US 20120125354A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2012/0125354 A1

(43) Pub. Date: May 24, 2012

Byrd et al.

(54) FIRE-CURED TOBACCO EXTRACT AND TOBACCO PRODUCTS MADE THEREFROM

(75) Inventors: **Crystal Dawn Hege Byrd**, Lexington, NC (US); **William Monroe Coleman, III**, Winston-Salem, NC (US); **Michael Francis Dube**, Winston-Salem, NC (US); **Anthony Richard Gerardi**, Winston-Salem, NC (US); **Eric Taylor Hunt**, Pfafftown, NC (US); **Darrell Eugene Holton, JR.**, Clemmons, NC (US); **Charles Bradford Rhoades, JR.**, Clemmons, NC (US); **Jack Gray Flinchum, JR.**, Clemmons, NC (US); **Dwayne William Beeson**, Kernersville, NC (US); **Jeremy Barrett Mabe**, Lexington, NC (US)

(73) Assignee: **R.J. Reynolds Tobacco Company**

(21) Appl. No.: **12/949,361**

(22) Filed: **Nov. 18, 2010**

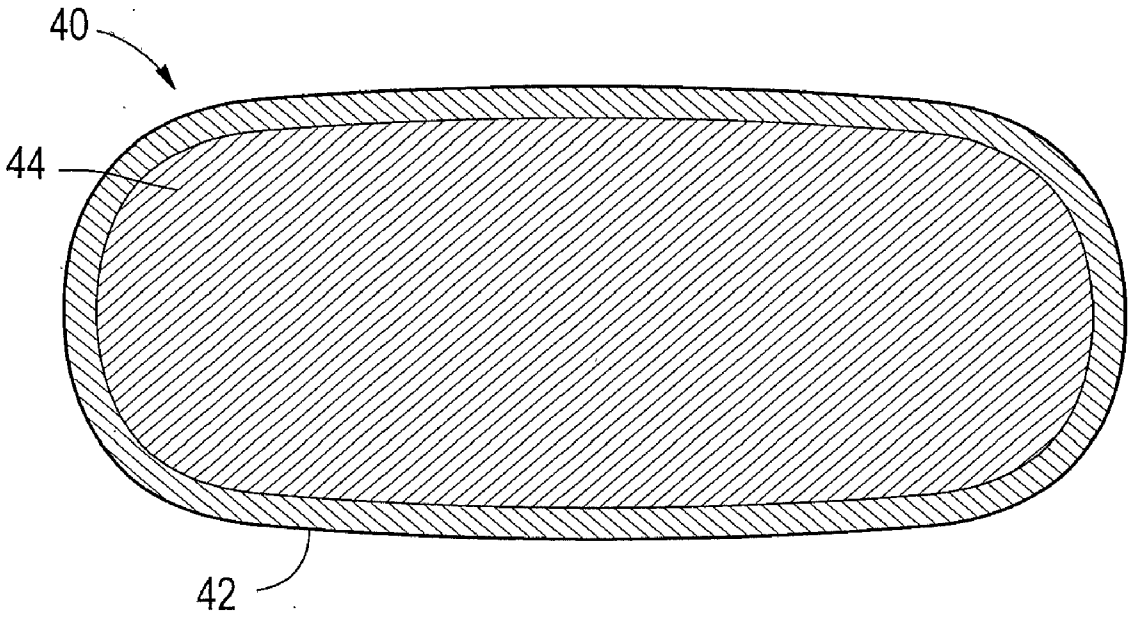
Publication Classification

(51) **Int. Cl.**
A24B 15/24 (2006.01)

(52) **U.S. Cl.** **131/297**; 131/352

(57) **ABSTRACT**

The invention provides a tobacco product including a flavorful tobacco composition in the form of an extract of a fire-cured tobacco material. Exemplary tobacco products include smoking articles, smokeless tobacco compositions, and aerosol-generating devices that do not burn tobacco. The invention also provides a process for preparing a smokeless tobacco composition, the method including: mixing a fire-cured tobacco material having a first benzo[a]pyrene concentration with water to produce an aqueous slurry; maintaining the slurry for a time and at a temperature sufficient to form a fire-cured tobacco extract, the aqueous fire-cured tobacco extract exhibiting a second benzo[a]pyrene concentration lower than the first benzo[a]pyrene concentration; separating the aqueous fire-cured tobacco extract from a residual pulp material, and mixing the aqueous fire-cured tobacco extract with a tobacco or non-tobacco plant material to form a smokeless tobacco composition.



