US 20250212938A1

(19) **United States**

(12) **Patent Application Publication** (10) **Pub. No.: US 2025/0212938 A1**

HODGSON et al. (43) **Pub. Date: Jul. 3, 2025**

(54) **A COMPOSITION COMPRISING AN AGGLOMERATE COMPRISING AN AEROSOL-GENERATING MATERIAL AND USES THEREOF**

(71) Applicant: **NICOVENTURES TRADING LIMITED**, London (GB)

(72) Inventors: **Matthew HODGSON**, London (GB); **John RICHARDSON**, London (GB)

(21) Appl. No.: **18/851,550**

(22) PCT Filed: **Mar. 31, 2023**

(86) PCT No.: **PCT/GB2023/050848**

§ 371 (c)(1),
(2) Date: **Sep. 26, 2024**

(30) **Foreign Application Priority Data**

Apr. 1, 2022 (GB) 2204795.5

Publication Classification

(51) **Int. Cl.**

A24B 15/18	(2006.01)
A24B 15/14	(2006.01)
A24B 15/16	(2020.01)
A24B 15/30	(2006.01)
A24D 1/20	(2020.01)

(52) **U.S. Cl.**

CPC ***A24B 15/186*** (2013.01); ***A24B 15/14*** (2013.01); ***A24B 15/16*** (2013.01); ***A24B 15/303*** (2013.01); ***A24D 1/20*** (2020.01)

(57) **ABSTRACT**

The invention relates to a composition comprising an agglomerate comprising a plurality of particles of an aerosol-generating material comprising a dried precursor material comprising an extract from a flavour- and/or active-containing plant material and optionally an aerosol-former material. The compositions may be used to generate an aerosol. For example, the compositions may be used in combustible or non-combustible aerosol-provision systems. The invention also relates to aerosol-provision systems comprising the compositions, and methods of providing a composition.

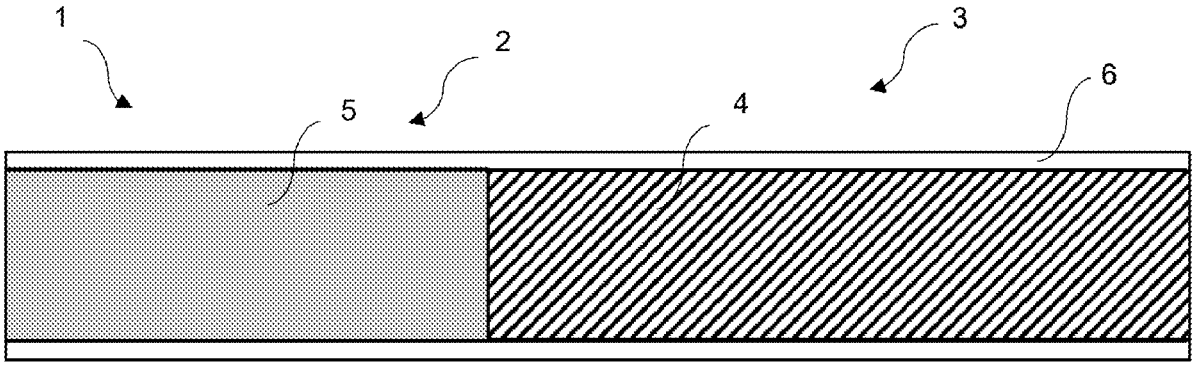


Fig. 1

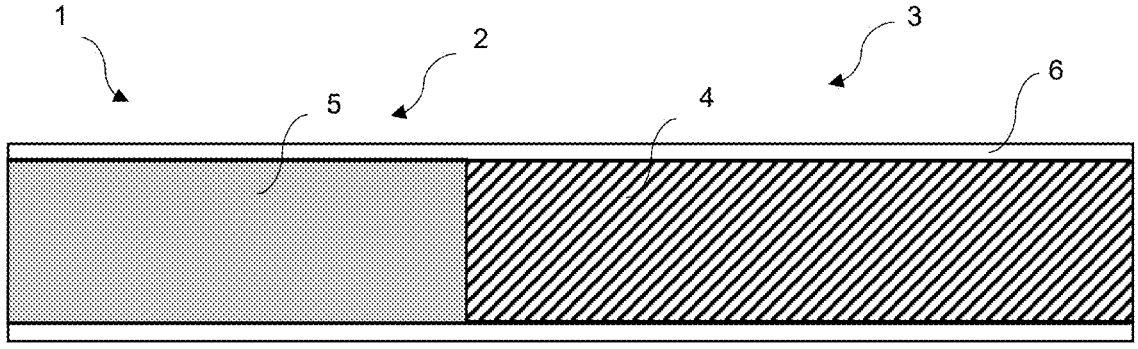
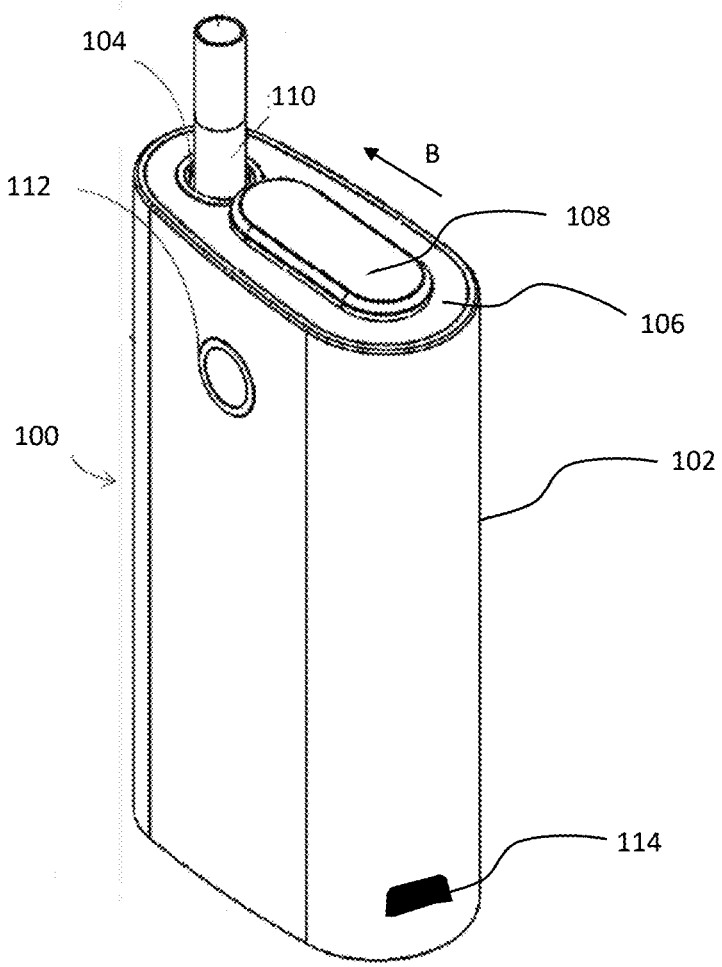


Fig. 2



A COMPOSITION COMPRISING AN AGGLOMERATE COMPRISING AN AEROSOL-GENERATING MATERIAL AND USES THEREOF

FIELD

[0001] The invention relates to a composition comprising an agglomerate comprising an aerosol-generating material, methods of manufacturing the composition and uses thereof.

BACKGROUND

[0002] Aerosol-generating materials for use in a combustible or a non-combustible aerosol provision system may include a variety of different active substances and/or flavours. Factors such as the concentration of volatile active and/or flavour components in the aerosol generating materials and the stability of the aerosol-generating materials will influence the properties of the aerosol generated.

SUMMARY

[0003] According to a first aspect of the present invention, there is provided a composition comprising an agglomerate comprising a plurality of particles of an aerosol-generating material comprising a dried precursor material comprising an extract from a flavour- and/or active-containing plant material.

[0004] In some embodiments, the agglomerate has a BET surface area of at least about 100 m^2/g.

[0005] In some embodiments, the agglomerate is sufficiently porous to allow an airflow to be drawn through it.

[0006] In some embodiments, the agglomerate comprises a binder.

[0007] In some embodiments, the binder is included in an amount of from about 0.1 wt % to about 30 wt %, based on the entire weight of the agglomerate.

[0008] In some embodiments, the binder is selected from the group consisting of: starches, polysaccharides, pectins, celluloses, cellulose derivatives such as carboxymethylcellulose, and alginates.

[0009] In some embodiments, the agglomerate has a size from about 1 mm to about 20 mm.

[0010] In some embodiments, the agglomerate consists essentially of the dried aerosol-generating material and an optional binder.

[0011] In some embodiments, the aerosol-generating material further comprises an aerosol-former material.

[0012] In some embodiments, the precursor material comprises from about 10 to about 95% by weight extract from a flavour- or active-containing plant material.

[0013] In some embodiments, the precursor material comprises from about 1 to about 36 wt % aerosol-former material.

[0014] In some embodiments, the precursor material comprises from 0 to about 40% by weight of an excipient.

[0015] In some embodiments, the dried aerosol-generating material comprises from about 99 to about 45% by weight dried extract from the flavour- or active-containing plant material.

[0016] In some embodiments, the dried aerosol-generating material comprises from about 1 to about 34% by weight of an aerosol-former material.

[0017] In some embodiments, the dried aerosol-generating material comprises from 0 to about 25% by weight of an excipient.

[0018] In some embodiments, the plant material is selected from the group consisting of tobacco, eucalyptus, star anise, cocoa and hemp.

[0019] In some embodiments, the extract from a flavour- or active-containing plant material is an aqueous extract.

[0020] In some embodiments, the extract from a flavour- or active-containing plant material is an aqueous tobacco extract.

[0021] In some embodiments, the dried aerosol-generating material comprising from about 40 to about 99% by weight tobacco solids.

[0022] In some embodiments, the dried aerosol-generating material having a water content of no more than about 5% (calculated on a wet weight basis).

[0023] In some embodiments, the composition comprises a moisture impermeable coating surrounding the aerosol-generating material.

[0024] In some embodiments, the coating surrounds the agglomerated aerosol-generating material.

[0025] In some embodiments, the composition comprises a sorbent material.

[0026] In some embodiments, the composition comprises heating material embedded within the agglomerate.

[0027] In some embodiments, the heating material is heated by electrical resistance.

[0028] In some embodiments, the heating material is a susceptor.

[0029] In some embodiments, the composition is for use in an aerosol provision system.

[0030] According to a second aspect of the present invention, there is provided an article comprising one or more agglomerates comprising a plurality of particles of an aerosol-generating material comprising a dried precursor material comprising an extract from a flavour- and/or active-containing plant material.

[0031] In some embodiments, the article comprises the composition according to the first aspect.

[0032] In some embodiments, the article comprises a means to prevent or reduce the absorption of moisture by the dried aerosol-generating material.

[0033] In some embodiments, the means is provided separately from the one or more agglomerates.

[0034] In some embodiments, the means comprises a film or wrapper comprising a moisture impermeable coating or a sorbent or desiccant material.

[0035] According to a third aspect of the present invention, there is provided a non-combustible aerosol-provision system comprising a composition according to the first aspect or an article according to the second aspect.

[0036] In some embodiments, the system is configured to heat the composition to form a vapour and/or aerosol.

[0037] In some embodiments, the system further comprises a further aerosol-generating material which is to be heated to form an aerosol and/or vapour, optionally wherein the further aerosol-generating material is a liquid.

[0038] In some embodiments, the composition is heated by the aerosol and/or vapour generated from the further aerosol-generating material.

[0039] In some embodiments, the system includes a means for heating the further aerosol-generating material to form a vapour, but not including a separate means for heating the composition.

[0040] According to a fourth aspect of the present invention, there is provided a method for providing a composition comprising:

[0041] drying a precursor material comprising an extract from a flavour- and/or active-containing plant material to form particles of a dried aerosol-generating material; and

[0042] adding a binder to the particles of dried aerosol-generating material before, during or after agglomerating the particles of dried aerosol-generating material.

[0043] In some embodiments, the method comprises drying or curing the binder to form an agglomerate.

[0044] In some embodiments, the method comprises shaping the agglomerated particles.

BRIEF DESCRIPTION OF THE DRAWINGS

[0045] Embodiments of the invention will now be described, by way of example only, with reference to accompanying drawings, in which:

[0046] FIG. **1** is a side-on cross-sectional view of a first embodiment of a consumable comprising a composition as described herein; and

[0047] FIG. **2** is a perspective illustration of a non-combustible aerosol provision device for generating aerosol from the composition of the consumable shown in FIG. **1**.

DETAILED DESCRIPTION

[0048] An aerosol-generating material is a material that is capable of generating aerosol, for example when heated, irradiated or energized in any other way.

