance with the present invention advantageously do not include metallic foil acting as thermal shielding elements. In particular, the aerosol-generating substrate is not circumscribed by one such metallic foil thermal shielding element.

[0300] Aerosol-generating articles in accordance with the invention as described above may be manufactured by a method comprising a first step of providing a continuous rod of aerosol-generating substrate, wherein a density of the aerosol-generating substrate is greater than about 300 milligrams per cubic centimetre. One such method comprises a second step of circumscribing the continuous rod of aerosol-generating substrate with a wrapper comprising a flame retardant composition comprising one or more flame retardant compounds. Further, the method comprises a third step of cutting the circumscribed continuous rod into discrete rod, each discrete rod being circumscribed by a portion of wrapper comprising the flame retardant composition

The flame retardant composition may be applied onto at least one side of a wrapping base material of the wrapper by an application process based on size pressing, spraying, printing or coating.

[0301] An aerosol-generating article in accordance with the present invention finds use in particular in an aerosol-generating system comprising the aerosol aerosol-generating article and an electrically operated aerosol-generating device, wherein the aerosol-generating device comprises a heater and an elongate heating chamber configured to receive the aerosol-generating article so that the aerosol-generating substrate of the article is heated in the heating chamber.

[0302] In some embodiments, the heater may be adapted to be inserted into the aerosol-generating substrate of the article when the article is received into the heating chamber. By way of example, the heater may be in the form of a heating rod or pin.

[0303] In other embodiments, the heater may comprise a substantially cylindrical, elongate heating element, and the heating chamber is disposed about a circumferential, longitudinal surface of the heater. Accordingly, during use, the thermal energy supplied by the heater travels radially outwards from a surface of the heater into the heating chamber and the aerosol-generating article. However, other shapes and configurations of the heater and heating chamber can alternatively be used. The heater may comprise a plurality of individual heating elements, the various heating elements being operable independently of one another so that different elements can be activated at different times to heat the aerosol-generating article. By way of example, the heater may comprise a plurality of axially aligned heating elements, which provide a plurality of independent heating zones along the length of the heater. Each heating element may have a length significantly less than the overall length of the heater. Thus, when one individual heating element is activated, it supplies thermal energy to a portion of the aerosol-generating substrate located radially in the vicinity of the heating element without substantially heating the remainder of the aerosol-generating substrate. Thus, different sections of the aerosol-generating substrate may be heated independently and at different times.

[0304] As an alternative, or in addition, the heater may comprise a plurality of elongate, longitudinally extending heating elements at different locations around the longitudinal axis of the heater. Thus, when one individual heating element is activated, it supplied thermal energy to a longitudinal portion of the aerosol-generating substrate lying substantially parallel and adjacent to the heating element. This arrangement also allows for the independent heating of the aerosol-generating substrate in distinct portions.

[0305] In some of these embodiments comprising a heater element disposed at a peripheral location relative to the heating chamber, the aerosol-generating system may further comprise an insulation means arranged between the heating chamber and an exterior of the device to reduce heat loss from heated aerosol-generating sub-

strate.

[0306] In further embodiments, the aerosol-generating article comprises a susceptor arranged within the aerosol-generating substrate, the susceptor being in thermal contact with the aerosol-generating substrate, and the heater is in the form of an inductive heating device comprising one or more induction coils. Electromagnetic energy released by the induction coils is absorbed by the susceptor and converted to heat, which is then transferred to the aerosol-generating substrate, mainly by conduction.

[0307] In the following, the invention will be further described with reference to the drawings of the accompanying Figures, wherein:

Figure 1 shows a schematic side sectional view of an aerosol-generating article in accordance with an embodiment of the invention; and

Figure 2 shows a schematic side sectional view of another aerosol-generating article in accordance with another embodiment of the invention.

[0308] The aerosol-generating article 10 shown in Figure 1 comprises a rod 12 of aerosol-generating substrate and a downstream section 14 at a location downstream of the rod 12 of aerosol-generating substrate. Further, the aerosol-generating article 10 comprises an upstream section 16 at a location upstream of the rod 12 of aerosol-generating substrate. Thus, the aerosol-generating article 10 extends from an upstream or distal end 18 to a downstream or mouth end 20.

[0309] The aerosol-generating article has an overall length of about 45 millimetres.