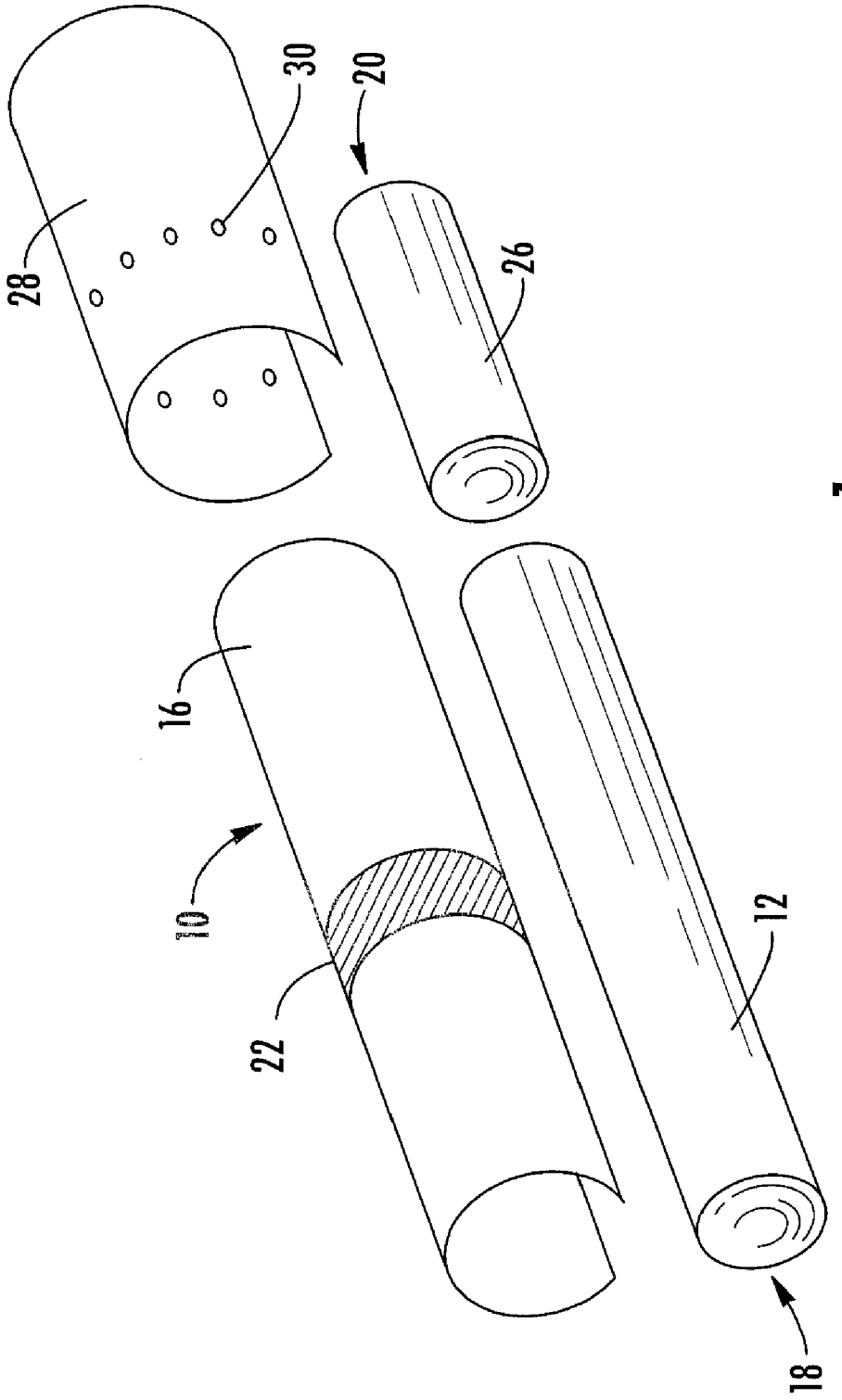


FIG. 1

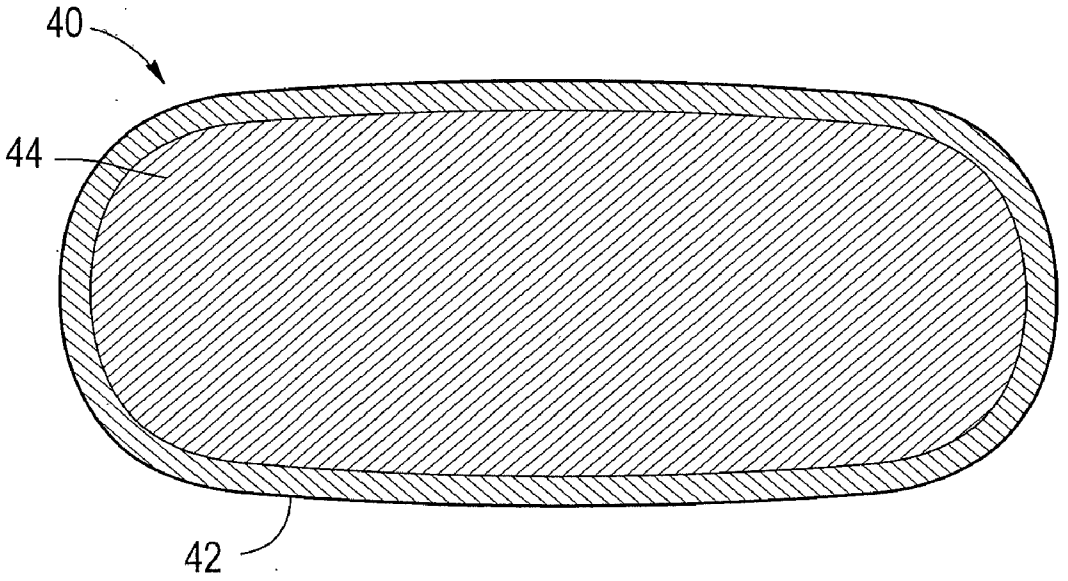


FIG. 2

FIRE-CURED TOBACCO EXTRACT AND TOBACCO PRODUCTS MADE THEREFROM

FIELD OF THE DISCLOSURE

[0001] The present disclosure relates to products made or derived from tobacco, or that otherwise incorporate tobacco, and are intended for human consumption. In particular, the disclosure relates to compositions or formulations incorporating tobacco, such as those intended to be employed in a smokeless form.

BACKGROUND OF THE INVENTION

[0002] Cigarettes, cigars, and pipes are popular smoking articles that employ tobacco in various forms. Such smoking articles are employed by heating or burning tobacco to generate aerosol (e.g., smoke) that may be inhaled by the smoker. Tobacco may also be enjoyed in a so-called "smokeless" form. Particularly popular smokeless tobacco products are employed by inserting some form of processed tobacco or tobacco-containing formulation into the mouth of the user. See for example, the types of smokeless tobacco formulations, ingredients, and processing methodologies set forth