[0049] Conventional aerosol-generating materials which comprise tobacco material or a tobacco extract may be used in combustible and non-combustible aerosol-generating devices, including hybrid devices and tobacco heating products, to provide the user with an aerosol with an authentic tobacco taste and texture. One issue encountered with such materials is that the content of the flavour, other volatile compound(s) and nicotine decreases with storage of the aerosol-generating material, dropping off particularly towards the end of the life of the material. This is because the more volatile components, including nicotine and many flavours and aromas, are readily released from the material. Additionally, as the moisture content of the aerosol-generating material increases through moisture absorption, the release of substances such as nicotine and flavours is negatively impacted. Aerosol-generating materials that are produced using conventional methods and procedures commonly need to be used within one to three days of production. There is therefore a need to improve the shelf life of the aerosol generating material.

[0050] A further issue associated with conventional aerosol-generating materials comprising tobacco material or a tobacco extract is that the concentration of the desired components such as nicotine and flavours is relatively low. This limits the concentration of these desired components in the aerosol generated. Additionally, this means that a relatively large amount of the aerosol-generating material is needed and, accordingly, high amounts of energy are required to heat the aerosol-generating material in order to release the desired components.

[0051] The present invention relates to compositions comprising an agglomerate comprising a plurality of particles of an aerosol-generating material comprising a dried precursor material comprising an extract from a flavour- and/or active-containing plant material and, optionally, an aerosol-former material. In some embodiments, the extract is a liquid solution or suspension and it may be dried or dehydrated using a process such as spray-drying or freeze-drying. The dried or dehydrated aerosol generating material may be formed from a precursor material comprising the extract from a flavour- and/or active-containing plant material and an aerosol-former material.

[0052] The aerosol-generating material comprising the dried extract from a flavour- and/or active-containing plant material comprises a high concentration of the flavour and/or active, with little or no material that does not contribute to the aerosol generated from the dried aerosol-generating material. As such, small amounts of the aerosol-generating material are sufficient to generate aerosol with desired active and flavour content. Further, the aerosol may be generated with the input of relatively low levels of energy.

[0053] An additional benefit of the aerosol-generating material being used as a solid substrate is that the low water content reduces issues associated with "hot puff", which are known in the art.

[0054] In some embodiments, the dried aerosol-generating material has a moisture content of from 0 to about 10%, or from 0 to about 5% (calculated on a wet weight basis), as measured by gas chromatography-thermal conductivity detector (GC-TCD) or Karl Fischer titration. In some embodiments, the moisture content of the dried aerosol-generating material is less than about 3 wt %, for example from about 0 to about 3 wt %, or from about 0.5 to about 2.5 wt %.

[0055] Karl Fischer titration is a classic method of chemical analysis for reliably determining the amount of water in a sample, and even just trace amounts. The method can be readily carried out using an automated Karl Fischer titrator. Similarly, the use of GC-TCD is also a well-established method for reliably determining the water content in a sample.

[0056] Unless stated otherwise, references to moisture content herein are references to the moisture content as measured by Karl Fischer titration.

[0057] The dried aerosol-generating material may be hygroscopic and so measures may need to be taken to ensure that the aerosol-generating material does not absorb moisture during processing, incorporation into a final product and storage in that final product prior to use.

[0058] It is not usually necessary for conventional aerosol-generating materials to be protected from the moisture in the surrounding environment. This is because conventional aerosol-generating materials are not hygroscopic and not particularly sensitive to moisture. In addition, humectants such as glycerol are often included in conventional aerosol-generating materials in appropriate amounts in order to target a particular moisture level in the aerosol-generating material. The highly concentrated nature of the dried aerosol-generating material used in the present invention means that the absorption of even small amounts of moisture can be very detrimental to the properties of the aerosol-generating

material and to the quality of the aerosol produced. What is more, the absorption of water can occur to such an extent that the dry powder takes on a paste-like consistency, which is undesirable in the compositions and consumables described herein.

[0059] Prevention of or reduction in absorption of water by the aerosol-generating material will also help to manage or avoid the phenomenon known as "hot puff".

[0060] In the present disclosure, a composition is provided comprising an agglomerate comprising a plurality of particles of an aerosol-generating material. The inventors have discovered that controlling the surface area, density and porosity of an agglomerate comprising particles of the aerosol-generating material as disclosed herein provides control over the release of the aerosol generated by heating the agglomerate. This means that predictable, consistent and sustained release of desirable aerosol components may be provided, with significant benefits for the user.

[0061] Thus, compositions are provided comprising an agglomerate comprising a plurality of particles of an aerosol-generating material comprising a dried precursor material comprising an extract from a flavour- and/or active-containing plant material and, optionally an aerosol-former material.

The Agglomerates

[0062] In the compositions disclosed herein, particles of the dried aerosol-generating material are agglomerated. This agglomerate is a collection of bound particles.

[0063] In some embodiments, the agglomerate is a low density agglomerate, with the agglomeration and binding of the particles of aerosol-generating material resulting in gaps between the particles making up the agglomerate. These gaps mean that the agglomerate is porous, with channels being formed throughout the agglomerate and, in some embodiments, rendering the agglomerate sufficiently porous so that air may be drawn through the agglomerate. Such low density agglomerates will also have a relatively high surface area.

[0064] Agglomerates with a high porosity/high surface area/low density have the advantages of providing passages within the agglomerate through which the aerosol generated upon heating the aerosol generating material can escape and is therefore available to be delivered to the user. The high porosity/high surface area/low density of the agglomerate may also assist the transfer of heat throughout the agglomerate, thus ensuring that all of the aerosol-generating material in the agglomerate is adequately heated to generate the desired aerosol. The transfer of heat may also be faster than in higher density agglomerates.

[0065] Given the impact of the porosity and density of the agglomerates on the aerosol-generation, the use of compositions as described herein, comprising agglomerated particles of aerosol-generating material, can allow the release of the aerosol to be controlled. The density and porosity of one or more agglomerates may be selected to provide a composition that has the desired aerosol release characteristics.

[0066] The porosity, density and/or surface area of the agglomerate will have an impact on the aerosol-generation and can therefore be selected to provide a composition that has the desired aerosol release characteristics. For example, the available surface area of the agglomerate (as measured by BET analysis) will affect the aerosol release and the active and/or flavour release. The higher the surface area, the more rapid the release. Frequently, the higher the surface area of the agglomerate, the greater proportion of the active and/or flavour contained in the aerosol-generating material that is released.

[0067] The make-up of the agglomerate and/or the agglomeration process can be selected and controlled to achieve the desired surface area of the agglomerates and thus the release rate. As a result, the compositions as described herein, comprising agglomerated particles of aerosol-generating material, may be used to generate an aerosol with a particular, desired timing and rate of release.

[0068] The surface area of porous materials, such as the agglomerates disclosed herein, may be estimated by measuring the variation of the volume of nitrogen adsorbed by the material in relation to the partial pressure of nitrogen at a constant temperature. Analysis of the results by mathematical models originated by Brunauer, Emmett and Teller results in a value known as the BET surface area.

[0069] In some embodiments, agglomerates of the present invention with high BET surface areas may be preferred over agglomerates with low BET surface areas. This is because agglomerates with high BET surface areas are likely to exhibit faster and possibly even greater aerosol generation than agglomerates with low BET surface areas.

[0070] In some embodiments, it may be advantageous for agglomerates with different BET surface areas to be combined, to provide a staggered release of aerosol and to provide aerosol generation over an extended period of time, for example for a session of multiple puffs of aerosol.

[0071] In some embodiments, at least some of the agglomerates used in the present invention have a BET surface area of at least about 100, at least about 150, at least about 200, at least about 250, at least about 300, at least about 350, at least about 400, at least about 450, at least about 500, at least about 550, at least about 600, at least about 650, at least about 700, at least about 750, at least about 800, at least about 900, or at least about 1000 m^2/g.

[0072] In some embodiments, a balance needs to be struck between the porosity of the agglomerates and their structural stability and integrity. Agglomerates with very high porosity may tend to be fragile and may readily break apart before use.

[0073] In some embodiments, an agglomerate comprises a plurality of particles, all of which comprise the aerosol-generating material formed by drying the precursor material described herein. In other embodiments, an agglomerate may further include particles of other material. For example, the agglomerates may further comprise particles of a different aerosol-generating material, such as particles of tobacco material or particles of a gel or dried gel. In other embodiments, the particles of aerosol-generating material may be agglomerated with particles of other materials, to give the agglomerate desired properties such as density, porosity, absorption or adsorption. For example, the agglomerate may include particles of one or more structural materials, such as chalk.

[0074] In addition to the structural benefit, this material may also absorb moisture and therefore reduce the amount of moisture absorbed by the dried extract. In some embodiments, the agglomerates comprise particles that comprise and/or hold flavour.

[0075] In some embodiments, it may be desirable for agglomerates to have lower porosity, higher density and/or smaller surface area. For example, this may be achieved by

agglomerating particles of different sizes or of smaller size, to increase the packing of the particles and reduce gaps within the structure.

[0076] In some embodiments, the dried aerosol-generating material is tacky and this tackiness may be sufficient to hold the particles of the agglomerate together. In some embodiments, the tackiness of the aerosol-generating material may increase with the moisture content of the material and so the moisture content of the particles of aerosol-generating material may be increased to provide an adequate level of tackiness to form an agglomerate of adequate stability.

[0077] In some embodiments, the tackiness of the particles may be increased by adding an aerosol-former material, such as glycerol. To achieve this effect, it may be necessary to add glycerol in an amount of at least 15 wt % based on the total weight of the agglomerate.

[0078] In some embodiments, the agglomerate does not comprise a binder to assist agglomeration of the particles in the agglomerate.

[0079] In some embodiments, the agglomerate comprises one or more binders to bind or adhere the particles of within the agglomerate together. For example, the one or more binders are selected from the group consisting of: starches, polysaccharides, pectins, celluloses, cellulose derivatives such as carboxymethylcellulose, and alginates.

[0080] In some embodiments, the amount of binder used to adhere the particles making up the agglomerate to one another is from about 1 to about 30% by weight based on the weight of the total agglomerate. In some embodiments, the amount of binder used is up to about 20%, up to about 15%, up to about 10%, up to about 5% by weight of the total agglomerate.

[0081] In some embodiments, it is desirable to include as little binder as possible. For example, the agglomerate may comprise from 0.1 to 10% by weight binder. In some embodiments, no more than about 7 wt %, 6 wt %, 5 wt %, 4 wt %, 3 wt %, or 2 wt % binder is included in an agglomerate. In some embodiments, an agglomerate comprises one or more binder in a total amount of from about 2 to about 5 wt %.

[0082] When forming the agglomerates described herein, the particles of aerosol-generated material and any addition components are mixed with any binder or aerosol-former material to be included. The binder or aerosol-former material may be added to the other components before or during mixing. In some embodiments, the mixing process and/or the nature of the components is sufficient form a stable agglomerate.

[0083] In some embodiments, the mixture may be subjected to a compressive force to help bond the particles together and to enhance the stability of the agglomerate. However, this compression needs to be such that the high surface area of the agglomerate is retained, and so it should not result in the total removal of gaps and passages between the constituent particles.

[0084] Simple mixing may generally result in agglomerates of a generally spherical shape. In some embodiments, the mixture may be shaped or moulded to provide an agglomerate with a desired shape.

[0085] In some embodiments, the agglomerate is formed and then allowed to dry or cure, in order to strengthen the bonding between the particles.

Moisture Protection

[0086] In some embodiments, the composition further includes a material to prevent or reduce the absorption of moisture by the dried aerosol-generating material.

[0087] In some embodiments, the hygroscopic aerosol-generating material has a moisture content of no greater than about 10% or no greater than about 5% (calculated on a wet weight basis), as measured by gas chromatography-thermal conductivity detector (GC-TCD) or Karl Fischer titration. This moisture content is stable, meaning that the moisture content of the aerosol-generating material is within this range not only when it is first prepared, but also after incorporation into an aerosol-generating article and following transport and storage. This stable moisture content is observed despite the fact that the hygroscopic aerosol-generating material would rapidly absorb moisture if exposed to the environment, even under "normal" humidity conditions. Indeed, when the aerosol-generating material is described as hygroscopic, this means that it will rapidly absorb water from the surrounding environment to significantly increase its water content. For example, upon exposure of the uncoated aerosol-generating material to the environment (for example, upon storage in an open container or the like), the moisture content rapidly increases to above 20% or above 25% (calculated on a wet weight basis), as measured by gas chromatography-thermal conductivity detector (GC-TCD) or Karl Fischer titration.

