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

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(57) **ABSTRACT**

The invention relates compositions comprising an aerosol-generating material and a binder, the 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 the compositions and substrates comprising the compositions.

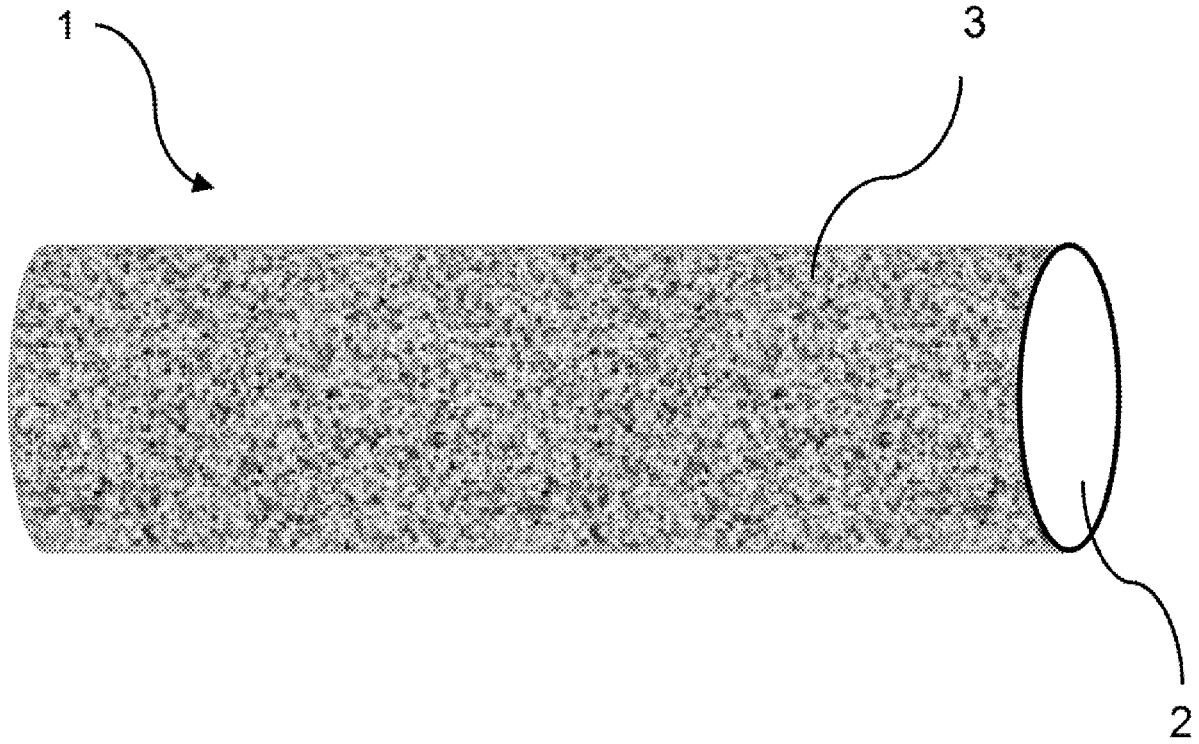


Fig. 1

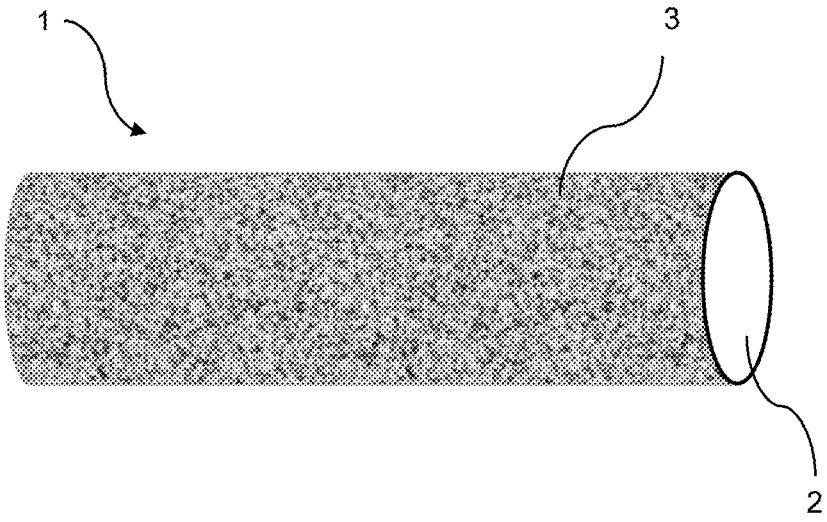


Fig. 2

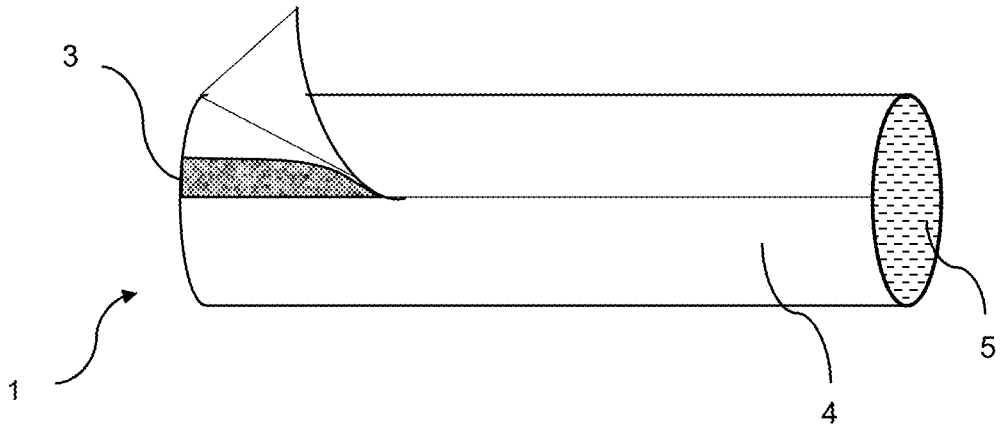


Fig. 3

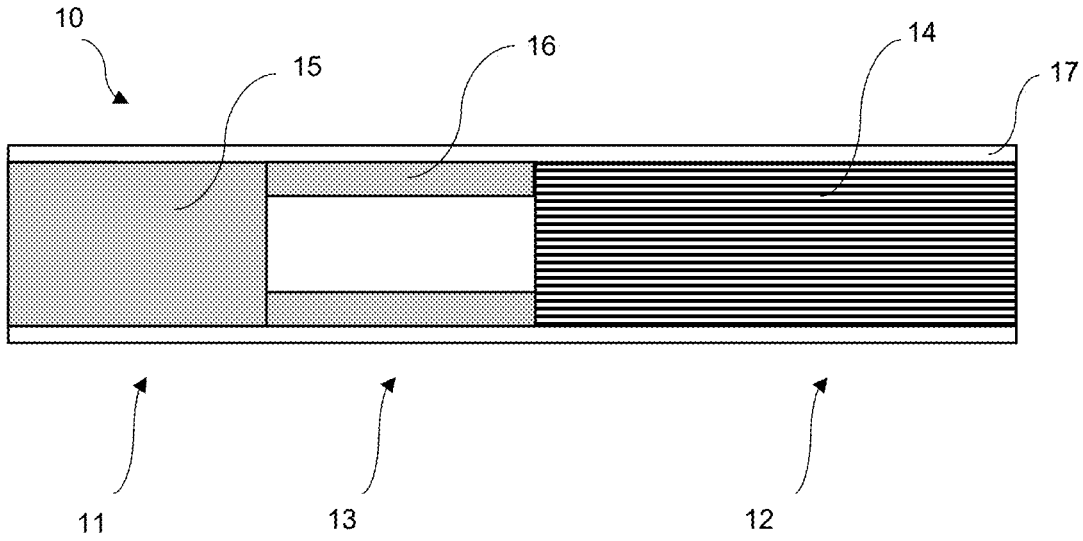
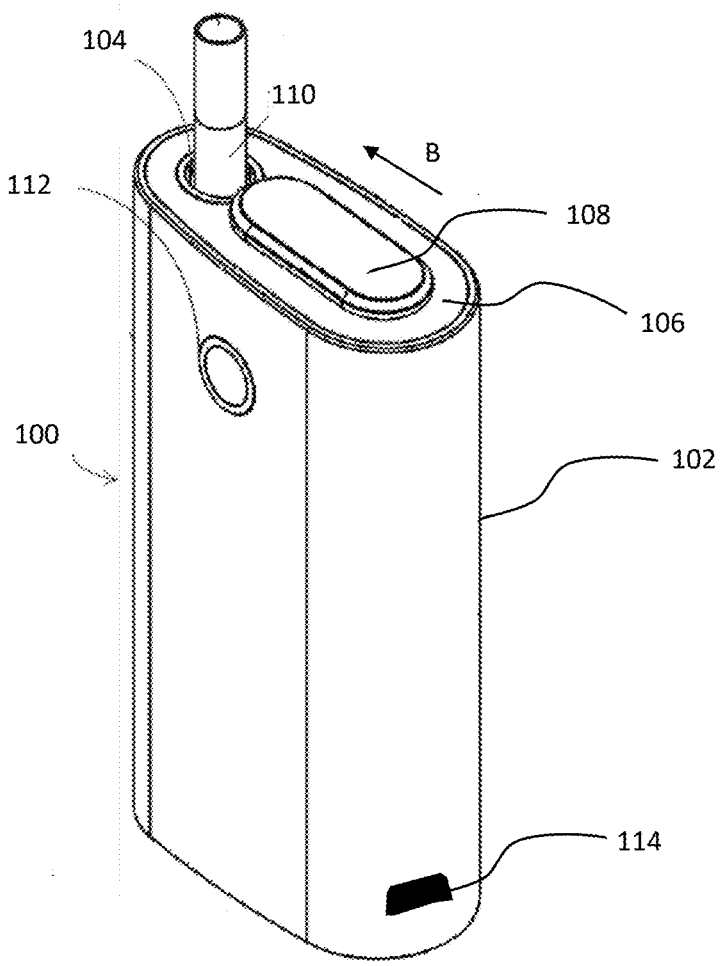


Fig. 4



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

FIELD

[0001] The invention relates to compositions comprising an aerosol-generating material and a binder, methods of preparing the compositions and of manufacturing substrates comprising the compositions on a support, and uses of the compositions.

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 aerosol-generating material and a binder in a ratio of from about 1:10 to about 2:1 by weight, the 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 binder is selected from the group consisting of: thermoreversible gelling agents; starches; polysaccharides; polysaccharide derivatives; celluloses; cellulose derivatives; gums; protein materials; polyol matrix materials; waxes; wax esters; and other polymers.

[0005] In some embodiments, the composition has adhesive properties.

[0006] In some embodiments, the aerosol-generating material is suspended or at least partially dissolved in the binder.

[0007] In some embodiments, the aerosol-generating material comprises an aerosol-former material.

[0008] In some embodiments, the precursor material comprises from about 10 to about 95% by weight extract from a flavour- or active-containing plant material.

[0009] In some embodiments, the precursor material comprises from about 1 to about 36 wt % aerosol-former material.

[0010] In some embodiments, the precursor material comprises from 0 to about 40% by weight of an excipient.

[0011] In some embodiments, the aerosol-generating material comprises from 45 to about 100% by weight dried extract from the flavour- or active-containing plant material.