[0310] The downstream section 14 comprises a support element 22 located immediately downstream of the rod 12 of aerosol-generating substrate, the support element 22 being in longitudinal alignment with the rod 12. In the embodiment of Figure 1, the upstream end of the support element 18 abuts the downstream end of the rod 12 of aerosol-generating substrate. In addition, the downstream section 14 comprises an aerosol-cooling element 24 located immediately downstream of the support element 22, the aerosol-cooling element 24 being in longitudinal alignment with the rod 12 and the support element 22. In the embodiment of Figure 1, the upstream end of the aerosol-cooling element 24 abuts the downstream end of the support element 22. In the embodiment of Figure 1, the support element 22 and the aerosol-cooling element 24 together define an intermediate hollow section 50 of the aerosol-generating article 10.

[0311] The support element 22 comprises a first hollow tubular segment 26. The first hollow tubular segment 26 is provided in the form of a hollow cylindrical tube made of cellulose acetate. The first hollow tubular segment 26 defines an internal cavity 28 that extends all the way from an upstream end 30 of the first hollow tubular segment to a downstream end 32 of the first hollow tubular segment 20. The internal cavity 28 is substantially empty, and so substantially unrestricted airflow is enabled along the internal cavity 28.

[0312] The first hollow tubular segment 26 has a length of about 8 millimetres, an external diameter of about 7.25 millimetres, and an internal diameter of about 1.9 millimetres. Thus, a thickness of a peripheral wall of the first hollow tubular segment 26 is about 2.67 millimetres.

[0313] The aerosol-cooling element 24 comprises a second hollow tubular segment 34. The second hollow tubular segment 34 is provided in the form of a hollow cylindrical tube made of cellulose acetate. The second hollow tubular segment 34 defines an internal cavity 36 that extends all the way from an upstream end 38 of the second hollow tubular segment to a downstream end 40 of the second hollow tubular segment 34. The internal cavity 36 is substantially empty, and so substantially unrestricted airflow is enabled along the internal cavity 36.

[0314] The second hollow tubular segment 34 has a length of about 8 millimetres, an external diameter of about 7.25 millimetres, and an internal diameter of about 3.25 millimetres. Thus, a thickness of a peripheral wall of the second hollow tubular segment 34 is about 2 millimetres. Thus, a ratio between the internal diameter of the first hollow tubular segment 26 and the internal diameter of the second hollow tubular segment 34 is about 0.75.

[0315] The aerosol-generating article 10 comprises a ventilation zone 60 provided at a location along the second hollow tubular segment 34. In more detail, the ventilation zone is provided at about 2 millimetres from the upstream end of the second hollow tubular segment 34. A ventilation level of the aerosol-generating article 10 is about 25 percent.

[0316] In the embodiment of Figure 1, the downstream section 14 further comprises a mouthpiece element 42 at a location downstream of the intermediate hollow section 50. In more detail, the mouthpiece element 42 is positioned immediately downstream of the aerosol-cooling element 24. As shown in the drawing of Figure 1, an upstream end of the mouthpiece element 42 abuts the downstream end 40 of the aerosol-cooling element 18.

[0317] The mouthpiece element 42 is provided in the form of a cylindrical plug of low-density cellulose acetate. The mouthpiece element 42 has a length of about 12 millimetres and an external diameter of about 7.25 millimetres.

[0318] The rod 12 comprises an aerosol-generating substrate of one of the types described above. A density of the aerosol-generating substrate is about 600 milligrams per cubic centimetre.

[0319] The rod 12 of aerosol-generating substrate has an external diameter of about 7.25 millimetres and a length of about 12 millimetres.

[0320] The aerosol-generating article 10 further comprises an elongate susceptor 44 within the rod 12 of aerosol-generating substrate. In more detail, the susceptor 44 is arranged substantially longitudinally within the aerosol-generating substrate, such as to be approximately

parallel to the longitudinal direction of the rod 12. As shown in the drawing of Figure 1, the susceptor 44 is positioned in a radially central position within the rod and extends effectively along the longitudinal axis of the rod 12. In more detail, the susceptor 44 is in thermal contact with the aerosol-generating substrate. The susceptor 44 extends all the way from an upstream end to a downstream end of the rod 12. In effect, the susceptor 44 has substantially the same length as the rod 12 of aerosol-generating substrate.

[0321] In the embodiment of Figure 1, the susceptor 44 is provided in the form of a strip and has a length of about 12 millimetres, a thickness of about 60 micrometres, and a width of about 4 millimetres.