in U.S. Pat. Nos. 1,376,586 to Schwartz; 3,696,917 to Levi; 4,513,756 to Pittman et al.; 4,528,993 to Sensabaugh, Jr. et al.; 4,624,269 to Story et al.; 4,991,599 to Tibbetts; 4,987,907 to Townsend; 5,092,352 to Sprinkle, III et al.; 5,387,416 to White et al.; 6,668,839 to Williams; 6,834,654 to Williams; 6,953,040 to Atchley et al.; 7,032,601 to Atchley et al.; and 7,694,686 to Breslin et al.; US Pat. Pub. Nos. 2004/0020503 to Williams; 2005/0115580 to Quinter et al.; 2005/0244521 to Strickland et al.; 2006/0191548 to Strickland et al.; 2007/0062549 to Holton, Jr. et al.; 2007/0186941 to Holton, Jr. et al.; 2007/0186942 to Strickland et al.; 2008/0029110 to Dube et al.; 2008/0029116 to Robinson et al.; 2008/0029117 to Mua et al.; 2008/0173317 to Robinson et al.; 2008/0196730 to Engstrom et al.; 2008/0209586 to Neilsen et al.; 2008/0305216 to Crawford et al.; 2009/0065013 to Essen et al.; and **2009/0293889** to Kumar et al.; PCT WO 04/095959 to Arnarp et al.; and U.S. patent application Ser. No. 12/638,394, filed Dec. 15, 2009, to Mua et al.; each of which is incorporated herein by reference.