[0012] In some embodiments, the aerosol-generating material comprises from about 1 to about 34% by weight aerosol-former material.

[0013] In some embodiments, the plant material is selected from the group consisting of tobacco, eucalyptus, star anise, cocoa and hemp.

[0014] In some embodiments, the extract from a flavour- or active-containing plant material is an aqueous extract.

[0015] In some embodiments, the extract from a flavour- or active-containing plant material is an aqueous tobacco extract.

[0016] In some embodiments, the aerosol-generating material has a water content of no more than about 5% (calculated on a wet weight basis).

[0017] In some embodiments, the composition further comprises an additional flavour or active.

[0018] In some embodiments, the composition does not comprise an added filler or diluent material.

[0019] According to a second aspect of the invention, there is provided a substrate comprising a composition according to the first aspect, on a support.

[0020] In some embodiments, the support comprises one or more selected from the group consisting of: paper, card, paperboard, cardboard, reconstituted material, a plastics material, a ceramic material, activated carbon, glass, a sintered material, a composite material, a plant-derived material, a fabric or fleece, a fibrous tow a metal, or a metal alloy.

[0021] In some embodiments, the composition covers at least a portion of a surface of the support.

[0022] In some embodiments, a plurality of discrete portions of the composition are provided on the support.

[0023] In some embodiments, the composition is dried or cured.

[0024] In some embodiments, the composition is used to adhere parts of the substrate to each other.

[0025] In some embodiments, the support comprises a heating material.

[0026] According to a third aspect of the present invention, there is provided an article comprising a composition according to the first aspect or a substrate according to the second aspect.

[0027] According to a fourth aspect of the present invention, there is provided a non-combustible aerosol-provision system comprising a composition according to the first aspect, or a substrate according to the second aspect.

[0028] According to a fifth aspect of the present invention, there is provided a method of providing a composition according to the first aspect, comprising: drying a precursor material comprising an extract from a flavour- and/or active-containing plant material to form an aerosol-generating material; and combining the aerosol-generating material with a binder.

[0029] In some embodiments, the method further comprises adjusting the particle size of the aerosol-generating material.

[0030] In some embodiments, the aerosol-generating material is suspended or at least partially dissolved in the binder.

[0031] According to a sixth aspect of the present invention, there is provided a method of providing a substrate according to the second aspect, comprising: drying a precursor material comprising an extract from a flavour- and/or active-containing plant material to form an aerosol-generating material; combining the aerosol-generating material with a binder; and applying the composition to a support.

[0032] In some embodiments, the composition is dried or cured in contact with the support.

[0033] In some embodiments, the precursor material is dried by spray-drying or freeze-drying.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034] Embodiments of the invention will now be described, by way of example only, with reference to accompanying drawings, in which:

[0035] FIG. **1** is a schematic illustration of a substrate comprising a composition as described herein.

[0036] FIG. **2** is a schematic illustration of another substrate comprising a composition as described herein.

[0037] FIG. **3** is a side-on cross-sectional view of a first embodiment of a consumable comprising a substrate as described herein; and

[0038] FIG. **4** is a perspective illustration of a non-combustible aerosol provision device for generating aerosol from the composition of the consumable shown in FIG. **3**.

DETAILED DESCRIPTION

[0039] An aerosol-generating material is a material that is capable of generating aerosol, for example when heated, irradiated or energized in any other way.

[0040] 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.

[0041] 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.

[0042] The present invention relates to compositions comprising a dried or dehydrated aerosol generating material formed from an extract from a flavour- and/or active-containing plant 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.

[0043] 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.

[0044] 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.

[0045] 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 %.

[0046] 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.

[0047] Unless stated otherwise, references to moisture content herein are references to the moisture content as measured by Karl Fischer titration.

[0048] 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.

[0049] 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.

[0050] 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".

[0051] In the present disclosure, the aerosol-generating material is provided in a composition comprising a binder. The combination of the aerosol-generating material and the binder is referred to herein as a composition. The ratio of aerosol-generating material to binder is from about 1:10 to about 2:1 by weight. Thus, there is sufficient binder to surround the aerosol-generating material, thereby protecting it from the moisture in the environment.

[0052] The composition may be used in an aerosol-provision system to generate an aerosol. The composition may be applied to a support which presents the composition and the aerosol-generating material therein in a manner suitable for use in an aerosol-provision system. This is a particularly

beneficial way to provide the aerosol-generating material as this material is highly concentrated so that only very small amounts are required compared to the conventional aerosol-generating materials.

The Binder

[0053] In the compositions described herein, the aerosol-generating material is combined or mixed with one or more binder. The compositions comprise the aerosol-generating material and one or more binder in a ratio of from about 1:10 to about 2:1 by weight.

[0054] In preferred embodiments, the aerosol-generating material is combined with the binder after the aerosol-generating material has been dried.

[0055] In some embodiments the one or more binder is selected from the group consisting of: thermoreversible gelling agents, such as gelatin; starches; polysaccharides; polysaccharide derivatives; celluloses; cellulose derivatives; gums; protein materials; polyol matrix materials; waxes; wax esters; and other polymers.

[0056] Suitable polysaccharides include, for example, agar, agarose, pectin, furoidan, furcellan, alginates, carrageenans, starches, dextrans, maltodextrins and cyclodextrins. 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.

[0057] In other embodiments, the one or more binder is a glue or adhesive, such as a solvent-based adhesive; a polymer dispersion adhesive; a pressure sensitive adhesive; a contact adhesive; a thermoplastic adhesive; or a hot-melt adhesive.

[0058] In some embodiments, the adhesive is polyvinyl acetate (PVA).