[0322] The upstream section 16 comprises an upstream element 46 located immediately upstream of the rod 12 of aerosol-generating substrate, the upstream element 46 being in longitudinal alignment with the rod 12. In the embodiment of Figure 1, the downstream end of the upstream element 46 abuts the upstream end of the rod 12 of aerosol-generating substrate. This advantageously prevents the susceptor 44 from being dislodged. Further, this ensures that the consumer cannot accidentally contact the heated susceptor 44 after use.

[0323] The upstream element 46 is provided in the form of a cylindrical plug of cellulose acetate circumscribed by a stiff wrapper. The upstream element 46 has a length of about 5 millimetres. The RTD of the upstream element 46 is about 30 millimetres H_2O.

[0324] As shown in the drawing of Figure 1, the aerosol-generating article 10 further comprises a wrapper 70 circumscribing the rod 12 of aerosol-generating substrate. The wrapper 70 comprises a wrapping base material having a basis weight of about 90 grams per square metre. Further, the wrapper 70 comprises a flame retardant composition comprising one or more flame retardant compounds.

[0325] In more detail, the flame retardant composition is provided at least in a treated portion 72 of the wrapper extending between the proximal end and the distal end of the rod 12 of aerosol-generating substrate. The treated portion 72 comprises about 3.5 grams of the one or more flame retardant compounds per square metre of surface area of the treated portion 72. Thus, the treated portion 72 of the wrapper 70 has an overall basis weight greater than the basis weight of the wrapping base material. In the embodiment of Figure 1, the treated portion 72 has a length substantially matching the length of the rod 12 of aerosol-generating substrate, and extends substantially over the whole outer surface area of the rod 12 of aerosol-generating substrate.

[0326] The aerosol-generating article 110 shown in Figure 2 has a number of features in common with the aerosol-generating article 10 of Figure 1, and will be described below insofar as it differs from the aerosol-generating article 10.

[0327] As shown in Figure 2, the aerosol-generating article 110 comprises a rod 12 of aerosol-generating substrate 12 and a modified downstream section 114 at a location downstream of the rod 12 of aerosol-generating substrate. Further, the aerosol-generating article 110 does not comprise an upstream section.

[0328] Like the downstream section 14 of the aerosol-generating article 10, the modified downstream section 114 of the aerosol-generating article 110 comprises a support element 22 located immediately downstream of the rod 12 of aerosol-generating substrate, the support element 22 being in longitudinal alignment with the rod 12, wherein the upstream end of the support element 22 abuts the downstream end of the rod 12 of aerosol-generating substrate.

[0329] Further, the modified downstream section 114 comprises an aerosol-cooling element 124 located immediately downstream of the support element 22, the aerosol-cooling element 124 being in longitudinal alignment with the rod 12 and the support element 22. In more detail, the upstream end of the aerosol-cooling element 124 abuts the downstream end of the support element 22.

[0330] In contrast to the downstream section 14 of the aerosol-generating article 10, the aerosol-cooling element 124 of the modified downstream section 114 comprises a plurality of longitudinally extending channels which offer a low or substantially null resistance to the passage of air through the rod. In more detail, the aerosol-cooling element 124 is formed from a preferably non-porous sheet material selected from the group comprising a metallic foil, a polymeric sheet, and a substantially non-porous paper or cardboard. In particular, in the embodiment illustrated in Figure 2, the aerosol-cooling element 124 is provided in the form of a crimped and gathered sheet of polylactic acid (PLA). The aerosol-cooling element 124 has a length of about 8 millimetres, and an external diameter of about 7.25 millimetres.

[0331] Similar to the embodiment of Figure 1, the aerosol-generating article 110 of Figure 2 further comprises a wrapper 70 circumscribing the rod 12 of aerosol-generating substrate. The wrapper 70 comprises a wrapping base material having a basis weight of about 90 grams per square metre. Further, the wrapper 70 comprises a flame retardant composition comprising one or more flame retardant compounds.

[0332] In more detail, the flame retardant composition is provided at least in a treated portion 72 of the wrapper extending between the proximal end and the distal end of the rod 12 of aerosol-generating substrate. The treated portion 72 comprises about 3.5 grams of the one or more flame retardant compounds per square metre of surface area of the treated portion 72. Thus, the treated portion 72 of the wrapper 70 has an overall basis weight greater than the basis weight of the wrapping base material. In the embodiment of Figure 1, the treated portion 72 has a length substantially matching the length of the rod 12 of aerosol-generating substrate, and extends substantially over the whole outer surface area of the rod 12 of aerosol-generating substrate.