[0088] In some embodiments, the compositions disclosed herein further comprise a moisture impermeable coating surrounding the agglomerated aerosol-generating material. This coating creates a moisture impermeable barrier around the dried-aerosol generating material.

[0089] The physical and chemical properties of the coating materials are important. In addition to forming a moisture impermeable coating, the coating also needs to remain stable and in place during the period between manufacture and use by the consumer. In some embodiments, it is desirable for the moisture impermeable coating to become permeable when the aerosol-generating material is heated to generate an aerosol. This is necessary to ensure that the aerosol can be released. In some embodiments, the coating is rendered permeable by melting or other decomposition of the coating material or at least part of the coating.

[0090] In some embodiments, the decomposition of the coating involves the coating losing its physical integrity so that it no longer forms a barrier around the aerosol-generating material. This may, for example, involve the coating melting, crumbling, disintegrating or otherwise breaking down.

[0091] Once a coating material is heated to its melting point, it can be expected that the integrity of the moisture impermeable coating may be compromised. The coating materials should therefore be selected so that the moisture impermeable coatings remain intact when exposed to normal environmental temperatures. Therefore, in some embodiments, the coating materials used should be ones that form moisture impermeable coatings that are stable at temperatures below 40 or 50° C. In some embodiments, it may be desirable to select a coating material that will form a moisture impermeable coating that remains intact during more extreme temperatures that may be encountered during storage and transport, such as those of 60 to 80° C.

[0092] In some embodiments, the moisture impermeable coating may become permeable when the temperature is

raised to about 100 to 110° C., so as to avoid superheating any moisture present in the coated aerosol-generating material. In some embodiments, the coating opens rapidly upon heating to form an aerosol. This will reduce the likelihood of the coating interfering with the volatilisation and the release of the resultant gas or vapour.

[0093] In some embodiments, the temperature at which the moisture impermeable coating becomes permeable, for example as a result of decomposition, is at least about 50° C., at least about 60° C., at least about 70° C. at least about 80° C., at least about 90° C., at least about 100° C., at least about 110° C., at least about 120° C. at least about 130° C., at least about 140° C., at least about 150° C., at least about 160° C., at least about 170° C., at least about 180° C., at least about 190° C. or at least about 200° C.

[0094] Additionally or alternatively, the temperature at which the moisture impermeable coating becomes permeable, for example as a result of decomposition, is no more than about 280° C., no more than about 270° C., no more than about 260° C., no more than about 250° C., no more than about 240° C., no more than about 230° C., no more than about 220° C., no more than about 210° C. or no more than 200° C., no more than about 190° C., no more than about 180° C., no more than about 170° C., no more than about 160° C., no more than about 150° C., no more than about 140° C., no more than about 130° C., no more than about 120° C., no more than about 110° C., or no more than about 100° C.

[0095] In some embodiments, the moisture impermeable coating comprises one or more materials selected from: a polysaccharide or cellulosic material, or a derivative thereof; a gum; a protein material; a polyol matrix material; a wax; a wax ester; and a polymer.

[0096] Suitable polysaccharides include, for example, agar, agarose, pectin, furoidan, furcellan, alginates, carrageenans, starches, dextrans, maltodextrins and cyclodextrins.

[0097] Suitable cellulosic materials include, for example, methyl cellulose, ethyl cellulose, hydroxypropyl cellulose, carboxymethyl cellulose, hydroxypropyl methylcellulose (HPMC), hydroxyethyl cellulose (HEC), cellulose acetate butyrate (CAB); cellulose acetate phthalate (CAP), cellulose acetate trimellitate (CAT) and cellulose acetate succinate (CAS), and cellulose ethers. Suitable modified starches include, for example, high-amylose starches, hydroxypropylated starches, octenyl succinate modified starches, starch esters, and starch-based polyelectrolyte complexes (SPECs). Suitable gums include, for example, gum arabic (acacia gum), guar gum, gum karaya, gum tragacanth, gum ghatti, quince seed gum, locust bean gum and xanthan gum. Suitable proteins include zein and gelatin. Suitable polyol matrixes may be formed from polyvinyl alcohol. Suitable waxes include, for example, palmitic acid, carnauba wax, beeswax, candelilla wax, and paraffin wax. Suitable wax esters include, for example, cetyl palmitate and triacontanyl palmitate. Suitable polymers include, for example, shellac, lignin, polyvinyl alcohol, polyurethane, polymerised, hydrolysed ethylene vinyl acetate, a polyester, a polycarbonate, a polymethacrylate, a polyglycol, polyethylene, polystyrene, polypropylene, and polyvinyl chloride. Suitable co-polymers include, for example, methacrylic acid copolymers, and acrylic acid copolymers.

[0098] In some embodiments, the coating material comprises additives that are released upon heating the composition and which therefore contribute to the generated aerosol. For example, the coating material may comprise an active substance, including one or more of the active substances described elsewhere herein. Additionally or alternatively, the coating material may comprise a flavour, including one or more of the flavours and flavourants described elsewhere herein. In some embodiments, the flavour added to the coating is a hydrophobic flavour. This may mean that the flavour further enhances the moisture-impermeability of the coating.

[0099] As the intention of the coating is to prevent or retard the adsorption of moisture by the aerosol-generating material, in some embodiments the moisture impermeable coating completely encapsulates the aerosol-generating material. An incomplete coating may sufficiently retard the absorption of moisture to provide some benefit, but in preferred embodiments, the coating should cover at least 80%, at least 90%, at least 95% or at least 99% of the surface area of the aerosol-generating material.

[0100] In some embodiments, the moisture impermeable coating prevents the dried aerosol-generating material absorbing any moisture from the surrounding environment.

[0101] Ideally, the coating will be thick enough to confer the desired moisture impermeability. The thickness of the coating may, in some embodiments, further influence the temperature at which the coating becomes permeable and allow volatile components generated by heating the dried aerosol-generating material to be released from the composition.

[0102] The thickness of the coating may also, in some embodiments, influence the rate at which the coating becomes permeable once exposed to the temperature of decomposition. This may allow the rate of release of the volatile components from the heated aerosol-generating material to be controlled.

[0103] In some embodiments, the moisture impermeable coating has a thickness of from about 1 μm to about 100 μm.

[0104] In some embodiments, the thickness of the coating is at least about 1 μm, at least about 5 μm, at least about 10 μm, at least about 15 μm, at least about 20 μm, at least about 25 μm, at least about 30 μm, at least about 35 μm or at least about 40 μm. Additionally or alternatively, the thickness of the coating is up to about 100 μm, up to about 90 μm, up to about 80 μm, up to about 75 μm, up to about 70 μm, up to about 65 μm, up to about 60 μm, up to about 55 μm, up to about 50 μm, up to about 45 μm or up to about 40 μm. In some embodiments, the thickness of the coating is from about 5 to about 50 μm.

[0105] For some materials, the minimum thickness of the coating may be dictated by the thickness required to ensure that the coating is moisture impermeable or sufficiently moisture impermeable to protect the surrounded aerosol-generating material. For some materials, the maximum thickness of the coating may be dictated by the time required to ensure that the coating is opened to enough of an extent to allow the vapour or aerosol generating by the heating of the aerosol-generating material to be generated and released. For this reason, in some embodiments, thicker coatings may be less preferred.

[0106] In some embodiments, the thickness of the moisture-impermeable coating applied to a particle or portion of aerosol-generating material may be substantially uniform, for example, varying by no more than 20%, 15%, 10% or no more than 5%.

[0107] In other embodiments, the thickness of the moisture-impermeable coating applied to a particle or portion of aerosol-generating material may vary by as much as 50% or more. In some embodiments, this will result in a coating which does not decompose in a uniform manner. For example, areas where the coating is thinner may tend to decompose faster. This may help to provide a more gradual and sustained release of the aerosol generated by heating the particle or portion of aerosol-generating material.

[0108] In some embodiments, the composition comprises a plurality of agglomerates each coated with the same material. Additionally or alternatively, the composition comprises a plurality of agglomerates each coated with the same thickness of coating.

[0109] In other embodiments, the composition comprises a plurality of agglomerates including at least two agglomerates coated with different coating materials. Additionally or alternatively, the composition comprises a plurality of agglomerates including at least two agglomerates with coatings of different thicknesses.

[0110] In order to control the release of the volatiles from the aerosol generating material upon heating, in some embodiments the coatings of different agglomerates of the aerosol-generating material may decompose at different temperatures or at different rates to control the release of volatile components generated by heating the dried aerosol-generating material.

[0111] In some embodiments, extended and controlled release of the volatile components may be achieved by the composition comprising discrete agglomerates of the dried aerosol-generating material that are surrounded by coatings of different thickness.

[0112] Alternatively or in addition, extended and controlled release of the volatile components may be achieved by the composition comprising discrete agglomerates of the dried aerosol-generating material are surrounded by coatings of different coating materials.

[0113] Thus, the compositions disclosed herein may be formulated with a coating to provide a predictable and consistent release of active and/or flavour components upon heating and over the course of a heating session. This means that the aerosol generating system can reliably provide a consistent aerosol, irrespective of the length of time the composition has been stored or the conditions under which it has been stored prior to use.

[0114] In some embodiments, the agglomerate comprising the aerosol-generating material has the desired particle size and shape before the moisture-impermeable coating is applied.

[0115] In some embodiments, the agglomerate comprising the aerosol-generating material has a size of from about 1 mm to about 20 mm (as measured by sieving), and optionally a size from about 1 mm to about 4 mm.

[0116] The coating may be applied to the agglomerated aerosol generating material using any conventional coating process. For example, the aerosol generating material may be coated by a fluidised bed coating process, by spray coating, gaseous aerosolised coating, tumbling (or rumble) coating in a rotary drum or immersion in a bath of the coating material.

[0117] In some embodiments, the coating is applied directly onto the surface of the aerosol-generating material. The coating may be applied to the surface of the agglomerate, or to the surface of the particles making up the agglomerate (i.e. it is applied to these particles before they are agglomerated).

[0118] In some embodiments, the coating is applied to the surface of the aerosol-generating material in the form of a powder. In such embodiments, the average particle size of the coating powder is from about 100 nm to about 50 μm. In some embodiments, the average particle size of the coating powder is at least about 100 nm, at least about 200 nm, at least about 300 nm, at least about 400 nm, at least about 500 nm, at least about 600 nm, at least about 700 nm, at least about 800 nm, at least about 900 nm, at least about 1 μm, at least about 2 μm, at least about 3 μm, at least about 4 μm, at least about 5 μm, at least about 10 μm, at least about 15 μm, at least about 20 μm, at least about 25 μm, at least about 30 μm, at least about 35 μm, or at least about 40 μm.

[0119] Additionally or alternatively, the average particle size of the coating powder is no more than about 50 μm, no more than about 45 μm, no more than about 40 μm, no more than about 35 μm, no more than about 30 μm, no more than about 25 μm, no more than about 20 μm, no more than about 15 μm, no more than about 10 μm, no more than about 5 μm, no more than about 4 μm, no more than about 3 μm, no more than about 2 μm, or no more than about 1 μm.

[0120] In some embodiments, the coating adheres to the surface of the aerosol-generating material by virtue of inter-particle forces, such as Van der Waals forces. In some embodiments, the surface of the aerosol-generating material is tacky and so particles of coating material readily adhere to the surface to form a complete or substantially complete coating. The tackiness of the aerosol-generating material may be adjusted by adjusting the moisture content of the aerosol-generating material at the time when the coating is applied.

[0121] In some embodiments, the moisture impermeable coating is formed as part of the spray-drying or freeze-drying step. For example, the moisture impermeable coating forming material may be included in the precursor material and forms a coating as the precursor material is dried. This may require the aerosol-generating material and coating material to have chemical properties that ensure that the coating material migrates to the surface of the dried material so that it surrounds the dried aerosol-generating material. For example, in some embodiments, the coating material is an apolar and/or hydrophobic material that may be included in the precursor material to be dried. Once these coated particles are formed by the drying step, they can be agglomerated.

[0122] As discussed above, the moisture-impermeable coating has the benefit of protecting the aerosol-generating material from moisture and the negative effects this can have in the material and the aerosol generated when it is heated. The coating can also, as mentioned control the release of the aerosol generated by heating the aerosol-generating material. In addition, there are other benefits provided by the coatings described herein. The aerosol-generating material may be tacky or sticky. This can make the material difficult to process and handle. The coating applied to the surface of the aerosol-generating material masks this tackiness, rendering the composition more readily processed and handled. The coating may also enhance the structural integrity of the aerosol-generating material. The coating gives the particle or portions of aerosol-generating material additional support

and strength, reducing the tendency for it to break and form dust that can be detrimental to the products and machinery used to make them.