[0059] In some embodiments, the binder does not comprise water. This may be preferred as the aerosol-generating material is highly sensitive to water and will readily absorb moisture and may transform from a solid to a paste in the presence of too much water. In addition, some support materials may also be sensitive to water. Some support materials, such as paper and card, may readily absorb moisture. As a result, such materials may be weakened or may deform or become discoloured when they are contacted with an aqueous binder. Also, the presence of water may require a drying step to remove the water and this requires energy input.

[0060] In some embodiments, the binder comprises a non-aqueous solvent or no solvent. For example, the binder may comprise a hot melt adhesive which does not include a solvent. Such binders may be applied to moisture sensitive support materials.

[0061] The physical and chemical properties of the binder are important. In addition to attaching the aerosol-generating material to the support and, in some embodiments, forming a coating around the aerosol-generating material, the binder also needs to remain stable and in place during the period between manufacture and use by the consumer.

[0062] In some embodiments, it is important that the binder is suitable for inclusion in a substrate or article that is to be used in an aerosol-generation system. In particular, it is important that the binder can be heated to maximum temperatures of from about 250° C. to about 350° C. without releasing compounds that are unsuitable for inhalation by a user.

[0063] In some embodiments, it is desirable for the binder to become permeable when the aerosol-generating material is heated to generate an aerosol. This may be necessary to ensure that the aerosol can be released from the aerosol-generating material surrounded by the binder. In some embodiments, the binder is rendered permeable by at least some partial melting or other decomposition of the binder material.

[0064] In some embodiments, the decomposition of the binder involves the binder losing its physical integrity so that it no longer forms a barrier around the aerosol-generating material. This may, for example, involve the binder melting, crumbling, disintegrating or otherwise breaking down.

[0065] Once a binder material is heated to its melting point, it can be expected that its binding properties may be compromised. The binder materials should therefore be selected so that they remain intact when exposed to normal environmental temperatures. Therefore, in some embodiments, the binder materials used should be ones that are stable at temperatures below 40 or 50° C. In some embodiments, it may be desirable to select a binder material that will remain intact during exposure to more extreme temperatures that may be encountered during storage and transport, such as those of 60 to 80° C.

[0066] In some embodiments, the binder 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 binder opens rapidly upon heating to form an aerosol. This will reduce the likelihood of the binder interfering with the volatilisation and the release of the resultant gas or vapour.

[0067] In some embodiments, the temperature at which the binder 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.

[0068] Additionally or alternatively, the temperature at which the binder 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.

[0069] In some embodiments, the amount of binder included in the composition is from about 5% to about 95%, or from about 35% to about 95% by weight based on the weight of the total composition. In some embodiments, the amount of binder is at least about 5%, at least about 10%, at least about 15%, at least about 20%, at least about 25%, at least about 30%, at least about 35% or at least about 40% by weight based on the weight of the total composition. In some embodiments, the amount of binder is up to about 95%, up to about 90%, up to about 85%, up to about 80%, up to about 75%, up to about 70%, up to about 65%, up to about 60%, up to about 55%, or up to about 50% by weight based on the weight of the total composition.

[0070] In some embodiments, the binder gives the composition adhesive properties. For example, in some embodiments, the composition includes the binder in a form which has not been dried or cured. This composition may be in the form of a liquid, slurry, gel or semi-solid. This composition may also be tacky or glue-like.

[0071] In other embodiments, the composition includes the binder in a form which has been dried or cured. This composition may be in the form of a solid, a dried coating or semi-solid. This dried or cured composition may be less tacky than the undried or uncured composition, or may be non-tacky. In some embodiments, the composition may be bonded to a surface or substrate it was in contact with when dried or cured.

[0072] In some embodiments, the composition is formed by adding the aerosol-generating material to the undried or uncured binder. This allows the materials to be mixed, and for the aerosol-generating material to become at least partially coated with or surrounded by the binder. When the binder is dried or coated, the aerosol-generating material will be at least partially embedded in the composition.

[0073] In some embodiments, the aerosol-generating material is soluble or partially soluble in the binder or other component of the composition, such as a solvent. As a result, when the aerosol-generating material is incorporated into the composition, the aerosol-generating material will dissolve or partially dissolve.

[0074] In other embodiments, the aerosol-generating material is not soluble in the binder or in any other component of the composition. As a result, when the aerosol-generating material is incorporated into the composition, the aerosol-generating material will not dissolve and will retain its solid form.

[0075] In some embodiments, the binder material comprises additives that are released upon heating the composition and which therefore contribute to the generated aerosol. For example, the binder material may comprise an active substance, including one or more of the active substances described elsewhere herein. Additionally or alternatively, the binder 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 binder is a hydrophobic flavour. This may mean that the flavour enhances the hydrophobicity of the composition.

The Dried Aerosol-Generating Material

[0076] 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.

[0077] 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. 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.

[0078] 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.

[0079] 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.

[0080] The precursor material and/or the dried aerosol-generating material may also optionally include one or more other functional materials.

[0081] 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.

[0082] 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.

[0083] 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 alone (i.e. without protection from moisture afforded by the compositions described herein) 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 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.

[0084] 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 30%, 50% or even as high as 90%, prior to use.

[0085] 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.

[0086] 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.

[0087] In some embodiments, the extract from a flavour- or active-substance containing plant material is an extract derived from tobacco material.

[0088] 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.

[0089] 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).

[0090] 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).

[0091] 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).

[0092] 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).

[0093] 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 %.

[0094] 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).

[0095] 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).

[0096] 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.

[0097] 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.

[0098] 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.

[0099] 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.

[0100] 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.

[0101] 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.

[0102] In some embodiments, the active substance comprises nicotine. In some embodiments, the active substance comprises caffeine, melatonin or vitamin B12.

[0103] In some embodiments, the precursor material may comprise an extract from other botanical source(s) along with or instead of the tobacco extract.

[0104] 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. 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*

[0105] 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.

[0106] 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.

[0107] 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).

[0108] 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).