Claims

1. An aerosol-generating article (10, 110) for producing an inhalable aerosol upon heating, the aerosol-generating article (10, 110) comprising:

   a rod (12) of aerosol-generating substrate, the aerosol-generating substrate comprising at least an aerosol-former, wherein the aerosol-generating substrate has an aerosol former content of at least about 10 percent on a dry weight basis;
   a downstream section (14, 114) at a location downstream of the rod (12) of aerosol-generating substrate; and
   a wrapper (70) circumscribing at least the rod (12) of aerosol-generating substrate;
   wherein a density of the aerosol-generating substrate is greater than about 300 milligrams per cubic centimetre; and
   wherein the wrapper (70) comprises a flame retardant composition comprising one or more flame retardant compounds.

2. An aerosol-generating article (10, 110) according to claim 1, wherein a density of the aerosol-generating substrate is greater than about 350 milligrams per cubic centimetre.

3. An aerosol-generating article (10, 110) according to claim 1, wherein a density of the aerosol-generating substrate is greater than about 400 milligrams per cubic centimetre.

4. An aerosol-generating article (10, 110) according to any one of claims 1 to 3, wherein the rod (12) of aerosol-generating substrate comprises a gathered sheet of homogenised tobacco material.

5. An aerosol-generating article (10, 110) according to any one of claims 1 to 3, wherein the rod (12) of aerosol-generating substrate comprises a gel composition, the gel composition comprising at least one gelling agent, at least one of an alkaloid compound and a cannabinoid compound, and an aerosol former.

6. An aerosol-generating article (10) according to any one of the preceding claims, wherein the rod (12) of aerosol-generating substrate further comprises a susceptor element (44) arranged within the aerosol-generating substrate.

7. An aerosol-generating article (10, 110) according to any one of the preceding claims, wherein the wrapper (70) comprises a wrapping base material and a layer comprising the flame retardant composition provided on a surface of the wrapping base material facing the aerosol-generating substrate, a surface of the wrapping base material facing away from the aerosol-generating substrate, or both.

8. An aerosol-generating article (10, 110) according to any one of claims 1 to 7, wherein the flame retardant composition comprises a polymer and a mixed salt based on at least one mono, di- and/or tri-carboxylic acid, at least one polyphosphoric, pyrophosphoric and/or phosphoric acid, and a hydroxide or a salt of an alkali or an alkaline earth metal, where the at least one mono, di- and/or tri-carboxylic acid and the hydroxide or salt form a carboxylate and the at least one polyphosphoric, pyrophosphoric and/or phosphoric acid and the hydroxide or salt form a phosphate.

9. An aerosol-generating article (10, 110) according to claim 8, wherein the flame retardant composition further comprises a carbonate of an alkali or an alkaline earth metal.

10. An aerosol-generating article (10, 110) according to any one claims 1 to 7, wherein the flame retardant composition comprises cellulose modified with at least one C_{10} or higher fatty acid, tall oil fatty acid (TOFA), phosphorylated linseed oil, phosphorylated downstream corn oil.

11. An aerosol-generating article (10, 110) according to any one of the preceding claims, wherein the rod (12) of aerosol-generating substrate has a length of less than about 40 millimetres.

12. An aerosol-generating article (10, 110) according to any one of the preceding claims, wherein the rod (12) of aerosol-generating substrate has a length of at least about 10 millimetres.

13. An aerosol-generating article (10, 110) according to any one of the preceding claims, wherein an overall length of the aerosol-generating article (10, 110) is less than about 70 millimetres.

14. An aerosol-generating article (10, 110) according to any one of the preceding claims wherein the wrapper (70) does not comprise metal.

15. A method of manufacturing an aerosol-generating article (10, 110) for generating an inhalable aerosol upon heating, the method comprising:

   providing a continuous rod of aerosol-generating substrate, wherein a density of the aerosol-generating substrate is greater than about 300 milligrams per cubic centimetre, the aerosol-generating substrate comprising at least an aerosol-former, wherein the aerosol-generating

substrate has an aerosol former content of at least about 10 percent on a dry weight basis;
circumscribing the continuous rod of aerosol-generating substrate with a wrapper (70) comprising a flame retardant composition comprising one or more flame retardant compounds; and
cutting the circumscribed continuous rod into discrete rods (12), each discrete rod (12) being circumscribed by a portion of the wrapper (70) comprising the flame retardant composition.

16. A method according to claim 15, wherein a layer of the flame retardant composition is applied onto at least one side of a wrapping base material of the wrapper (70) by an application process based on size pressing, spraying, printing or coating.