[0123] In an alternative or additional approach to protecting the aerosol-generating material from moisture, the compositions described herein include a sorbent material. This sorbent material is intended to absorb or adsorb moisture from the environment, thus reducing the exposure of the aerosol-generating material to moisture, thus reducing the absorption of moisture by the aerosol-generating material prior to its use.

[0124] The competition between the aerosol-generating material and the sorbent material for moisture means that the amount of moisture absorbed by the aerosol-generating material is reduced. The greater the affinity of the sorbent material for water, the greater the amount or moisture the sorbent will adsorb or absorb, and the smaller the amount of moisture that is available for the aerosol-generating material to absorb.

[0125] In some embodiments, the sorbent material is more hygroscopic than the aerosol-generating material. For example, the Dynamic Vapour Sorption (DVS) is a gravimetric technique that may be used to measure how quickly a sample of a material absorbs water by varying the vapour concentration surrounding the sample and measuring the change in mass which this produces. DVS may be used to measure of the rate of water uptake of both the sorbent material and the aerosol-generating material. In preferred embodiments, the rate of water uptake of the sorbent material preferably being greater than that of the aerosol-generating material.

[0126] In particular, the rate of water uptake of the sorbent material is preferably greater than that of the aerosol-generating material at or above about 20% RH, above about 30% RH, above about 40% RH or above about 50% RH.

[0127] In some embodiments, the sorbent material not only absorbs or adsorbs moisture, but will also prevent the release of this water (as vapour) in a manner that may interfere with the desired aerosol being generated by heating the aerosol-generating material. Therefore, in some embodiments, the sorbent holds onto the captured moisture whilst the aerosol-generating material is heated to form an aerosol. Thus, in some embodiments, the sorbent material holds the absorbed or adsorbed moisture at a temperature of up to about 200° C., about 250° C., about 300° C., up to about 325° C., or up to about 350° C. In other embodiments, the sorbent releases the water at a temperature of from about 100° C. to about 150° C., so that it releases the water at a temperature below that at which the first puff of aerosol for inhalation by the consumer will be generated.

[0128] In some embodiments, the sorbent material is a desiccant.

[0129] Suitable sorbent materials may comprise one or more selected from the group consisting of: silica gel, molecular sieves, activated carbon, zeolites, sodium acrylic acid, and simple salts, carbonates and hydroxides, such as alkaline earth metal or alkali metal salts, carbonates and hydrides, for example calcium chloride, sodium chloride, magnesium sulphate, potassium carbonate and sodium hydroxide. These sorbent materials are suitable for inclusion in a composition that is to be heated to generate an aerosol for inhalation by a consumer. In some embodiments, the sorbent material is stable at the temperatures to which it is exposed when the composition is heated to generate an aerosol. Thus, in such embodiments, the sorbent does not decompose, melt or otherwise disintegrate when exposed to elevated temperatures during use of the compositions.

[0130] In some embodiments, the composition comprises the sorbent material on the surface of the agglomerated aerosol-generating material. For example, the sorbent material may form a partial or incomplete coating surrounding the agglomerate. The partial or incomplete coating means that the aerosol generated by heating the aerosol-generating material can be released from the composition and is available for inhalation. In some embodiments, the partial coating is in the form or a permeable network. This ensures that the sorbent is present on the surface of the agglomerated aerosol-generating material, but that it does not prevent the volatiles generated by heating the aerosol-generating material being released.

[0131] Where the sorbent material swell as it absorbs moisture, it is desirable for the coating to such that it does not become a complete coating as a result of the swelling of the sorbent material. In some embodiments, therefore, it is desirable for the coating of sorbent to be sufficiently incomplete to ensure that the aerosol-generating material is exposed and cannot be eventually completely surrounded by the sorbent material.

[0132] In some embodiments, the composition comprises sorbent material in the form of particles. These particles may, for example, be included with particles of the aerosol-generating material in the agglomerate. In some embodiments, the particles of sorbent and the particles of aerosol-generating material are homogenously mixed within the agglomerate. In other embodiments, the particles of sorbent are not included in the agglomerated aerosol-generating material. In some embodiments, the sorbent particles may be concentrated in one or more locations to increase their exposure to ambient moisture. This may mean that the moisture is more likely to be absorbed or adsorbed by the sorbent material than by the aerosol-generating material.

[0133] In some embodiments, the composition comprises one or more sorbent particles or granules. In some embodiments, the sorbent particles have an average size of at least about 50 nm, at least about 100 nm, at least about 200 nm, at least about 500 nm, at least about 1 μm, at least about 10 μm, at least about 50 μm, at least about 100 μm, at least about 200 μm, at least about 500 μm, at least about 600 μm, at least about 700 μm, at least about 800 μm, at least about 900 μm, or at least about 1 mm.

[0134] Additionally or alternatively, the sorbent particles have an average size of no more than about 3 mm, no more than about 2.5 mm, no more than about 2 mm, no more than about 1.5 mm, no more than about 1 mm, no more than about 900 μm, no more than about 800 μm, no more than about 700 μm, no more than about 600 μm, or no more than about 500 μm.

[0135] In some embodiments, the composition comprises an agglomerate formed from one or more particles of aerosol-generating material and one or more particles of a sorbent material. Optionally, the sorbent may be present on or at the surface of the agglomerate, or the sorbent may be more concentrated at the surface. In some embodiments, the agglomerates of aerosol-generating material and sorbent material have an average size from about 3 mm to about 20 mm.

[0136] In some embodiments, the amount of sorbent material included in the composition is at least about 5% based

on the total weight of the composition, at least about 10%, at least about 15%, at least about 20%, at least about 25% or at least about 30%. Alternatively or additionally, the amount of sorbent material included in the composition is no more than about 50% based on the total weight of the composition, no more than about 45%, no more than about 40%, no more than about 35%, no more than about 30%, no more than about 25% or no more than about 20%.

[0137] In some embodiments, the amount of sorbent included is from about 5 to about 40% by weight of the composition, or from about 10 to 30% by weight of the composition.

[0138] The amount of the sorbent to be included may be limited by the potential swelling of the sorbent material as it absorbs moisture. This increase in size of the sorbent will increase the volume of the composition comprising the aerosol-generating material and sorbent material. In extreme circumstances, where large amounts of sorbent are included in the composition and in an environment with a high level of moisture, the expansion of the sorbent may cause issues such as the consumable no longer fitting onto the aerosol-provision device, or the airflow through the composition being reduced and the release of the aerosol being compromised.

The Dried Aerosol-Generating Material

[0139] The aerosol-generating material comprises a dried extract from a flavour- and/or active-containing plant material. In some embodiments, the aerosol-generating material further comprises an aerosol-former material.

[0140] In some embodiments, the aerosol-generating material is formed by drying a precursor material comprising an extract from a flavour- and/or active-containing plant material.

[0141] The drying process is selected to retain the desired components of the precursor material and, therefore, the aerosol-generating material may comprise one or more active substances and/or flavours.

[0142] In some embodiments, the precursor material further comprises one or more aerosol-former material. Additionally or alternatively, one or more aerosol-former materials may be added to the dried precursor material to provide an aerosol-generating material with the desired aerosol-former material content.

[0143] The precursor material and/or the dried aerosol-generating material may also optionally include one or more other functional materials.

[0144] Therefore, the aerosol-generating material may comprise one or more active substances and/or flavours, and, optionally, one or more aerosol-former materials. The precursor material and/or the dried aerosol-generating material may also optionally include one or more other functional materials.

[0145] The invention enjoys the advantage of an aerosol-generating material that is formulated to have an increased shelf life and so it may be easily transported and stored. Without wishing to be bound by any particular theory, it is hypothesised that the low water content of the dried aerosol-generating material reduces evaporation over time of other solvents, and reduces degradation of nicotine and/or other volatile compounds. A low water content also inhibits microbial growth. The compositions comprising the dried aerosol-generating materials described herein are stable at a range of temperatures and humidities and have an increased shelf-life, and are therefore easy to store and transport. In some embodiments, the compositions may be stored at temperatures in the range of 0-35° C. In some embodiments, the compositions may be stored at a relative humidity of up to about 50%, prior to use.

[0146] The aerosol-generating materials also have the advantage of having a high concentration of the desired components. This means that relatively small amounts of the aerosol-generating material are required and less energy is required to heat and release the desired components. Significantly, the aerosols generated from these materials also provide an authentic tobacco taste of reasonable strength.

[0147] A further advantage of the aerosol-generating materials is that they may be used as a solid aerosol-generating substrate in Hybrid systems or Tobacco Heating Products (THPs). This makes the invention versatile enough to be used in a range of products without the need for further processing.

[0148] In some embodiments, the extract from a flavour- or active-substance containing plant material is an extract derived by contacting the plant material with a suitable solvent, such as an aqueous solvent or an alcohol such as ethanol. The liquid portion comprising the solvent and any dissolved plant components may then be separated or partially separated from the remaining solid plant material to provide the extract to be included in the precursor composition and dried.

[0149] In some embodiments, the extract from a flavour- or active-substance containing plant material is an extract derived from tobacco material.

[0150] The tobacco extract or material may be from or may be any type of tobacco and any part of the tobacco plant, including tobacco lamina, stem, stalk, ribs, scraps and shorts or mixtures of two or more thereof. Suitable tobacco extracts or materials include the following types: Virginia or flue-cured tobacco, Burley tobacco, Oriental tobacco, or blends of tobacco materials, optionally including those listed here. The tobacco may be expanded, such as dry-ice expanded tobacco (DIET), or processed by any other means. In some embodiments, the tobacco material may be reconstituted tobacco material. The tobacco may be pre-processed or unprocessed, and may be, for instance, solid stems (SS); shredded dried stems (SDS); steam treated stems (STS); or any combination thereof. The tobacco material may be fermented, cured, uncured, toasted, or otherwise pre-treated. The tobacco material may be provided in the form of cut rag tobacco. The cut rag tobacco can have a cut width of at least 15 cuts per inch (about 5.9 cuts per cm, equivalent to a cut width of about 1.7 mm) for example. The cut rag tobacco can be formed from a mixture of forms of tobacco material, for instance a mixture of one or more of paper reconstituted tobacco, leaf tobacco, extruded tobacco and bandcast tobacco.

[0151] The precursor material which is dried to form the aerosol-generating material may comprise at least about 10 wt %, at least about 15 wt %, at least about 20 wt %, at least about 25 wt %, at least about 30 wt %, at least about 35 wt %, or at least about 40 wt % tobacco solids (calculated on a wet weight basis). Additionally or alternatively, the precursor material may comprise up to about 60 wt %, up to about 55 wt %, up to about 50 wt %, up to about 45 wt %, or up to about 40 wt % tobacco solids (calculated on a wet weight basis). In some embodiments, the precursor material

comprises from about 20 wt % to about 40 wt % tobacco solids (calculated on a wet weight basis).

[0152] In some embodiments, the precursor material comprises at least about 10 wt %, about 20 wt %, at least about 30 wt %, at least about 40 wt %, at least about 50 wt %, at least about 60 wt %, at least about 70 wt %, at least about 80 wt %, or at least about 90 wt % extract from a tobacco or other flavour- or active-substance containing plant material (calculated on a wet weight basis). Alternatively or additionally, precursor material may comprise up to about 99 wt %, up to about 90 wt %, up to about 80 wt %, up to about 70 wt % or up to about 60 wt % extract from tobacco or other flavour- or active-substance containing plant material (calculated on a wet weight basis). In some embodiments, the precursor material comprises around 50 wt % tobacco extract (calculated on a wet weight basis).

[0153] In some embodiments, the aerosol-generating material may comprise at least about 45 wt %, at least about 50 wt %, at least about 60 wt %, at least about 70 wt %, at least about 80 wt %, at least about 90 wt %, or at least about 95 wt % tobacco material or tobacco extract, or flavour- or active-substance containing plant material extract (calculated on a dry weight basis). In some embodiments, the aerosol-generating material may comprise about 60 to about 80 wt % tobacco extract (calculated on a dry weight basis).

[0154] In some embodiments, the dried aerosol-generating material may comprise from about 2 wt % to about 10 wt % of nicotine, or from about 3 to about 6 wt % of nicotine (calculated on a dry weight basis).

[0155] In some embodiments, the precursor material comprises around 50 v/v % tobacco extract. Where the precursor material comprises around 50 v/v % tobacco extract and the tobacco extract has a tobacco solid content of between about 55 and about 60 v/v %, the overall tobacco solid content of the precursor material is from about 27.5 to about 30 v/v %.