[0109] The aerosol-generating material and/or the precursor material may comprise cannabidiol (CBD).

[0110] The aerosol-generating material and/or the precursor material may comprise nicotine and cannabidiol (CBD).

[0111] The aerosol-generating material and/or the precursor material may comprise nicotine, cannabidiol (CBD), and THC (tetrahydrocannabinol).

[0112] The aerosol-generating material further comprises an aerosol-former material. In some embodiments, this aerosol-former material is included in the precursor material.

[0113] 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.

[0114] 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.

[0115] 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.

[0116] 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.

[0117] A combination of two or more aerosol forming agents may be used, in equal or differing proportions.

[0118] 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).

[0119] 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.

[0120] 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.

[0121] 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.

[0122] 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).

[0123] 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).

[0124] 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.

[0125] 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.

[0126] 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).

[0127] In some embodiments, the aerosol-generating material and/or the precursor material comprises one or more excipients in an amount of from 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.

[0128] 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).

[0129] 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.

[0130] 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.

[0131] In embodiments in which the excipient is agar, the precursor material may comprise 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.

[0132] 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 %.

[0133] 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 %.

[0134] 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

[0135] 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.

[0136] 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.

[0137] 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.

[0138] 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.

[0139] 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.

[0140] 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.

[0141] 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.

[0142] 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.

[0143] 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.

[0144] 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.

[0145] 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.

[0146] 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.

[0147] 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.

[0148] 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.

[0149] 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.

[0150] 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.

[0151] 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.

[0152] 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).

[0153] In some embodiments, the aerosol-generating material is in the form of particles or granules. Smaller granule particles have a greater surface area to volume ratio and they may therefore exhibit enhanced release of constituents compared to particles of larger sizes. They will also be easier to combine with the binder in the composition to provide an even distribution of the aerosol-generating material throughout the composition. The smaller particles will also provide a composition with a smoother consistency where the particles of aerosol-generating material do not dissolve in the other components of the composition.

[0154] A yet further advantage of the use of fine particles of aerosol-generating material in the compositions is that this will help to ensure that the particles are surrounded by the binder and are therefore protected from the environment. This will mean that this highly hygroscopic material is not exposed to moisture and therefore cannot absorb moisture. This means that additional measures (such as coating or packaging the aerosol-generating material) are not required to protect it from moisture.

[0155] 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, of no greater than about 0.4 mm, of no greater than about 0.3 mm, of no greater than about 0.2 mm or to have an average particle size of no greater than about 0.1 mm, when measured by sieving.

[0156] 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.

[0157] 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 tobacco 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.

[0158] 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.

[0159] 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.

[0160] 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.

[0161] 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.

[0162] 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

[0163] 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.

[0164] In small scale examples, the precursor material is freeze-dried using freeze-drying microscopy, for example using a Lyostat freeze-drying microscope.

[0165] 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.

[0166] 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.

[0167] 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.

[0168] 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 %.

[0169] 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.

[0170] 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.

Other Components

[0171] In some embodiments, the compositions described herein comprise one or more components in addition to the aerosol-generating material and binder.

[0172] For example, the composition may comprise an aerosol-former material in addition to the aerosol-former material included in the aerosol-generating material. Such aerosol-former materials may be any of the specific materials discussed elsewhere herein. In some embodiments, the additional aerosol-former material may be included in an amount of at least about 5%, at least about 10%, at least about 15%, at least about 20%, at least about 25% or at least about 30% by weight of the total composition. Alternatively or additionally, the additional aerosol-former material may be included in an amount of up to about 50%, up to about 45%, up to about 40%, up to about 35%, up to about 30%, up to about 25% or up to about 20% by weight of the total composition.

[0173] In other embodiments, the composition may comprise a solvent. The solvent may be included to give the binder component the desired properties, such as viscosity before drying or curing, or its ability to dissolve the aerosol-generating material. The solvent may be included in an amount of at least about 5%, at least about 10%, at least about 15%, at least about 20% or at least about 30% by weight of the total composition. Alternatively or additionally, the solvent may be included in an amount of up to about 90%, up to about 80%, up to about 70%, up to about 60%, up to about 50% or up to about 40% by weight of the total composition.

[0174] In some embodiments, the solvent is selected from the group consisting of water; alcohols, such as ethanol and methanol; acetone; and carboxylate esters, such as methyl acetate and ethyl acetate.

[0175] In other embodiments, the composition may comprise a filler, bulking agent or diluent. These components may be included to give the composition the desired properties before and/or after drying or curing. The filler, bulking agent or diluent may be included in an amount of at least about 1%, at least about 5%, at least about 10%, at least about 20% or at least about 30% by weight of the total composition. Alternatively or additionally, the filler, bulking agent or diluent may be included in an amount of up to about 60%, up to about 50%, up to about 40%, up to about 30%, up to about 20%, up to about 10% or up to about 5% by weight of the total composition.

[0176] 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, cellulose and cellulose derivatives. In particular cases, the composition comprises no calcium carbonate such as chalk.

[0177] In some embodiment in which the composition comprised a filler component, the filler may be fibrous. For example, the filler may be a fibrous organic filler material such as wood pulp, hemp fibre, cellulose or cellulose derivatives. Without wishing to be bound by any particular theory, it is believed that including fibrous filler may increase the tensile strength of the composition.

[0178] In some embodiments, the compositions may comprise a colourant. The addition of a colourant may alter the visual appearance of the composition. By adding a colourant to the composition, the composition may be colour-matched to other components of a substrate or article comprising the composition. In some embodiments, the colourant may be included in an amount of at least about 1%, at least about 2%, or at least about 5% by weight of the total composition. Alternatively or additionally, the colourant may be included in an amount of up to about 10%, up to about 7% or up to about 5% by weight of the total composition.