[0003] One type of smokeless tobacco product is referred to as "snuff." Representative types of moist snuff products, commonly referred to as "snus," are manufactured in the United States and Europe, particularly in Sweden. See, for example, Bryzgalov et al., 1N1800 Life Cycle Assessment, Comparative Life Cycle Assessment of General Loose and Portion Snus (2005). In addition, certain quality standards associated with snus manufacture have been assembled as a so-called GothiaTek standard. Exemplary smokeless tobacco products include CAMEL Snus, CAMEL Orbs, CAMEL Strips and CAMEL Sticks by R. J. Reynolds Tobacco Company; REVEL Mint Tobacco Packs and SKOAL Snus by U.S. Smokeless Tobacco Company; and MARLBORO Snus and Taboka by Philip Morris USA.

[0004] Various treatment methods and additives have been proposed for altering the overall character or nature of tobacco materials utilized in tobacco products. For example, additives or treatment processes have been utilized in order to alter the chemistry or sensory properties of the tobacco material, or in the case of smokable tobacco materials, to alter the chemistry or sensory properties of mainstream smoke generated by smoking articles including the tobacco material. See, for example, Leffingwell et al., *Tobacco Flavoring for Smoking Products*, R.J. Reynolds Tobacco Company (1972), which is incorporated herein by reference. In addition, tobacco materials have been processed or blended in a manner designed to achieve certain sensory or chemistry characteristics. See, for example, U.S. Pat. No. 7,025,066 to Lawson et al. and US Pat. Pub. No. 2008/0245377 to Marshall et al., which are incorporated herein by reference.

[0005] It would be desirable to provide an enjoyable form of tobacco product, such as a smokeless tobacco product, and to provide processes for preparing tobacco-containing compositions suitable for use in smokeless tobacco products.

SUMMARY OF THE INVENTION

[0006] The present invention relates to a tobacco product, such as a smokeless tobacco product (e.g., moist snuff, dry snuff, chewing tobacco, tobacco-containing gums, and dissolvable or meltable tobacco products) intended or configured for insertion into the mouth of a user, and to processes for preparing a formulation suitable for use within such a tobacco product. The tobacco products of the invention include a flavorful tobacco composition such as one having the form of a fire-cured tobacco extract. In one embodiment, the invention provides fire-cured tobacco extracts that exhibit distinctive sensory characteristics associated with fire-cured tobacco (e.g., smoky aroma or flavor), while also exhibiting advantageous chemical composition differences as compared to fire-cured tobacco in whole form, such as reduced levels of benzo[a]pyrene or other polycyclic aromatic hydrocarbons.

[0007] The extract is typically an aqueous extract of the cured tobacco material, but certain other polar protic solvents or co-solvent mixtures that include water can be used without departing from the invention. The concentration of benzo[a]pyrene in the extract is typically no more than about 10 ppb and often no more than about 5 ppb.

[0008] Although smokeless tobacco composition are particularly important types of tobacco products that would benefit from the extracts of the invention, other tobacco products can also benefit from such flavorful tobacco compositions, such as smoking articles (e.g., cigarettes) or aerosol-generating devices that contain tobacco or tobacco components but which do not combust tobacco or other plant material. Typically, the tobacco product will comprise a tobacco material or a non-tobacco plant material as a carrier for the extract.

[0009] In another embodiment, the extract of the invention is used to form a reconstituted tobacco material. In particular, such a material can include the extract of the invention (e.g., a fire-cured tobacco extract) combined with an extracted tobacco pulp (e.g., a fire-cured tobacco pulp), wherein the pulp has been pre-treated to reduce benzo[a]pyrene concentration.