[0156] In some embodiments, the tobacco extract has a solids content of between about 40 and about 65 wt %, between about 45 and about 65 wt %, or between about 40 and about 60 wt % (calculated on a wet weight basis). In some embodiments, the water content of the tobacco extract is between about 35 wt % and about 65 wt %, or between about 35 and about 55 wt % (calculated on a wet weight basis). In some embodiments, the nicotine content of the tobacco extract is between about 1 wt % and about 5 wt % (calculated on a wet weight basis).

[0157] In some embodiments, the dried aerosol-generating material may comprise at least about 45 wt %, at least about 50 wt %, at least about 60 wt %, at least about 70 wt %, at least about 80 wt %, at least about 90 wt %, or at least about 95 wt % tobacco solids (calculated on a dry weight basis). Additionally or alternatively, the aerosol-generating material may comprise up to about 99 wt %, up to about 98 wt %, up to about 95 wt %, up to about 90 wt % or up to about 80 wt %. In some embodiments, the dried aerosol-generating material may comprise about 60 to about 80 wt % tobacco solids (calculated on a dry weight basis).

[0158] In some embodiments, the tobacco extract is an aqueous tobacco extract. In some embodiments, the tobacco extract may be concentrated and subsequently diluted before being added to the precursor material and dried. In other embodiments, the tobacco extract is not concentrated and may be used directly in the precursor material.

[0159] The precursor material may be in the form of a slurry, a suspension, a gel, a liquid or a solid, but in some embodiments which may be preferred, it is in the form of a suspension or liquid. In some embodiments, particles of solid material may be removed from the extract and/or from the precursor material by filtration and/or centrifugation.

[0160] In some embodiments, it may be desirable for any particles in the precursor composition to have an average particle size of no greater than about 3 mm, of no greater than 1 mm, of no greater than about 0.5 mm, or to have an average particle size of no greater than about 0.3 mm, when measured by sieving or by observing the size of the particles by SEM.

[0161] The water content of the precursor material may be at least about 20 wt %, at least about 30 wt %, at least about 40 wt %, at least about 50 wt %, at least about 60 wt %, at least about 70 wt %, at least about 80 wt %, or at least about 90 wt % on a wet weight basis. Alternatively or additionally, the water content of the precursor material may be up to about 95 wt %, up to about 90 wt %, up to about 85 wt %, up to about 80 wt %, up to about 75 wt %, up to about 70 wt %, up to about 65 wt %, up to about 60 wt %, up to about 55 wt % or up to about 50 wt % on a wet weight basis. In some embodiments, the water content of the precursor material is between about 40 and about 50 wt % on a wet weight basis (50% and 60 v/v %). When the precursor material has a lower water content, the spray/freeze-drying process is quicker, as there is less water to remove.

[0162] In some embodiments, the dried aerosol-generating material and/or the precursor material comprises one or more active substance. This may be derived from the extract or it may be added. In some embodiments, the extract from a flavour- or active-substance containing plant material comprises an active substance.

[0163] The active substance may be a physiologically active material, which is a material intended to achieve or enhance a physiological response. The active substance may for example be selected from nutraceuticals, nootropics and psychoactives. The active substance may comprise, for example, nicotine, caffeine, taurine, theine, vitamins such as B6 or B12 or C, melatonin, cannabinoids, or constituents, derivatives, or combinations thereof. The active substance may comprise one or more constituents, derivatives or extracts of tobacco, cannabis or another botanical.

[0164] In some embodiments, the active substance comprises nicotine. In some embodiments, the active substance comprises caffeine, melatonin or vitamin B12.

[0165] In some embodiments, the precursor material may comprise an extract from other botanical source(s) along with or instead of the tobacco extract.

[0166] As noted herein, the extract may comprise or be derived from one or more botanicals or constituents, derivatives or extracts thereof. As used herein, the term "botanical" includes any material derived from plants including, but not limited to, extracts, leaves, bark, fibres, stems, roots, seeds, flowers, fruits, pollen, husk, shells or the like. The extract may comprise or be derived from botanicals in the form of liquid, gas, solid, powder, dust, crushed particles, granules, pellets, shreds, strips, sheets, or the like.

[0167] Example botanicals are tobacco, eucalyptus, star anise, hemp, cocoa, cannabis, fennel, lemongrass, peppermint, spearmint, rooibos, chamomile, flax, ginger, *Ginkgo biloba*, hazel, hibiscus, laurel, licorice (liquorice), matcha, mate, orange skin, papaya, rose, sage, tea such as green tea or black tea, thyme, clove, cinnamon, coffee, aniseed (anise), basil, bay leaves, cardamom, coriander, cumin, nutmeg,

oregano, paprika, rosemary, saffron, lavender, lemon peel, mint, juniper, elderflower, vanilla, wintergreen, beefsteak plant, curcuma, turmeric, sandalwood, cilantro, bergamot, orange blossom, myrtle, cassis, valerian, pimento, mace, damien, marjoram, olive, lemon balm, lemon basil, chive, carvi, verbena, tarragon, geranium, mulberry, ginseng, theanine, theacrine, maca, ashwagandha, damiana, guarana, chlorophyll, baobab or any combination thereof. The mint may be chosen from the following mint varieties: *Mentha arventis, Mentha* c.v., *Mentha niliaca, Mentha piperita, Mentha piperita citrata* c.v., *Mentha piperita* c.v., *Mentha spicata crispa, Mentha cardifolia, Mentha longifolia, Mentha suaveolens variegata, Mentha pulegium, Mentha spicata* c.v. and *Mentha suaveolens*.

[0168] In some embodiments, the extract comprises or is derived from one or more botanicals or constituents, derivatives or extracts thereof selected from eucalyptus, star anise, cocoa and hemp.

[0169] In some embodiments, the extract comprises or is derived from one or more botanicals or constituents, derivatives or extracts thereof selected from rooibos and fennel.

[0170] In some embodiments, the aerosol-generating material and/or the precursor material comprises one or more cannabinoid compounds 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) and cannabielsoin (CBE), cannabicitran (CBT).

[0171] The aerosol-generating material and/or the precursor material may comprise one or more cannabinoid compounds selected from the group consisting of cannabidiol (CBD) and THC (tetrahydrocannabinol).

[0172] The aerosol-generating material and/or the precursor material may comprise cannabidiol (CBD).

[0173] The aerosol-generating material and/or the precursor material may comprise nicotine and cannabidiol (CBD).

[0174] The aerosol-generating material and/or the precursor material may comprise nicotine, cannabidiol (CBD), and THC (tetrahydrocannabinol).

[0175] In some embodiment, the aerosol-generating material further comprises an aerosol-former material. In some embodiments, this aerosol-former material is included in the precursor material.

[0176] The aerosol-former material may comprise one or more constituents capable of forming an aerosol. The aerosol-former may be, for instance, a polyol aerosol generator or a non-polyol aerosol generator. It may be a solid or liquid at room temperature, but preferably is a liquid at room temperature.

[0177] In some embodiments, the aerosol-former material may comprise one or more of glycerine, glycerol, propylene glycol, diethylene glycol, triethylene glycol, tetraethylene glycol, 1,3-butylene glycol, erythritol, meso-Erythritol, ethyl vanillate, ethyl laurate, a diethyl suberate, triethyl citrate, triacetin, a diacetin mixture, benzyl benzoate, benzyl phenyl acetate, tributyrin, lauryl acetate, lauric acid, myristic acid, and propylene carbonate.

[0178] In some embodiments, the aerosol former comprises one or more polyhydric alcohols, such as propylene glycol, triethylene glycol, 1,3-butanediol and glycerin; esters of polyhydric alcohols, such as glycerol mono-, di- or triacetate; and/or aliphatic esters of mono-, di- or polycarboxylic acids, such as dimethyl dodecanedioate and dimethyl tetradecanedioate. In some embodiments, the aerosol-former material comprises one or more compounds selected from erythritol, propylene glycol, glycerol, vegetable glycerine (VG), triacetin, sorbitol and xylitol.

[0179] In some embodiments, the aerosol-former material comprises, consists essentially of or consists of glycerol. Glycerol provides a visible aerosol when the aerosol-generation device is used. It is common that consumers like the aerosol generating device to provide a visible aerosol, as this enables the consumer to visualise the product and what they are consuming. This makes glycerol a desirable choice for aerosol former material. Propylene glycol has the benefit that it is a better flavour carrier than glycerol.

[0180] A combination of two or more aerosol forming agents may be used, in equal or differing proportions.

[0181] In some embodiments, the precursor material comprises at least about 1 wt %, at least about 5 wt %, at least about 10 wt %, or at least about 20 wt % aerosol-former material (calculated on a wet weight basis). Additionally or alternatively, the precursor material may comprise up to about 40 wt %, up to about 35, up to about 30 wt %, up to about 25 wt %, up to about 20 wt %, or up to about 10 wt % aerosol-former material (calculated on a wet weight basis).

[0182] In embodiments of the invention in which the aerosol-former material is glycerol, the precursor material may comprise at most 36 wt % of glycerol. The inventors have demonstrated that dry weight inclusion levels up to 36 wt % (calculated on a dry weight basis) of aerosol-former material are possible.

[0183] The amount of glycerol in the precursor material, and therefore the dried aerosol material, is important because it is both an aerosol-forming material and also a plasticizer. If the concentration of glycerol it too high, it may be detrimental to a critical temperature of the product during the freeze-drying process and may result in collapse of the product if the critical temperature of the formulation is exceeded. On the other hand, sufficient glycerol should be included to provide the consumer with an adequate and pleasing aerosol.

[0184] As glycerol and some other aerosol-former materials are considered to have anti-freeze properties, it is particularly surprising that it is possible to freeze-dry a precursor material comprising such materials. Nevertheless, the inventors have discovered that precursor materials comprising glycerol may be freeze dried to form a highly useful aerosol-generating material.

[0185] In some embodiments, the dried aerosol-generating material may comprise at least about 1 wt %, at least about 5 wt %, at least about 10 wt %, at least about 20 wt %, at least about 30 wt %, or at least about 40 wt % aerosol-former material (calculated on a dry weight basis).

[0186] In some embodiments, the dried aerosol-generating material may comprise from about 1 to about 34 wt %, or from about 17 to about 34 wt % aerosol-former material (calculated on a dry weight basis). In some embodiments in which the aerosol-former material is glycerol, the dried aerosol-generating material may comprise from about 13 to about 34 wt % glycerol (calculated on a dry weight basis).

[0187] In embodiments in which Burley tobacco is used, the aerosol-generating material may comprise from about 17

to about 36 wt % of glycerol. The amount of glycerol in the aerosol material is important because it is both an aerosol-forming material and a plasticizer. If the concentration of glycerol is too high, it may be detrimental to the critical temperature of the product during the freeze-drying process and may result in collapse of the product if a critical temperature of the formulation is exceeded. On the other hand, sufficient glycerol should be included to provide the consumer with an adequate and pleasing aerosol.

[0188] In some embodiments, the aerosol-generating material and/or the precursor material further comprises one or more excipients. In some embodiments, the excipient stabilises and preserves the precursor material and the inventors have found the inclusion of an excipient especially important for stability when the precursor material comprised glycerol as the aerosol-forming material. The excipient may also act as a bulking agent or a filler material. In some embodiments, the inclusion of an excipient may also improve the handleability of the dried aerosol-generating material, helping it to retain its granular form by helping to reduce moisture uptake and the resulting increase in tackiness of the material. The presence of an excipient may also have an effect on the speed of (freeze) drying.

[0189] Suitable excipients include mannitol, sucrose, trehalose, lactose, sorbitol, raffinose, maltose, dextrans such as Dextran 10, Dextran 70, Dextran 90, maltodextrin, gelatin, agar, cyclodextrins, and polyethylene glycols such as PEG 2000-6000, and polyvinylpyrrolidone (PVP 10).

[0190] In some embodiments, the aerosol-generating material and/or the precursor material comprises one or more excipients in an amount of from about 0 to about 40 wt % on a wet weight basis. In some embodiments, the precursor material may comprise at least about 1 wt %, at least about 10 wt %, at least about 20 wt %, at least about 30 wt %, and/or up to about 40 wt %, up to about 30%, up to about 20 wt %, or up to about 10 wt % excipient on a wet weight basis.

[0191] In some embodiments, the aerosol-generating material may comprise at least about 0.1 wt %, at least about 10 wt %, at least about 20 wt %, or at least about 25 wt % excipient (calculated on a dry weight basis). In some embodiments, the aerosol-generating material may comprise up to about 25%, up to about 20 wt %, up to about 15 wt %, or up to about 10 wt % excipient (calculated on a dry weight basis).

[0192] In an exemplary embodiment, the aerosol-generating material comprises about 36 wt % glycerol, about 45 wt % tobacco extract, and about 19 wt % excipient on a dry weight basis.