17. An aerosol-generating system comprising an electrically operated aerosol-generating device and an aerosol-generating article (10, 110) according to any one of claims 1 to 14, the aerosol-generating device comprising means for heating the rod (12) of aerosol-generating substrate to a temperature sufficient to generate an aerosol from the aerosol-generating substrate.

Patentansprüche

1. Aerosolerzeugender Artikel (10, 110) zur Erzeugung eines inhalierbaren Aerosols bei Erwärmung, der aerosolerzeugende Artikel (10, 110) umfassend:

Ein Stab (12) aus aerosolerzeugendem Substrat wenigstens einen Aerosolbildner umfassend, wobei der Stab aus aerosolerzeugendem Substrat einen Aerosolbildnerngehalt von wenigstens etwa 10 Prozent auf Trockengewichtsbasis aufweist;
einen nachgelagerten Teilbereich (14, 114) an einer dem Stab (12) aus aerosolerzeugendem Substrat nachgelagerten Stelle; und
eine Umhüllung (70), die wenigstens den Stab (12) aus aerosolerzeugendem Substrat umhüllt;
wobei eine Dichte des aerosolerzeugenden Substrats größer als etwa 300 Milligramm pro Kubikzentimeter ist; und
wobei die Umhüllung (70) eine flammhemmende Zusammensetzung umfasst, die eine oder mehrere flammhemmende Verbindungen umfasst.

2. Aerosolerzeugender Artikel (10, 110) gemäss Anspruch 1, wobei eine Dichte des aerosolerzeugenden Substrats größer als etwa 350 Milligramm pro Kubikzentimeter ist.

3. Aerosolerzeugender Artikel (10, 110) gemäss Anspruch 1, wobei eine Dichte des aerosolerzeugenden Substrats größer als etwa 400 Milligramm pro Kubikzentimeter ist.

4. Aerosolerzeugender Artikel (10, 110) gemäss einem beliebigen der Ansprüche von 1 bis 3, wobei der Stab (12) des aerosolbildenden Substrates ein zusammengefasstes Flächengebilde aus homogenisiertem Tabakmaterial umfasst.

5. Aerosolerzeugender Artikel (10, 110) gemäss einem beliebigen der Ansprüche 1 bis 3, wobei der Stab (12) des aerosolerzeugenden Substrats eine Gelzusammensetzung umfasst, wobei die Gelzusammensetzung wenigstens ein Geliermittel, wenigstens eine Alkaloidverbindung und eine Cannabinoidverbindung und einen Aerosolbildner umfasst.

6. Aerosolerzeugender Artikel (10) gemäss einem beliebigen vorhergehenden Anspruch wobei der Stab (12) eines aerosolerzeugenden Substrates ferner eine Suszeptorelement (44) aufweist, das innerhalb des aerosolerzeugenden Substrats angeordnet ist.

7. Aerosolerzeugender Artikel (10, 110) gemäss einem beliebigen vorhergehenden Anspruch wobei die Umhüllung (70) ein Umhüllungsgrundmaterial und eine Schicht umfasst, welche die flammhemmende Zusammensetzung umfasst, die auf einer Oberfläche des Umhüllungsgrundmaterials, die dem aerosolerzeugenden Substrat zugewandt ist, einer Fläche des Umhüllungsgrundmaterials, die von dem aerosolerzeugenden Substrat abgewandt ist, oder beidem vorgesehen ist.

8. Aerosolerzeugender Artikel (10, 110) gemäss einem beliebigen der Ansprüche 1 bis 7, wobei die flammhemmende Zusammensetzung ein Polymer und ein gemischtes Salz auf Basis wenigstens einer Mono-, Di- und/oder Tricarbonsäure umfasst, sowie ein Hydroxid oder ein Salz eines Alkali- oder Erdalkalimetalls, wobei die wenigstens eine Mono-, Di- und/oder Tri-Carbonsäure und das Hydroxid oder Salz ein Carboxylat und die wenigsten eine Polyphosphor-, Pyrophosphor- und/oder Phosphorsäure und das Hydroxid oder Salz ein Phosphat bilden.

9. Aerosolerzeugender Artikel (10, 110) gemäss Anspruch 8, wobei die flammhemmende Zusammensetzung ferner ein Carbonat eines Alkali- oder Erdalkalimetalls umfasst.

10. Aerosolerzeugender Artikel (10, 110) gemäss einem beliebigen der Ansprüche 1 bis 7, wobei die flammhemmende Zusammensetzung Cellulose umfasst, die mit wenigstens einer C_{10} - oder höheren Fettsäure, Tallölfettsäure (Tall Oil Fatty Acid - TOFA),

phosphoryliertem Leinsamenöl, phosphoryliertem nachgelagertem Maisöl modifiziert ist.