[0010] In another aspect, the invention provides a method of producing a flavorful tobacco composition characterized by sensory attributes associated with a fire-cured tobacco material and a reduced benzo[a]pyrene concentration. The method includes the step of mixing a fire-cured tobacco material having a first benzo[a]pyrene concentration (e.g., at least about 100 ppb benzo[a]pyrene) with a polar protic solvent (e.g., water or co-solvent mixtures including water) to produce a slurry, the slurry providing intimate contact between the fire-cured tobacco material and the polar protic solvent. The method also includes maintaining the slurry for a time and at a temperature sufficient to form an extract comprising components of the cured tobacco material soluble in the polar

protic solvent, the extract exhibiting a second benzo[a]pyrene concentration (e.g., less than about 10 ppb benzo[a]pyrene) lower than the first benzo[a]pyrene concentration. Thereafter, the extract is separated from a residual pulp material comprising components of the fire-cured tobacco material that are insoluble in the polar protic solvent. The method typically also includes the step of utilizing the extract as a flavorful tobacco composition by, for example, introducing the separated extract into a tobacco product, which will often involve applying the separated extract to a tobacco material or non-tobacco plant material to form a treated material that can then be incorporated into a tobacco product. In certain embodiments, the extract is recombined with the extracted pulp following treatment of the pulp to reduce benzo[a]pyrene content, such as a second extraction of the pulp adapted to remove benzo[a]pyrene. If desired, the extract can be concentrated by removing at least a portion of the solvent prior to incorporation into a tobacco product.

[0011] In one particular embodiment, the invention provides a process for preparing a composition suitable for use as a smokeless tobacco composition, comprising: mixing a fire-cured tobacco material having a first benzo[a]pyrene concentration with water to produce an aqueous slurry, the slurry providing intimate contact between the fire-cured tobacco material and the water; maintaining the slurry for a time and at a temperature sufficient to form a fire-cured tobacco extract comprising flavorful and aromatic components of the fire-cured tobacco material soluble in water, the aqueous fire-cured tobacco extract exhibiting a second benzo[a]pyrene concentration lower than the first benzo[a]pyrene concentration; separating the aqueous fire-cured tobacco extract from a residual pulp material comprising components of the fire-cured tobacco material that are insoluble in water; and mixing the aqueous fire-cured tobacco extract with a tobacco or non-tobacco plant material to form a smokeless tobacco composition.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] In order to provide an understanding of embodiments of the invention, reference is made to the appended drawings, which are not necessarily drawn to scale, and in which reference numerals refer to components of exemplary embodiments of the invention. The drawings are exemplary only, and should not be construed as limiting the invention.

[0013] FIG. **1** is an exploded perspective view of a smoking article having the form of a cigarette, showing the smokable material, the wrapping material components, and the filter element of the cigarette; and

[0014] FIG. **2** is a cross-sectional view of a smokeless tobacco product embodiment, taken across the width of the product, showing an outer pouch filled with a smokeless tobacco composition of the invention.

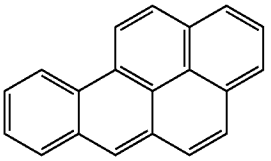
DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0015] The present invention now will be described more fully hereinafter. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. As used in this specification and the claims, the singular forms "a," "an," and "the" include plural referents unless the context clearly dictates otherwise. Reference to "dry weight percent" or "dry weight basis" refers to weight on the basis of dry ingredients (i.e., all ingredients except water).

[0016] The present invention provides a process for preparing a flavorful tobacco composition it the form of a tobacco extract. In certain embodiments, the extracts of the invention provide a tobacco composition having advantageous sensory characteristics combined with a reduced amount of certain compounds found in the unextracted tobacco material. The process of the invention is particularly useful for forming an extract of a fire-cured tobacco material, although it can be applied to other tobacco materials such as tobacco cured using other curing techniques (e.g., air-cured tobacco materials). A "fire-cured tobacco" as used herein refers to a tobacco material subjected to a fire curing process. In fire curing, tobacco leaves are exposed to gaseous combustion products from an open fire in the curing enclosure, typically for several weeks, resulting in a distinctive smoky aroma and flavor. The distinctive sensory characteristics of fire-cured tobacco can also be described in some cases as woody, sweet, nutty, spicy, earthy, or sour. The fire used for such curing processes is typically characterized as low-burning or smoldering, meaning the fire is maintained in a state that promotes smoke production. Fire cured tobaccos are sometimes referred to as "dark fire" or "dark-fired" tobacco. See, for example, the fire-curing processes and resulting tobacco characteristics set forth in U.S. Pat. Nos. 7,650,891 and 7,650,892, both to Groves et al., and 7,757,697 to Thomas et al., all of which are incorporated by reference herein. See also, pages 164-182 of *Tobacco Production, Chemistry and Technology*, Davis et al. (Eds.) (1999).