[0193] In another exemplary embodiment, the aerosol-generating material comprises from about 17 to about 39 wt % glycerol, from about 41 to about 76 wt % tobacco extract, and from 0 to about 28 wt % excipient on a dry weight basis.

[0194] In embodiments in which the excipient is agar, the precursor material may comprise from 0 wt %, about 5 wt %, or about 10 wt % agar. The inventors have found that agar makes the precursor material more viscous and that the freeze-drying process is easier when the precursor material comprises a lower concentration of the agar excipient.

[0195] In some embodiments, the precursor material comprises about 50 wt % tobacco extract, from 0 to about 36 wt % aerosol forming agent (for example, from 0 to about 15 v/v %) and from 0 to about 40 wt % (for example, about 37.5 v/v %) excipient. The tobacco extract may comprise about 55 wt % tobacco solids and the overall tobacco solids content of the precursor material is about 27.5 wt %.

[0196] In some embodiments, the precursor material comprises about 50 wt % tobacco extract, up to about 36 wt % (for example, about 15 v/v %) glycerol and from 0 to about 40 wt % (for example, about 37.5 v/v %) excipient. The tobacco extract may comprise about 55 wt % tobacco solids and the overall tobacco solids content of the precursor material is about 27.5 wt %.

[0197] Some sample formulations of dried aerosol-generating materials formed from aqueous tobacco extracts are summarised in Table 1 below, with the amounts provided on a dry weight basis. These are theoretical values (before drying and inherent losses). Typically from about 80 to 89% of the glycerol is retained following the drying. Glycerol may be used as an aerosol-former material, but can be replaced or partially replaced with one or more other aerosol-former material such as those disclosed herein. The excipient used may be a dextran such as Dextran 70. Again, this may be replaced or partially replaced with alternative excipients, such as those disclosed herein.

TABLE 1

Tobacco extract, including nicotine (%)	Aerosol-former material (%)	Excipient (%)	Nicotine (%)
100	0	0	4.8-9.2
85-70	15-30	0	3.6-7.3
80-70	0	20-30	3.8-6.5
45-70	10-36	16-25	3-5

[0198] The percentage content of nicotine in the formulation will depend on the type of tobacco used, and the presence of other components, i.e. the aerosol-former and the excipient.

[0199] In some embodiments, the aerosol-generating material and/or the precursor material comprises one or more binders. In some embodiments the one or more binder is selected from the group consisting of: thermoreversible gelling agents, such as gelatin; starches; polysaccharides; pectins; celluloses; cellulose derivatives, such as carboxymethylcellulose; and alginates.

[0200] In some embodiments, the aerosol-generating material and/or the precursor material comprises one or more flavour-modifier, flavour or flavourant. This may be derived from the extract or it may be added. As used herein, the terms "flavour" and "flavourant" refer to materials which, where local regulations permit, may be used to create a desired taste, aroma or other somatosensorial sensation in a product for adult consumers. They may include naturally occurring flavour materials, botanicals, extracts of botanicals, synthetically obtained materials, or combinations thereof (e.g., tobacco, cannabis, licorice (liquorice), hydrangea, eugenol, Japanese white bark magnolia leaf, chamomile, fenugreek, clove, maple, matcha, menthol, Japanese mint, aniseed (anise), cinnamon, turmeric, Indian spices, Asian spices, herb, wintergreen, cherry, berry, red berry, cranberry, peach, apple, orange, mango, clementine, lemon, lime, tropical fruit, papaya, rhubarb, grape, durian, dragon fruit, cucumber, blueberry, mulberry, citrus fruits, Drambuie, bourbon, scotch, whiskey, gin, tequila, rum, spearmint, peppermint, lavender, aloe vera, cardamom, celery, cascarilla, nutmeg, sandalwood, bergamot, geranium, khat, naswar, betel, shisha, pine, honey essence, rose oil, vanilla,

lemon oil, orange oil, orange blossom, cherry blossom, cassia, caraway, cognac, jasmine, ylang-ylang, sage, fennel, wasabi, piment, ginger, coriander, coffee, hemp, a mint oil from any species of the genus *Mentha*, eucalyptus, star anise, cocoa, lemongrass, rooibos, flax, *Ginkgo biloba*, hazel, hibiscus, laurel, mate, orange skin, rose, tea such as green tea or black tea, thyme, juniper, elderflower, basil, bay leaves, cumin, oregano, paprika, rosemary, saffron, lemon peel, mint, beefsteak plant, curcuma, cilantro, myrtle, cassis, valerian, pimento, mace, damien, marjoram, olive, lemon balm, lemon basil, chive, carvi, verbena, tarragon, limonene, thymol, camphene), flavour enhancers, bitterness receptor site blockers, sensorial receptor site activators or stimulators, sugars and/or sugar substitutes (e.g., sucralose, acesulfame potassium, aspartame, saccharine, cyclamates, lactose, sucrose, glucose, fructose, sorbitol, or mannitol), and other additives such as charcoal, chlorophyll, minerals, botanicals, or breath freshening agents. They may be imitation, synthetic or natural ingredients or blends thereof. They may be in any suitable form, for example, liquid such as an oil, solid such as a powder, or gas.

[0201] In some embodiments, the flavour comprises menthol, spearmint and/or peppermint. In some embodiments, the flavour comprises flavour components of cucumber, blueberry, citrus fruits and/or redberry. In some embodiments, the flavour comprises eugenol. In some embodiments, the flavour comprises flavour components extracted from tobacco. In some embodiments, the flavour comprises flavour components extracted from cannabis.

[0202] In some embodiments, the flavour may comprise a sensate, which is intended to achieve a somatosensorial sensation which are usually chemically induced and perceived by the stimulation of the fifth cranial nerve (trigeminal nerve), in addition to or in place of aroma or taste nerves, and these may include agents providing heating, cooling, tingling, numbing effect. A suitable heat effect agent may be, but is not limited to, vanillyl ethyl ether and a suitable cooling agent may be, but not limited to eucolyptol, WS-3.

[0203] In some embodiments, the aerosol-generating material and/or the precursor material comprises one or more other functional materials, which may comprise one or more of pH regulators, colouring agents, preservatives, fillers, stabilizers, and/or antioxidants.

[0204] In some embodiments, the aerosol-generating material and/or the precursor material contains a filler component. The filler component is generally a non-tobacco component, that is, a component that does not include ingredients originating from tobacco. In some embodiments, the precursor material comprises less than 60 wt % of a filler, such as from 1 wt % to 60 wt %, or 5 wt % to 50 wt %, or 5 wt % to 30 wt %, or 10 wt % to 20 wt % on a wet weight basis.

[0205] The filler, if present, may comprise one or more inorganic filler materials such as calcium carbonate, perlite, vermiculite, diatomaceous earth, colloidal silica, magnesium oxide, magnesium sulphate, magnesium carbonate, and suitable inorganic sorbents, such as molecular sieves. The filler may comprise one or more organic filler materials such as wood pulp, hemp fibre, cellulose and cellulose derivatives.

[0206] In some embodiments, the dried aerosol-generating material is in the form of a gel. A gelling agent may be added to the aerosol-generating material, the precursor material or may be optionally omitted. The gelling agent may comprise one or more compounds selected from cellulosic gelling agents, non-cellulosic gelling agents, guar gum, acacia gum and mixtures thereof.

[0207] In some embodiments, the cellulosic gelling agent is selected from the group consisting of: hydroxymethyl cellulose, hydroxyethyl cellulose, hydroxypropyl cellulose, carboxymethylcellulose (CMC), hydroxypropyl methylcellulose (HPMC), methyl cellulose, ethyl cellulose, cellulose acetate (CA), cellulose acetate butyrate (CAB), cellulose acetate propionate (CAP) and combinations thereof.

[0208] In some embodiments, the gelling agent comprises (or is) one or more of hydroxyethyl cellulose, hydroxypropyl cellulose, hydroxypropyl methylcellulose (HPMC), carboxymethylcellulose, guar gum, or acacia gum.

[0209] In some embodiments, the gelling agent comprises (or is) one or more non-cellulosic gelling agents, including, but not limited to, agar, xanthan gum, gum Arabic, guar gum, locust bean gum, pectin, carrageenan, starch, alginate, and combinations thereof. In preferred embodiments, the non-cellulose based gelling agent is alginate or agar.

[0210] The aerosol-generating material and/or the precursor material may comprise an acid. The acid may be an organic acid. In some of these embodiments, the acid may be at least one of a monoprotic acid, a diprotic acid and a triprotic acid. In some such embodiments, the acid may contain at least one carboxyl functional group. In some such embodiments, the acid may be at least one of an alpha-hydroxy acid, carboxylic acid, dicarboxylic acid, tricarboxylic acid and keto acid. In some such embodiments, the acid may be an alpha-keto acid.

[0211] In some such embodiments, the acid may be at least one of succinic acid, lactic acid, benzoic acid, citric acid, tartaric acid, fumaric acid, levulinic acid, acetic acid, malic acid, formic acid, sorbic acid, benzoic acid, propanoic and pyruvic acid. In some embodiments, the acid is selected from one of lactic acid, benzoic acid and levulinic acid.

[0212] In other embodiments the acid may be an inorganic acid. In some of these embodiments the acid may be a mineral acid. In some such embodiments, the acid may be at least one of sulphuric acid, hydrochloric acid, boric acid and phosphoric acid.

[0213] The inclusion of an acid may be beneficial in embodiments in which the aerosol-generating material and/or the precursor material comprises nicotine. In such embodiments, the presence of an acid may stabilise dissolved species in the slurry from which the aerosol-generating material is formed. The presence of the acid may reduce or substantially prevent evaporation of nicotine during drying of the slurry, thereby reducing loss of nicotine during manufacturing.

[0214] In certain embodiments, the aerosol-generating material comprises a gelling agent comprising a cellulosic gelling agent and/or a non-cellulosic gelling agent, an active substance and an acid.

[0215] The dried aerosol-generating material may be in any solid form. For example, the aerosol-generating material may be in the form of particles, granules or powder. The aerosol-generating material may be in the form of a monolithic form, tablet, agglomerate or "cake". In some embodiments, the aerosol-generating material formed by freeze- or spray-drying and is then processed with other suitable steps as required and known to the person skilled in the art to provide the dried material in the desired form, for example in the form of particles of the desired size(s).

[0216] In some embodiments, the aerosol-generating material is in the form of granules. The granules may be of any size, cross-sectional shape or mass. The aerosol-generating material in the form of granules is advantageous due to the high surface area to volume ratio, which positively impacts the release of volatiles from the material. This form also facilitates incorporation of the material into an aerosol provision system.

[0217] In some embodiments, the aerosol-generating material is free-flowing and non-sticky, and this aids the further processing and handling of the aerosol-generating material.

[0218] Smaller granule particles have a greater surface area to volume ratio and they may therefore exhibit enhanced release of tobacco constituents compared to particles of larger sizes.

[0219] In some embodiments, it may be desirable for the particles in the precursor composition, to have an average particle size of no greater than about 3 mm, of no greater than 1 mm, of no greater than about 0.5 mm, or to have an average particle size of no greater than about 0.3 mm, when measured by sieving.

[0220] In some embodiments, the average particle size is within the range of about 0.1 to about 3 mm, of about 0.1 to about 1 mm, of about 0.1 to about 0.5 mm, of about 0.1 to about 0.4 mm, or in the range of about 0.2 to about 0.3 mm. In some embodiments, at least about 90% of the particles of the precursor composition will have a particle size within the range of about 0.1 to about 3 mm, or of about 0.1 to about 1 mm, or of about 0.1 to about 0.5 mm. In some embodiments, at least about 90% of the tobacco particles of the precursor composition will have a particle size within the range of about 0.1 to about 3 mm, or of about 0.1 to about 1 mm, or of about 0.1 to 0.5 mm. In some embodiments, none of the particles in the precursor composition have a particle size greater than 5 mm, greater than 4 mm, greater than 2 mm, greater than 1.5 mm, or greater than about 1 mm. In some embodiments, the average particle size is less than 1 mm.

[0221] When preparing the precursor compositions to be dried, the particle size of any solid material present may be reduced by grinding, shredding, cutting or crushing plant material. Suitable machinery to create such plant particles includes, for example, shredders, cutters, or mills, such as hammer mills, roller mills or other types of commercially available milling machinery. The size of the plant particles is selected to provide particles which can be readily prepared from a variety of different types of plant material, having the properties described herein, and which provide a source of plant constituents that are readily released.