[0179] Natural or synthetic colourants, such as natural or synthetic dyes, food-grade colourants and pharmaceutical-grade colourants may be used.

[0180] The colourant may be incorporated during the formation of the composition (e.g. when mixing the components including the binder and aerosol-generating material that form the composition) or it may be applied to the composition after its formation (e.g. by spraying it onto the surface of the composition).

[0181] In some embodiments, the compositions may comprise a flavour or an active substance, in addition to those that are included in the aerosol-generating material. The flavour or active may be released from the composition with components of the aerosol-generating material upon heating. The flavour or active may be any of those discussed elsewhere herein. In some embodiments, the additional flavour or active may be included in an amount of at least about 1%, at least about 2%, or at least about 5% by weight of the total composition. Alternatively or additionally, the additional flavour or active may be included in an amount of up to about 20%, up to about 15%, up to about 10% or up to about 5% by weight of the total composition.

[0182] In some embodiments, the additional flavour or active may be included in the compositions in encapsulated form.

[0183] In some embodiments, the compositions may comprise a combustion retarding additive, to help ensure that the composition, or any substrate or article it is incorporated into or onto, resists combustion when exposed to high temperatures or to flames.

[0184] In some embodiments, the combustion retarding additive is a salt. As used herein, a salt is a chemical compound consisting of an ionic assembly of cation and anions. The salts used herein are those whose anion and/or whose cation may be effective in retarding combustion.

[0185] In some embodiments, the salt is a halide salt, i.e. has a halide anion. In some embodiments, the salt is a chloride salt or a bromide salt. The presence of high concentrations of chloride or bromide has been shown to retard combustion.

[0186] In some embodiments, the salt may be an alkali metal salt, i.e. has an alkali metal cation. In some embodiments, the salt has an alkali earth metal cation. In some embodiments, the salt has a zinc cation or an iron cation, such as a ferric or ferrous cation. In some embodiments, the salt has an ammonium cation or a phosphonium cation.

[0187] In some embodiments, the salt has a carboxylate anion. For example, the salt may be an alkali metal carboxylate, such as potassium citrate, potassium succinate, potassium malate, potassium acetate, potassium tartrate, potassium oxalate, sodium citrate, sodium succinate, sodium acetate, or sodium malate.

[0188] In other embodiments, the salt has an anion selected from: borate, carbonate, phosphate, sulphate or sulphamate.

[0189] In some embodiments, sodium chloride (NaCl) is the combustion retarding additive used. It has been demonstrated that wrapper with a high chloride content is difficult to combust. Further, sodium chloride is neutral, highly soluble and does not affect pH of the composition.

[0190] In some embodiments, the combustion retarding additive is an alkaline earth metal oxide or hydroxide. In some embodiments, the additive is magnesium oxide or magnesium hydroxide.

[0191] In some embodiments, the combustion retarding additive may be included in an amount of at least about 3%, at least about 3.5%, at least about 4%, at least about 5%, at least about 6%, at least about 7%, at least about 8%, at least about 9%, or at least about 10% by weight of the total composition. Alternatively or additionally, the combustion retarding additive is included in an amount of no more than about 50%, no more than about 40%, no more than about

30%, no more than about 25%, no more than about 20%, no more than about 15%, or no more than about 10% by weight of the total composition.

The Support

[0192] The compositions disclosed herein may be provided on a support to provide a substrate. Due to the adhesive properties of some of the compositions, the support does not have to have a porous or rough surface in order to enhance adhesion of the composition to the support.

[0193] The support or a layer of the support may be formed of any material suitable for receiving and holding the aerosol generating material. In some embodiments, the support provides a surface upon which the composition is applied. In some embodiments, the support may provide a sleeve or cover that surrounds and supports the composition.

[0194] The support may, for example, be or comprise one or more materials selected from the following: paper; card; paperboard; cardboard; reconstituted material such as reconstituted paper or reconstituted plant material; a plastics material, such as polylactic acid; a ceramic material; activated carbon; glass; a sintered material, such as sintered glass, metal(s), ceramics or plastics; a composite material; a plant-derived material; a fabric or fleece; a fibrous tow such as cellulose acetate tow; a metal, or a metal alloy.

[0195] In some embodiments, the support comprises a material with an inherently rough surface. For example, the support or part thereof may be formed from a paper material, such as tipping paper, porous plug wrap, cigarette paper or tea bag paper. The paper may be a porous paper. In one example of the support surface comprising a paper material, the paper preferably has a weight of from about 20 gsm to about 100 gsm.

[0196] In some embodiments, the support comprises a fabric, fleece or a fibrous material, such as a tow. Such support materials may inherently have a porous structure, with spaces between fibres.

[0197] In some embodiments, the support is a woven or non-woven fabric or fleece comprising a plurality of fibres. In some embodiments, the fleece or fabric is manufactured by a dry-laid process, an air-laid process, a wet-laid process, a spun melt process, a melt blown process or the like to entangle fibres or filaments into a web in a manner that does not involve weaving or knitting.

[0198] The fabrics may comprise fibres formed from materials including cellulose fibres, viscose fibres, regenerated cellulose fibres, wood fibres, cotton fibres, wool fibres, or other fleece forming polymers, such as polyglycolic acid fibres, polylactic acid fibres, polyhydroxyalkanoate fibres, polycaprolactone fibres, polybutylene succinate fibres, polybutylene succinate adipate fibres, and combinations thereof. In some embodiments, the fibres are thermostable and/or biodegradable.

[0199] In some embodiments, the support is a porous material, such as an open-cell reticulated foam or sintered structure. In some embodiments, the porous material comprises a ceramic material, activated carbon material, zeolites, silica, wood, cork or other naturally occurring materials with a porous surface.