11. Aerosolerzeugender Artikel (10, 110) gemäss einem beliebigen vorhergehenden Anspruch, wobei der Stab (12) aus aerosolerzeugendem Substrat eine Länge von weniger als 40 Millimetern aufweist.

12. Aerosolerzeugender Artikel (10, 110) gemäss einem beliebigen vorhergehenden Anspruch, wobei der Stab (12) aus aerosolerzeugendem Substrat eine Länge von wenigstens ca. 10 Millimetern aufweist.

13. Aerosolerzeugender Artikel (10, 110) gemäss einem beliebigen vorhergehenden Anspruch, wobei die Gesamtlänge des aerosolerzeugenden Artikels (10, 110) weniger als 70 Millimeter beträgt.

14. Aerosolerzeugender Artikel (10, 110) gemäss einem beliebigen vorhergehenden Anspruch, wobei die Umhüllung (70) kein Metall umfasst.

15. Verfahren zum Herstellen eines aerosolerzeugender Artikels (10, 110) zum Erzeugen eines inhalierbaren Aerosols beim Erhitzen, wobei das Verfahren Folgendes umfasst:

Bereitstellen eines kontinuierlichen Stabs aus aerosolerzeugendem Substrat, wobei eine Dichte des aerosolerzeugenden Substrats größer als etwa 300 Milligramm pro Kubikzentimeter ist, wobei das aerosolerzeugende Substrat wenigstens einen Aerosolbildner umfasst, wobei das aerosolerzeugende Substrat einen Aerosolbildnergehalt von wenigstens etwa 10 Prozent auf Trockengewichtsbasis aufweist;
Umhüllen des kontinuierlichen Stabs des Aerosol erzeugenden Substrats mit einer Umhüllung (70), die eine flammhemmende Zusammensetzung umfasst, die eine oder mehrere flammhemmende Verbindungen umfasst; und
Schneiden des umhüllten kontinuierlichen Stabs in einzelne Stäbe (12), wobei jeder einzelne Stab (12) von einem Abschnitt der Umhüllung (70) umhüllt wird, der die flammhemmende Zusammensetzung umfasst.

16. Verfahren gemäss Anspruch 15, wobei eine Schicht der flammhemmenden Zusammensetzung auf wenigstens eine Seite eines Umhüllungsgrundmaterials der Umhüllung (70) durch ein Auftragungsverfahren auf Basis von Leimpressen, Sprühen, Drucken oder Beschichten aufgebracht wird.

17. Aerosolerzeugungssystem, das eine elektrisch betriebene Aerosolerzeugungsvorrichtung und einen aerosolerzeugenden Artikel (10, 110) gemäss einem beliebigen der Ansprüche 1 bis 14 umfasst, wobei die Aerosolerzeugungsvorrichtung Mittel zum Erhitzen des Stabes (12) des Aerosolerzeugungssubstrats auf eine Temperatur umfasst, die ausreichend ist, um ein Aerosol aus dem aerosolerzeugenden Substrat zu erzeugen.

Revendications

1. Article de génération d'aérosol (10, 110) destiné à produire un aérosol inhalable lors du chauffage, l'article de génération d'aérosol (10, 110) comprenant :

une tige (12) de substrat de génération d'aérosol, le substrat de génération d'aérosol comprenant au moins un agent de formation d'aérosol, dans lequel le substrat de génération d'aérosol a une teneur en agent de formation d'aérosol d'au moins environ 10 pour cent sur la base du poids à sec ;
une section aval (14, 114) à un emplacement en aval de la tige (12) du substrat de génération d'aérosol ; et
une enveloppe (70) qui circonscrit au moins la tige (12) de substrat de génération d'aérosol ; dans lequel une masse volumique du substrat de génération d'aérosol est supérieure à environ 300 milligrammes par centimètre cube ; et
dans lequel l'enveloppe (70) comprend une composition ignifuge comprenant un ou plusieurs composés ignifuges.

2. Article de génération d'aérosol (10, 110) selon la revendication 1, dans lequel une masse volumique du substrat de génération d'aérosol est supérieure à environ 350 milligrammes par centimètre cube.

3. Article de génération d'aérosol (10, 110) selon la revendication 1, dans lequel une masse volumique du substrat de génération d'aérosol est supérieure à environ 400 milligrammes par centimètre cube.