[0222] Particles of the aerosol-generating material of a smaller size may be advantageous for aerosol generation. Without wishing to be bound by any particular theory, smaller particles may have a greater surface area to volume ratio, which may improve aerosol generation. In some embodiments, the dried aerosol-generating material readily forms particles with an average size of smaller than 1 mm. In some embodiments, the particles may be as small as 10 μm or even as small as 1 μm. The size of the particles may be determined by sieving or by observing the particles by SEM.

[0223] In some embodiments, the freeze dried precursor material is ground into particles and may be sieved to exclude particles that are considered too small or too large to be used as aerosol-generating material.

[0224] In some embodiments, aerosol-generating material used in the present invention has a particle size distribution D10 from about 5 to about 25 μm (meaning that 10% of the particles in the tested sample are smaller than the value), a particle size distribution D50 from about 30 to about 200 μm (meaning that 50% of the particles in the tested sample are smaller than the value), and a particle size distribution D90 from about 500 to about 2500 μm (meaning that 90% of the particles in the tested sample are smaller than the value). These values are determined using particle size analyser Microtrac CamSizer® X2. Percentages referred to here are volume percentages.

[0225] In some embodiments, the freeze dried material used as the aerosol-generating material according to the present invention has a particle size distribution D10 from about 8 to about 15 μm, a particle size distribution D50 from about 50 to about 150 μm, and a particle size distribution D90 from about 900 to about 1700 μm.

[0226] In some embodiments, the D10 mean is from about 10 to about 15 μm, the D50 mean from about 40 to about 140 μm and the D90 mean from about 800 to about 1600 μm.

Spray-Drying and Freeze-Drying

[0227] The drying methods used to dry the precursor material may be any suitable drying process, including freeze-drying or spray-drying processes. The drying process used must be compatible with the precursor material and the desired make-up of the aerosol-generating material. As it may be desirable for the aerosol-generating material to include active and/or flavour substances derived from the extract in the precursor material, it is important to select a drying method that will retain a sufficient amount of these components.

[0228] In small scale examples, the precursor material is freeze-dried using freeze-drying microscopy, for example using a Lyostat freeze-drying microscope.

[0229] In a spray-drying process, the precursor material is sprayed and rapidly dried using a hot gas. The use of spray drying provides several advantages to the present invention: the dry particle size can be controlled and may be consistent; tobacco or flavour extracts or materials are heat sensitive but can still be spray-dried at relatively high inlet temperatures; a short residence time in the spray-drying equipment is required; and minimal loss of flavour/volatiles. This makes the process adaptable to reduce loss of volatile compounds and maintain the desired flavour of the aerosol generating material.

[0230] Freeze-drying, also known as lyophilisation or cryodesiccation, is a process in which the precursor material is frozen, the temperature lowered and the water is removed via sublimation under reduced pressure conditions. Without wishing to be bound by any specific theory, it is believed that the low processing temperatures and rapid water loss via sublimation avoid changes in the aerosol-generating material's structure, appearance and characteristics. This process preserves the structure of the precursor material, and reduces the loss and decomposition of volatile flavour compounds.

[0231] The dried aerosol-generating material has a lower water content than the precursor material. The water content of the aerosol-generating material may be at most about 0.5 wt %, about 1 wt %, about 2%, about 5 wt %, about 10 wt %, or about 20 wt % (calculated on a wet weight basis). The

water content of the dried aerosol-generating material may be reduced from the precursor material by at least about 50 wt %, about 60 wt %, about 70 wt %, about 80 wt %, about 90 wt %, about 95 wt %, about 98 wt %, or by about 100 wt %. In some embodiments the dried aerosol-generating material has a water content of less than about 5 wt %, less than about 4 wt %, less than about 3 wt %, less than about 2 wt % or less than about 1 wt % (calculated on a wet weight basis), as measured by gas chromatography-thermal conductivity detector (GC-TCD) or Karl Fischer measurement.

[0232] In an exemplary embodiment of the invention, the precursor material comprises Burley tobacco extract and a water content of 60 wt %. After the freeze-drying operation described herein, the dried aerosol generating material has a water content of 3 wt %.

[0233] A lower water content of the dried aerosol-generating material is associated with longer shelf-life and stability. However, very low water content may be associated be a brittle structure and a smaller particle size, as well as taking longer to process. The material is also very hygroscopic. If the water content of the dried aerosol-generating material is too high on the other hand, the desired increased stability may not be achieved. The dried aerosol-generating material may also not be as easy to handle with higher water content, with the material becoming sticky.

[0234] The inventors have found that when the precursor material comprises an excipient, the precursor material may be better suited to being dried via spray-drying (compared to a precursor material without an excipient). Without wishing to be bound by any particular theory, it is speculated that increasing the amount of the excipient in the precursor material raises the glass transition temperature to above 100° C. and this affects the physical properties of the material, making it more suitable for spray drying.

Use of the Compositions

[0235] The compositions comprising an agglomerate comprising particles of aerosol-generating material may be used in combustible or non-combustible aerosol provision systems, or in an aerosol-free delivery system.

[0236] In some embodiments, the compositions are used with an additional aerosol-generating material, such as tobacco material in the form of cut rag or reconstituted tobacco material.

[0237] In some embodiments, the compositions further include a heating material that comprises one or more materials selected from the group consisting of: an electrically-conductive material, a magnetic material, and a magnetic electrically-conductive material. In some embodiments, the heating material may comprise a metal or a metal alloy. In some embodiments, the heating material may comprise one or more materials selected from the group consisting of: aluminium, gold, iron, nickel, cobalt, conductive carbon, graphite, plain-carbon steel, stainless steel, ferritic stainless steel, copper, and bronze.

[0238] In some embodiments, the heating material may be heated by induction heating. Induction heating is a process in which an electrically-conductive object is heated by penetrating the object with a varying magnetic field. In some embodiments, the heating material may be heated by resistive heating. In such embodiments, the heating material is connected to a power supply. Alternatively, the heating may be microwave heating or infrared heating.

[0239] The present invention also relates to a consumable or article, comprising one or more agglomerates comprising a plurality of particles of an aerosol-generating material comprising a dried precursor material comprising an extract from a flavour- and/or active-containing plant material.

[0240] In some embodiments, the composition is provided in a consumable.

[0241] A consumable is an article comprising aerosol-generating material, part or all of which is intended to be consumed during use by a user. In this case, the aerosol-generating material, or at least some of the aerosol-generating material, is in the form of the composition disclosed herein, comprising an agglomerate comprising a plurality of particles of an aerosol-generating material.

[0242] A consumable may comprise one or more other components, such as an aerosol-generating material storage area, an aerosol-generating material transfer component, an aerosol generation area, a housing, a wrapper, a mouthpiece, a filter and/or an aerosol-modifying agent. A consumable may also comprise an aerosol generator, such as a heater, that emits heat to cause the aerosol-generating material to generate aerosol in use. The heater may, for example, comprise combustible material, a material heatable by electrical conduction, or a susceptor. The consumable may be any shape or size that is appropriate to the smoking device. In a preferred embodiment of the invention, the consumable is a rod shape.

[0243] In some embodiments, the composition comprising an agglomerate comprising particles of aerosol-generating material is provided in an aerosol-generating device such as a tobacco-heating product (THP) or hybrid e-cigarette product.

[0244] Advantageously, the composition may be used directly as a solid substrate and the composition is directly heated without burning to provide an inhalable aerosol.

[0245] In some embodiments, the composition comprising an agglomerate comprising particles of aerosol-generating material may be incorporated into the consumable in the absence of any carrier or other substrate material that would need to be heated.

[0246] In some embodiments, the total mass of the dried aerosol generating material included for use in a delivery system is up to about 200 mg, up to about 190 mg, up to about 180 mg, up to about 170 mg, up to about 160 mg, up to about 150 mg, up to about 140 mg, up to about 130 mg, up to about 120 mg, up to about 110 mg, up to about 100 mg, up to about 90 mg, up to about 80 mg, up to about 70 mg, up to about 60 mg, or up to about 50 mg.

[0247] Alternatively or in addition, the total mass of the dried aerosol generating material included may be at least about 5 mg, at least about 10 mg, at least about 15 mg, at least about 20 mg, at least about 25 mg, at least about 30 mg, at least about 35 mg, at least about 40 mg, at least about 45 mg, or at least about 50 mg.

[0248] In some embodiments, the total mass of the dried aerosol-generating material is sufficient to provide aerosol, for example, for up to about 10 puffs to be generated in a single session or over a series of multiple sessions. In such embodiments, the total mass of the dried aerosol-generating material provided is from about 10 to 100 mg, or from about 25 to about 50 mg.

[0249] In some embodiments, the consumable comprises a moisture impermeable coating that surrounds but which may be separate from the aerosol-generating material. For

example, the moisture impermeable coating may surround the composition (thereby surrounding the aerosol-generating material within the composition). In some embodiments, the moisture impermeable coating may be provided as a film or wrapper, optionally being deposited on a moisture permeable carrier.

[0250] In some embodiments, the consumable comprises a sorbent or desiccant material. The sorbent or desiccant material may be provided in the composition as discussed above. Alternatively, these components may be provided separately in the consumable, but in such a manner that the sorbent still competes with the aerosol-generating material for the moisture in the environment and therefore reduces the amount of moisture absorbed by the aerosol-generating material. In some embodiments, the sorbent may be provided in or on a wrapper that surrounds the aerosol generating material in the consumable. In other embodiments, the sorbent may be incorporated into a separate section of the consumable to the aerosol-generating material. This may have the benefit of reducing the exposure of the sorbent to the high temperatures that the aerosol-generating material is heated to upon use. For example, the sorbent may be located in an adjacent section of the consumable which is not directly heated. This may be downstream or upstream of the aerosol-generating material. In some embodiments, the sorbent is included in one or more sections of the consumable that does not include the aerosol-generating material, such as a cooling element section, or a filter section.

[0251] In yet further embodiments, the sorbent may be separated or removed from the aerosol-generating material and/or from the consumable before it is used. For example, the sorbent may be located in the packaging within which the consumable is held prior to use. In some embodiments, this packaging may be a wrapper, a box or other container. The sorbent may be incorporated into the packaging material or part thereof. Alternatively, the sorbent may be provided in a separate article, such as a sachet or sheet, located with the consumable within the packaging.

Delivery Systems

[0252] The delivery systems described herein can be combustible aerosol provision systems, non-combustible aerosol provision systems or an aerosol-free delivery systems.

[0253] As used herein, the term "delivery system" is intended to encompass systems that deliver at least one substance to a user, and includes:

[0254] combustible aerosol provision systems, such as cigarettes, cigarillos, cigars, and tobacco for pipes or for roll-your-own or for make-your-own cigarettes (whether based on tobacco, tobacco derivatives, expanded tobacco, reconstituted tobacco, tobacco substitutes or other smokeable material);

[0255] non-combustible aerosol provision systems that release compounds from an aerosol-generating material without combusting the aerosol-generating material, such as electronic cigarettes, tobacco heating products, and hybrid systems to generate aerosol using a combination of aerosol-generating materials; and

[0256] aerosol-free delivery systems that deliver the at least one substance to a user orally, nasally, transdermally or in another way without forming an aerosol, including but not limited to, lozenges, gums, patches, articles comprising inhalable powders, and oral products such as oral tobacco which includes snus or moist snuff, wherein the at least one substance may or may not comprise nicotine.

[0257] According to the present disclosure, a "combustible" aerosol provision system is one where a constituent aerosol-generating material of the aerosol provision system (or component thereof) is combusted or burned during use in order to facilitate delivery of at least one substance to a user.

[0258] In some embodiments, the delivery system is a combustible aerosol provision system, such as a system selected from the group consisting of a cigarette, a cigarillo and a cigar.

[0259] In some embodiments, the disclosure relates to a component for use in a combustible aerosol provision system, such as a filter, a filter rod, a filter segment, a tobacco rod, a spill, an aerosol-modifying agent release component such as a capsule, a thread, or a bead, or a paper such as a plug wrap, a tipping paper or a cigarette paper.

[0260] According to the present disclosure, a "non-combustible" aerosol provision system is one where a constituent aerosol-generating material of the aerosol provision system (or component thereof) is not combusted or burned in order to facilitate delivery of at least one substance to a user.

[0261] In some embodiments, the delivery system is a non-combustible aerosol provision system, such as a powered non-combustible aerosol provision system.

[0262] In some embodiments, the non-combustible aerosol provision system is an electronic cigarette, also known as a vaping device or electronic nicotine delivery system (END), although it is noted that the presence of nicotine in the aerosol-generating material is not a requirement.

[0263] In some embodiments, the non-combustible aerosol provision system is an aerosol-generating material heating system, also known as a heat-not-burn system. An example of such a system is a tobacco heating system.