[0200] In some embodiments, the support may, for example, be or comprise glass, a plastics material, a ceramic material, a composite material, a metal, or a metal alloy.

[0201] In FIG. **1**, a substrate **1** is illustrated comprising a cylindrical support structure **2**, the outer surface of which has been covered with a composition comprising an aerosol-generating material and a binder, as discussed herein. The adhesive qualities of the composition mean that it can be applied to a surface and then dried or cured to provide a coating bonded to that surface.

[0202] In some embodiments, the support is a wrapper material, such as a paper wrapper. The composition may be applied to at least a portion of a surface of the wrapper. In some embodiments, the composition may be used as a glue to secure the wrapper in place, or to hold the wrapper closed around the rod or aerosol-generating material.

[0203] FIG. **2** illustrates such an embodiment, showing a substrate **1** comprising a sheet wrapper **4** which is held in a rolled configuration by a strip or stripe of adhesive composition **3** as disclosed herein. In the embodiment shown, the wrapper **4** is wrapped around a section or plug of an additional aerosol-generating material **5**.

[0204] In such an embodiment, there is an advantage that the aerosol-generating material can essentially be incorporated into material that would be included in the substrate or article anyway. This minimises the additional manufacturing complexity and cost. It also minimises the material that needs to be heated in addition to the aerosol-generating material in order to generate the aerosol, and so minimises the additional energy required.

[0205] In other embodiments, the support may be an additional aerosol-generating material, such tobacco material in the form of cut rag or reconstituted tobacco material. The composition may be added to the additional aerosol-generating material to introduce the dried aerosol-generating material included in the composition. Additionally, the composition may be introduced in order to stabilise or structurally strengthen the additional aerosol-generating material.

[0206] In some embodiments, the support consists of or comprises 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.

[0207] 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.

[0208] In some embodiments, the composition is applied to the support in a plurality of spaced areas of the surface of the support, forming discrete portions of aerosol generating material embedded within the binder. These portions may each generate aerosol for a single puff or enough aerosol for a series of puffs. In some embodiments, the substrate may allow the portions of aerosol-generating material to be independently heated. In other embodiments, the portions may be heated together, but the compositions may be formulated or provided in forms to generate different aerosols and/or may generate aerosols at different times or at different rates.

Use of the Compositions

[0209] The substrates including the composition comprising aerosol-generating material and binder may be used in combustible or non-combustible aerosol provision systems, or in an aerosol-free delivery system.

[0210] The present invention also relates to a consumable or article comprising an aerosol-generating material and a binder in a ratio of from about 1:10 to about 2:1 by weight, the aerosol-generating material comprising a dried precursor material comprising an extract from a flavour- and/or active-containing plant material.

[0211] In some embodiments, the substrate is provided in a consumable. Alternatively, the substrate may be used as a consumable.

[0212] 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 provided as part of a substrate as disclosed herein, including the composition comprising aerosol-generating material and binder.

[0213] 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. As mentioned above, at least some of these components of a consumable may also be components of the substrate described herein.

[0214] The consumable may be any shape or size that is appropriate to the smoking device. In some embodiments, the consumable is a rod shape. In other embodiments, it may take the form of a flat strip, a rod, or a flexible sleeve.

[0215] In some embodiments, the substrate comprising a composition as disclosed herein is provided in an aerosol-generating device such as a tobacco-heating product (THP) or hybrid e-cigarette product. Advantageously, the substrate may be directly heated without burning to provide an inhalable aerosol. In some embodiments, heating the substrate will first cause the coating to decompose, to breach the barrier it forms around the aerosol-generating material. Then, the aerosolised components of the aerosol-generating material, for example the glycerol, nicotine and/or tobacco flavour will be released.

[0216] In some embodiments, the substrate including a composition comprising an aerosol-generating material and binder may be incorporated into the consumable in the absence of any other carrier or other material that would need to be heated.

[0217] 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.

[0218] 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.

[0219] 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.

[0220] In some embodiments, the composition itself protects the hygroscopic aerosol-generating material from absorbing moisture from the environment, it is not necessary for the consumable to be stored in reduced humidity conditions prior to use.

[0221] In embodiments where the composition itself does not protect the hygroscopic aerosol-generating material from absorbing moisture from the environment, the consumable may advantageously comprise 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.

[0222] In some embodiments, the consumable may comprise a sorbent or desiccant material. The sorbent or desiccant material may be provided in the composition as discussed above. Alternatively, the sorbent or desiccant material 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.

[0223] 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.

[0224] In yet further embodiments, the sorbent or desiccant material 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

[0225] The delivery systems described herein can be combustible aerosol provision systems, non-combustible aerosol provision systems or an aerosol-free delivery systems.

[0226] As used herein, the term "delivery system" is intended to encompass systems that deliver at least one substance to a user, and includes:

[0227] 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 smokable material);

[0228] 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

[0229] 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.

[0230] 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.

[0231] 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.

[0232] 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.

[0233] 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.

[0234] In some embodiments, the delivery system is a non-combustible aerosol provision system, such as a powered non-combustible aerosol provision system.

[0235] 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.

[0236] 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.

[0237] 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 an aerosol-generating material provided on a support. 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.

[0238] 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.

[0239] In some embodiments, the disclosure relates to consumables comprising a composition comprising an aerosol-generating material and a binder and configured to be used with non-combustible aerosol provision devices. These consumables are sometimes referred to as articles throughout the disclosure.

[0240] 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 substrate or to a heat transfer material in proximity to the exothermic power source.

[0241] 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.

[0242] In some embodiments, the consumable for use with the non-combustible aerosol provision device may comprise a substrate including a composition comprising aerosol-generating material and a binder, 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.

[0243] FIG. **3** is a side-on cross-sectional view of a consumable or article **10** for use in an aerosol delivery system. The article **10** comprises a mouthpiece segment **11**, and an aerosol generating segment **12**.