4. Article de génération d'aérosol (10, 110) selon l'une quelconque des revendications 1 à 3, dans lequel la tige (12) de substrat de génération d'aérosol comprend une feuille froncée de matériau de tabac homogénéisé.

5. Article de génération d'aérosol (10, 110) selon l'une quelconque des revendications 1 à 3, dans lequel la tige (12) de substrat de génération d'aérosol comprend une composition en gel, la composition en gel comprenant au moins un agent gélifiant, au moins l'un parmi un composé alcaloïde et un composé cannabinoïde, et un agent de formation d'aérosol.

6. Article de génération d'aérosol (10) selon l'une quelconque des revendications précédentes, dans le-

quel la tige (12) de substrat de génération d'aérosol comprend en outre un élément suscepteur (44) agencé au sein du substrat de génération d'aérosol.

7. Article de génération d'aérosol (10, 110) selon l'une quelconque des revendications précédentes, dans lequel l'enveloppe (70) comprend un matériau de base d'enveloppement et une couche comprenant la composition ignifuge prévue sur une surface du matériau de base d'enveloppement faisant face au substrat de génération d'aérosol, une surface du matériau de base d'enveloppement étant face à l'opposé du substrat de génération d'aérosol, ou les deux.

8. Article de génération d'aérosol (10, 110) selon l'une quelconque des revendications 1 à 7, dans lequel la composition ignifuge comprend un polymère et un sel mixte à base d'au moins un acide mono-, di- et/ou tri-carboxylique, d'au moins un acide polyphosphorique, pyrophosphorique et/ou phosphorique, et d'un hydroxyde ou d'un sel d'un métal alcalin ou alcalino-terreux, où l'au moins un acide mono-, di- et/ou tri-carboxylique et l'hydroxyde ou le sel forment un carboxylate, et l'au moins un acide polyphosphorique, pyrophosphorique et/ou phosphorique et l'hydroxyde ou le sel forment un phosphate.

9. Article de génération d'aérosol (10, 110) selon la revendication 8, dans lequel la composition ignifuge comprend en outre un carbonate d'un métal alcalin ou alcalino-terreux.

10. Article de génération d'aérosol (10, 110) selon l'une quelconque des revendications 1 à 7, dans lequel la composition ignifuge comprend de la cellulose modifiée avec au moins un acide gras en C_{10} ou supérieur, un acide gras de tallol (TOFA), de l'huile de lin phosphorylée, de l'huile de maïs phosphorylée en aval.

11. Article de génération d'aérosol (10, 110) selon l'une quelconque des revendications précédentes, dans lequel la tige (12) de substrat de génération d'aérosol a une longueur inférieure à environ 40 millimètres.

12. Article de génération d'aérosol (10, 110) selon l'une quelconque des revendications précédentes, dans lequel la tige (12) de substrat de génération d'aérosol a une longueur d'au moins environ 10 millimètres.

13. Article de génération d'aérosol (10, 110) selon l'une quelconque des revendications précédentes, dans lequel une longueur totale de l'article de génération d'aérosol (10, 110) est inférieure à environ 70 millimètres.

14. Article de génération d'aérosol (10, 110) selon l'une quelconque des revendications précédentes, dans lequel l'enveloppe (70) ne comprend pas de métal.

15. Procédé de fabrication d'un article de génération d'aérosol (10, 110) pour générer un aérosol inhalable lors du chauffage, le procédé comprenant :

la fourniture d'une tige continue de substrat de génération d'aérosol, dans lequel une masse volumique du substrat de génération d'aérosol est supérieure à environ 300 milligrammes par centimètre cube, le substrat de génération d'aérosol comprenant au moins un agent de formation d'aérosol, dans lequel le substrat de génération d'aérosol a une teneur en agent de formation d'aérosol d'au moins environ 10 pour cent sur la base du poids à sec ;
le fait de circonscrire la tige continue de substrat de génération d'aérosol avec une enveloppe (70) comprenant une composition ignifuge comprenant un ou plusieurs composés ignifuges ; et
la coupe de la tige continue circonscrite en tiges (12) discrètes, chaque tige (12) discrète étant circonscrite par une portion de l'enveloppe (70) comprenant la composition ignifuge.

16. Procédé selon la revendication 15, dans lequel une couche de la composition ignifuge est appliquée sur au moins un côté d'un matériau de base d'enveloppement de l'enveloppe (70) par un processus d'application basé sur un pressage de taille, une pulvérisation, une impression ou un revêtement.