[0264] In some embodiments, the non-combustible aerosol provision system is a hybrid system to generate aerosol using a combination of aerosol-generating materials, one or a plurality of which may be heated and may be a composition comprising an agglomerate comprising a plurality of particles of an aerosol-generating material. Each of the aerosol-generating materials may be, for example, in the form of a solid, liquid or gel and may or may not contain nicotine. In some embodiments, the hybrid system comprises a liquid or gel aerosol-generating material and a solid aerosol-generating material. The solid aerosol-generating material may comprise, for example, tobacco or a non-tobacco product.

[0265] Typically, the non-combustible aerosol provision system may comprise a non-combustible aerosol provision device and a consumable for use with the non-combustible aerosol provision device.

[0266] In some embodiments, the disclosure relates to consumables comprising a composition comprising an agglomerate comprising a plurality of particles of an aerosol-generating material and configured to be used with non-combustible aerosol provision devices. These consumables are sometimes referred to as articles throughout the disclosure.

[0267] In some embodiments, the non-combustible aerosol provision system, such as a non-combustible aerosol provision device thereof, may comprise a power source and a controller. The power source may, for example, be an

electric power source or an exothermic power source. In some embodiments, the exothermic power source comprises a carbon substrate which may be energised so as to distribute power in the form of heat to a composition comprising an agglomerate comprising a plurality of particles of an aerosol-generating material or to a heat transfer material in proximity to the exothermic power source.

[0268] In some embodiments, the non-combustible aerosol provision system may comprise an area for receiving the consumable, an aerosol generator, an aerosol generation area, a housing, a mouthpiece, a filter and/or an aerosol-modifying agent.

[0269] In some embodiments, the consumable for use with the non-combustible aerosol provision device may comprise a composition comprising an agglomerate comprising particles of aerosol-generating material, an aerosol-generating material storage area, an aerosol-generating material transfer component, an aerosol generator, an aerosol generation area, a housing, a wrapper, a filter, a mouthpiece, and/or an aerosol-modifying agent.

[0270] FIG. **1** is a side-on cross sectional view of a consumable or article **1** for use in an aerosol delivery system. The article **1** comprises a mouthpiece segment **2**, and an aerosol generating segment **3**.

[0271] The aerosol generating segment **3** is in the form of a cylindrical rod and comprises a composition comprising an agglomerate comprising a plurality of particles of an aerosol-generating material **4**. The composition can be any of the compositions comprising agglomerates discussed herein.

[0272] Although described above in rod form, the aerosol-generating segment **3** can be provided in other forms, for instance a plug, pouch, or packet of material within an article.

[0273] The mouthpiece segment **2**, in the illustrated embodiment, includes a body of material **5** such as a fibrous or filamentary tow.

[0274] The rod-shaped consumable **1** further comprises a wrapper **6** circumscribing the mouthpiece segment **2** and aerosol generating segment **3**, such as a paper wrapper.

[0275] FIG. **2** shows an example of a non-combustible aerosol provision device **100** for generating aerosol from an aerosol-generating medium/material such as the composition of a consumable **110**, as described herein. In broad outline, the device **100** may be used to heat a replaceable article **110** comprising the aerosol-generating medium, for instance an article **1** as illustrated in FIG. **1** or as described elsewhere herein, to generate an aerosol or other inhalable medium which is inhaled by a user of the device **100**. The device **100** and replaceable article **110** together form a system.

[0276] The device **100** comprises a housing **102** (in the form of an outer cover) which surrounds and houses various components of the device **100**. The device **100** has an opening **104** in one end, through which the article **110** may be inserted for heating by a heating assembly. In use, the article **110** may be fully or partially inserted into the heating assembly where it may be heated by one or more components of the heater assembly.

[0277] The device **100** of this example comprises a first end member **106** which comprises a lid **108** which is moveable relative to the first end member **106** to close the opening **104** when no article **110** is in place. In FIG. **2**, the lid **108** is shown in an open configuration, however the lid **108** may move into a closed configuration. For example, a user may cause the lid **108** to slide in the direction of arrow "B".

[0278] The device **100** may also include a user-operable control element **112**, such as a button or switch, which operates the device **100** when pressed. For example, a user may turn on the device **100** by operating the switch **112**.

[0279] The device **100** may also comprise an electrical component, such as a socket/port **114**, which can receive a cable to charge a battery of the device **100**. For example, the socket **114** may be a charging port, such as a USB charging port.

[0280] In some embodiments, the substance to be delivered may be a composition comprising an agglomerate comprising particles of aerosol-generating material, and optionally another aerosol-generating material that may or may not be heated. As appropriate, the composition and other aerosol-generating material may comprise one or more active constituents, one or more flavours, one or more aerosol-former materials, and/or one or more other functional materials.

Stability

[0281] The invention enjoys the advantage of longer shelf life than other tobacco extracts.

[0282] The nicotine content of the precursor and aerosol-generating material after the freeze drying process has been calculated, providing an indication of the amount of nicotine retained following the processing. Compared to the original tobacco extract, the nicotine recovery of the dried aerosol generating material is at least about 76 wt % on a dry weight basis. The nicotine recovery of the dried aerosol generating material compared to the original tobacco extract may be at least about 60%, at least about 70%, at least about 75%, at least about 80%, or at least about 90% on a dry weight basis.

[0283] The glycerol content of the precursor and dried aerosol-generating material after the freeze drying process has been calculated, providing an indication of the amount of glycerol retained following the processing. Compared to the precursor material, the glycerol recovery of the dried aerosol generating material is at least about 85%. The glycerol recovery of the dried aerosol generating material compared to the precursor material may be at least about 70%, at least about 75%, at least about 80%, at least about 85%, at least about 90% at least about 95% on a dry weight basis.

Example 1

[0284] In a first test, the precursor material comprised essentially of aqueous tobacco extract, and glycerol. The aqueous tobacco extract was diluted further with glycerol up to about 24 wt % (calculated on a dry weight basis). The Burley aqueous tobacco extract had a tobacco solid content of about 40 wt %, and a water content of about 60 wt %. The precursor material was dried via freeze drying.

Example 2

[0285] In a further test, the precursor material comprised essentially of aqueous tobacco extract, glycerol and Dextran 70. The glycerol content was about 0 to about 15 v/v %, or up to about 36 wt % calculated on a dry weight basis. The precursor material was dried via freeze drying.

Example 3

[0286] The freeze-dried material of Example 1 or Example 2 is ground to provide a loose powder with an average size of from about 0.1 mm to about 1 mm. The loose powder is then combined with 5 wt % of sodium alginate as a binder, and the mixture undergoes tumble-growth/agitation agglomeration to form agglomerates from the powder. This results in agglomerates with a high surface area, high porosity and low density.

Example 4

[0287] The freeze-dried material of Example 1 or Example 2 is ground to provide a loose powder with an average size of from about 0.1 mm to about 1 mm. The loose powder is then combined with 5 wt % of propylene glycol as a binder, and the mixture undergoes tumble-growth/agitation agglomeration to form agglomerates from the powder. This results in agglomerates with a high surface area, high porosity and low density.

[0288] The various embodiments described herein are presented only to assist in understanding and teaching the claimed features. These embodiments are provided as a representative sample of embodiments only, and are not exhaustive and/or exclusive. It is to be understood that advantages, embodiments, examples, functions, features, structures, and/or other aspects described herein are not to be considered limitations on the scope of the invention as defined by the claims or limitations on equivalents to the claims, and that other embodiments may be utilised and modifications may be made without departing from the scope of the claimed invention. Various embodiments of the invention may suitably comprise, consist of, or consist essentially of, appropriate combinations of the disclosed elements, components, features, parts, steps, means, etc., other than those specifically described herein. In addition, this disclosure may include other inventions not presently claimed, but which may be claimed in future.

1. A composition comprising an agglomerate comprising a plurality of particles of an aerosol-generating material comprising a dried precursor material comprising an extract from a flavour- and/or active-containing plant material.

2. A composition as claimed in claim **1**, wherein the agglomerate has a BET surface area of at least about 100 m^2/g.

3. A composition as claimed in claim **1**, wherein the agglomerate is sufficiently porous to allow an airflow to be drawn through it.

4. A composition as claimed in claim **1**, wherein the agglomerate comprises a binder.

5. A composition as claimed in claim **4**, wherein the binder is included in an amount of from about 0.1 wt % to about 30 wt %, based on the entire weight of the agglomerate.

6. A composition as claimed in claim **4**, wherein the binder is selected from the group consisting of: starches, polysaccharides, pectins, celluloses, cellulose derivatives such as carboxymethylcellulose, and alginates.

7. A composition as claimed in claim **1**, wherein the agglomerate has a size from about 1 mm to about 20 mm.

8. A composition as claimed in claim **1**, wherein the agglomerate consists essentially of the dried aerosol-generating material and an optional binder.

9. A composition as claimed in claim **1**, wherein the aerosol-generating material further comprises an aerosol-former material.

10. A composition as claimed in claim **1**, the precursor material comprising from about 10 to about 95% by weight extract from a flavour- or active-containing plant material.

11. A composition as claimed in claim **1**, the precursor material comprising from about 1 to about 36 wt % aerosol-former material.

12. A composition as claimed in claim **1**, the precursor material comprising from about 0 to about 40% by weight of an excipient.

13. A composition as claimed in claim **1**, the dried aerosol-generating material comprising from about 99 to about 45% by weight dried extract from the flavour- or active-containing plant material.

14. A composition as claimed in claim **1**, the dried aerosol-generating material comprising from about 1 to about 34% by weight of an aerosol-former material.

15. A composition as claimed in claim **1**, the dried aerosol-generating material comprising from about 0 to about 25% by weight of an excipient.

16. A composition as claimed in claim **1**, wherein the plant material is selected from the group consisting of tobacco, eucalyptus, star anise, cocoa and hemp.

17. A composition as claimed in claim **1**, wherein the extract from a flavour- or active-containing plant material is an aqueous extract.

18. A composition as claimed in claim **1**, wherein the extract from a flavour- or active-containing plant material is an aqueous tobacco extract.

19. A composition as claimed in claim **1**, the dried aerosol-generating material comprising from about 40 to about 99% by weight tobacco solids.

20. A composition as claimed in claim **1**, the dried aerosol-generating material having a water content of no more than about 5% (calculated on a wet weight basis).

21. A composition as claimed in claim **1**, comprising a moisture impermeable coating surrounding the aerosol-generating material.

22. A composition as claimed in claim **21**, wherein the coating surrounds the agglomerated aerosol-generating material.

23. A composition as claimed in claim **1**, comprising a sorbent material.

24. A composition as claimed in claim **1**, comprising heating material embedded within the agglomerate.

25. A composition as claimed in claim **24**, wherein the heating material is heated by electrical resistance.

26. A composition as claimed in claim **24**, wherein the heating material is a susceptor.

27. A composition as claimed in claim **1**, for use in an aerosol provision system.

28. An article comprising one or more agglomerates comprising a plurality of particles of an aerosol-generating material comprising a dried precursor material comprising an extract from a flavour- and/or active-containing plant material.

29. An article, comprising the composition as claimed in claim **1**.

30. An article as claimed in claim **28**, comprising a means to prevent or reduce the absorption of moisture by the dried aerosol-generating material.

31. An article as claimed in claim **30**, wherein the means is provided separately from the one or more agglomerates.

32. An article as claimed in claim **31**, wherein the means comprises a film or wrapper comprising a moisture impermeable coating or a sorbent or desiccant material.

33. A non-combustible aerosol-provision system comprising a composition as claimed in claim **1**.

34. A non-combustible aerosol-provision system as claimed in claim **33**, wherein the system is configured to heat the composition to form a vapour and/or aerosol.

35. A non-combustible aerosol-provision system as claimed in claim **33**, further comprising a further aerosol-generating material which is to be heated to form an aerosol and/or vapour, optionally wherein the further aerosol-generating material is a liquid.

36. A non-combustible aerosol-provision system as claimed in claim **35**, wherein the composition is heated by the aerosol and/or vapour generated from the further aerosol-generating material.

37. A non-combustible aerosol-provision system as claimed in claim **35**, including a means for heating the further aerosol-generating material to form a vapour, but not including a separate means for heating the composition.

38. A method for providing a composition comprising:

drying a precursor material comprising an extract from a flavour- and/or active-containing plant material to form particles of a dried aerosol-generating material; and

adding a binder to the particles of dried aerosol-generating material before, during or after agglomerating the particles of dried aerosol-generating material.

39. A method as claimed in claim **38**, wherein the method comprises drying or curing the binder to form an agglomerate.

40. A method as claimed in claim **38**, comprising shaping the agglomerated particles.

* * * * *