[0244] The aerosol generating segment **12** is in the form of a cylindrical rod and comprises a section or plug of aerosol-generating material **14**, such as cut rag tobacco or reconstituted tobacco material. The mouthpiece segment **11** in the illustrated embodiment includes a body of material **15** such as a plug of fibrous or filamentary tow. Between the aerosol generating segment **12** and the mouthpiece segment **11**, there is positioned a cooling section **13** comprising a hollow tube **16** formed from a suitable material such as cellulose acetate, paper or a heat absorbing material.

[0245] The consumable **10** further comprises a wrapper **17**, such as a paper wrapper, circumscribing the mouthpiece segment **11**, the cooling section **13** and the aerosol generating segment **12**. This wrapper may include a strip of an adhesive composition comprising an aerosol-generating material and a binder to hold the wrapper in place, as illustrated in FIG. **2**.

[0246] FIG. **4** shows an example of a non-combustible aerosol provision device **100** for generating aerosol from an aerosol-generating medium/material such as the composi-

tion of a consumable no, as described herein. In broad outline, the device **100** may be used to heat a replaceable article no comprising the aerosol-generating medium, for instance an article **10** as illustrated in FIG. **3** 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 no together form a system.

[0247] 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 no may be inserted for heating by a heating assembly. In use, the article no may be fully or partially inserted into the heating assembly where it may be heated by one or more components of the heater assembly.

[0248] 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. **4**, 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".

[0249] 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**.

[0250] 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.

[0251] In some embodiments, the substance to be delivered may be the aerosol-generating material of a substrate as described herein, and optionally another aerosol-generating material that may or may not be heated. As appropriate, the substrate 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

[0252] The invention enjoys the advantage of longer shelf life than other tobacco extracts.

[0253] 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.

[0254] 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.

[0255] In addition, once surrounded by the moisture impermeable coating, the content of volatile components such as nicotine and flavours, and the content of the aerosol-forming material in the aerosol-generating material will be maintained until the composition is heated to generate an aerosol. This will be even without packaging or other protection from exposure to moisture.

Example 1

[0256] 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

[0257] 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 2

[0258] The freeze-dried material of Example 1 or Example 2 is ground to provide a loose powder with an average particle size of from about 10 μm to about 50 μm. 32.4 mg of the powder was then added to 130.7 mg of a diluted PVA binder. This mixture is then applied to the surface of a cardboard strip for insertion into a Tobacco Heating Product device to heat the composition and provide an aerosol for inhalation by a user.

Example 4

[0259] 10 separate portions of a composition comprising 5 mg of the freeze-dried aerosol-generating material of Example 1 or Example 2 and 10 mg of a hot melt adhesive are deposited on the surface of a support comprising aluminium sections which can be heated by magnetic hysteresis heating. The support and the portions of the composition are then heated to form an aerosol to be inhaled by a consumer.

Example 5

[0260] The freeze-dried material of Example 1 or Example 2 is ground to provide a loose powder with an average particle size of from about 10 μm to about 50 μm. 50 mg of the powder is then added to 50 mg of a PVA binder. This mixture is then applied to the edge of a paper wrapper that circumscribes a rod tobacco material forming a consumable for use in a Tobacco Heating Product device, thus holding the wrapper in place.

[0261] 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 aerosol-generating material and a binder in a ratio of from about 1:10 to about 2:1 by weight, the 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 binder is selected from the group consisting of: thermoreversible gelling agents; starches; polysaccharides; polysaccharide derivatives; celluloses; cellulose derivatives; gums; protein materials; polyol matrix materials; waxes; wax esters; and other polymers.

3. A composition as claimed in claim **1**, wherein the composition has adhesive properties.

4. A composition as claimed in claim **1**, wherein the aerosol-generating material is suspended or at least partially dissolved in the binder.

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

6. 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.

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

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

9. A composition as claimed in claim **1**, the aerosol-generating material comprising from 45 to about 100% by weight dried extract from the flavour- or active-containing plant material.

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

11. 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.

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

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

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

15. A composition as claimed in claim **1**, further comprising an additional flavour or active.

16. A composition as claimed in claim **1**, wherein the composition does not comprise an added filler or diluent material.

17. A substrate comprising a composition as claimed in claim **1**, on a support.

18. A substrate as claimed in claim **17**, wherein the support comprises one or more selected from the group consisting of: paper, card, paperboard, cardboard, reconstituted material, a plastics material, a ceramic material, activated carbon, glass, a sintered material, a composite material, a plant-derived material, a fabric or fleece, a fibrous tow a metal, or a metal alloy.

19. A substrate as claimed in claim **17**, wherein the composition covers at least a portion of a surface of the support.

20. A substrate as claimed in claim **17**, wherein a plurality of discrete portions of the composition are provided on the support.

21. A substrate as claimed in claim **17**, wherein the composition is dried or cured.

22. A substrate as claimed in claim **17**, wherein the composition is used to adhere parts of the substrate to each other.

23. A substrate as claimed in claim **17**, wherein the support comprises a heating material.

24. An article comprising a composition as claimed in claim **1**.

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

26. A method of providing a composition as claimed in claim **1**, comprising:

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

combining the aerosol-generating material with a binder.

27. A method as claimed in claim **26**, further comprising adjusting the particle size of the aerosol-generating material.

28. A method as claimed in claim **26**, wherein the aerosol-generating material is suspended or at least partially dissolved in the binder.

29. A method of providing a substrate as claimed in claim **17**, comprising:

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

combining the aerosol-generating material with a binder; and

applying the composition to a support.

30. A method as claimed in claim **29**, wherein the composition is dried or cured in contact with the support.

31. A method as claimed in claim **26**, wherein the precursor material is dried by spray-drying or freeze-drying.

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