17. Système de génération d'aérosol comprenant un dispositif électrique de génération d'aérosol et un article de génération d'aérosol (10, 110) selon l'une quelconque des revendications 1 à 14, le dispositif de génération d'aérosol comprenant un moyen pour chauffer la tige (12) du substrat de génération d'aérosol à une température suffisante pour générer un aérosol à partir du substrat de génération d'aérosol.

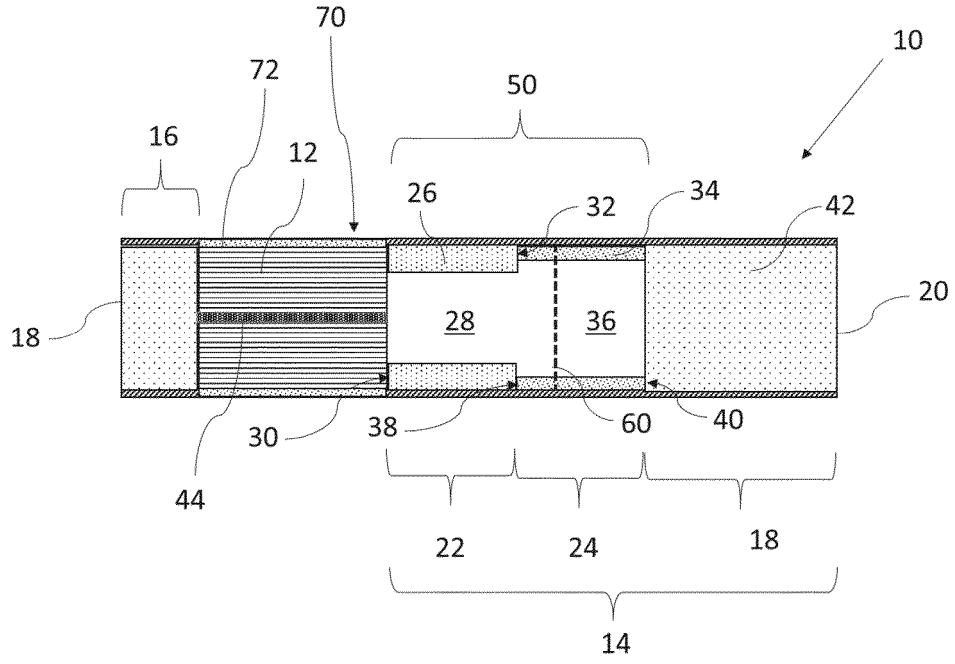

Figure 1

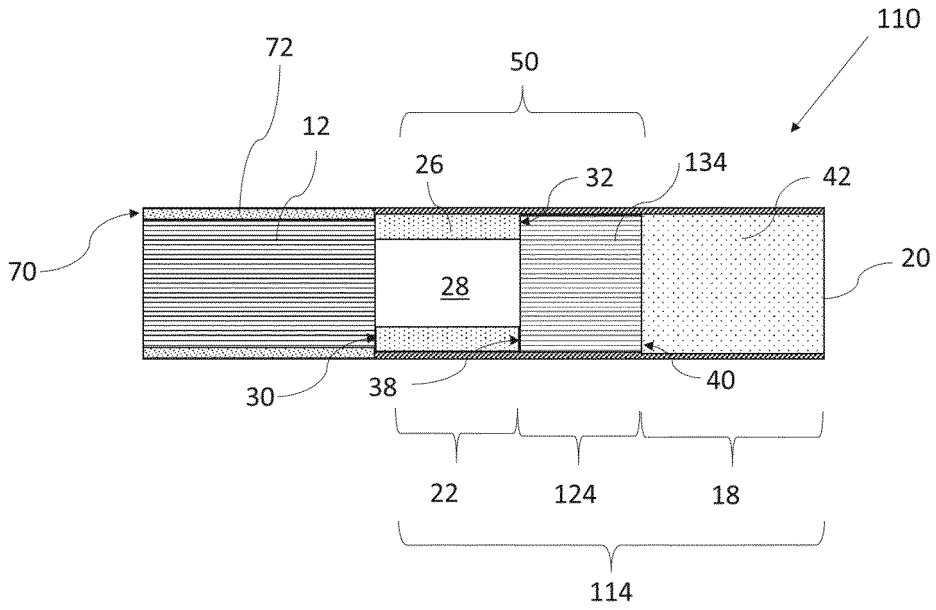

Figure 2

REFERENCES CITED IN THE DESCRIPTION

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