[0017] During fire curing, the tobacco material is involved in intimate interaction and contact with the gaseous combustion products of the fire in the curing enclosure, meaning the smoke from the fire directly contacts the surface of the tobacco material. This interaction between the smoke and the tobacco results in chemical changes to the tobacco material that lead to both the distinctive smoky aroma and flavor commonly associated with fire-cured tobacco and other less desirable chemical changes in the tobacco. The present invention provides a treatment process that separates at least a portion of the components of the fire-cured tobacco that provide the distinctive sensory characteristics (i.e., smoky aroma and flavor) from at least a portion of the components of the fire-cured tobacco that do not contribute to a significant degree to the desired and distinctive sensory characteristics. In other words, the invention provides a separation process that selectively extracts components of fire-cured tobacco that are desirable from a sensory standpoint, but leaves behind at least a portion of those components that are not necessary or desirable from a sensory standpoint.

[0018] When the process of the invention is applied to a fire-cured tobacco material, an extract can be formed in certain embodiments that is characterized by the desirable sensory attributes (e.g., smoky aroma and flavor) associated with fire-cured tobacco, but with an altered chemistry profile that includes reduction in certain polycyclic aromatic hydrocarbons typically found in fire-cured tobacco, such as benzo[a]pyrene (i.e., BaP). The structure of BaP is given below.



Benzo[a]pyrene

[0019] Discussion of BaP and other polycyclic aromatic hydrocarbons can be found in Gelboin, *Physiological Reviews* 60(4) (1980) 1107-1166; Phillips, *Mutation Research* 443 (1999) 139-147; Rodgman and Perfetti, *Contributions to Tobacco Research* 22(1) (2006) 13-69; Rodgman and Cook, *Contributions to Tobacco Research* 23(6) (2009) 384-410; and A. Rodgman and T. A. Perfetti, The Chemical Components of Tobacco and Tobacco Smoke, CRC Press, Taylor and Francis Group, Boca Raton, USA, (2009), all of which are incorporated by reference herein.

[0020] Fire-cured tobacco extracts containing reduced levels of polycyclic aromatic hydrocarbons enable the production of smoking articles and smokeless tobacco compositions that exhibit the desirable sensory characteristics of fire-cured tobacco, but with reduced content of compounds not associated with the desirable sensory properties, such as BaP. It is noted that sensory characteristics of a composition can be evaluated using human sensory panels as is understood in the art.

[0021] Although the BaP content can vary based on the particular tobacco plant and specific fire-curing process employed, a typical BaP range for a fire-cured tobacco is about 150 to about 800 parts by billion (ppb). In certain embodiments of the invention, fire-cured tobacco extracts can be formed with significantly lower BaP levels, such as less than about 10 ppb, less than about 5 ppb, or even less than about 1 ppb. In other terms, the amount of BaP reduction that occurs during the extraction process of the invention can be characterized as a reduction of at least about 90 percent by weight of the content of BaP in the original unextracted tobacco material, more often at least about 95 percent or at least about 99 percent. It was heretofore unknown that a fire-cured tobacco extract could be formed that retains the distinctive sensory elements of such tobaccos, but which exhibits a reduced content of certain less desirable chemical compounds such as BaP. In one embodiment of the method of the invention, the cured tobacco material (e.g., fire-cured tobacco) subjected to the extraction process has a BaP concentration of at least about 100 ppb, more often at least about 150 ppb, or even at least about 200 ppb or at least about 300 ppb. Following the extraction process, the separated extract exhibits a much lower BaP concentration, such as a concentration of no more than about 10 ppb, or no more than about 5 ppb, or no more than about 1 ppb.

[0022] Various methods for determining BaP content are known in the art. Typically, the method involves extracting BaP from a tobacco material with methanol or a relatively non-polar solvent such as hexane, cyclohexane or methylene chloride. The extract is then filtered and analyzed using a High Performance Liquid Chromatography (HPLC) method with fluorescence detection or a Gas Chromatography-Mass Spectrometry (GC-MS) technique. Publications directed to extraction and detection of BaP in tobacco or tobacco products include Rodgman and Perfetti, *Contributions to Tobacco Research* 22(1) (2006) 13-69; Risner, *Beitr. Tabakforsch. Int* 15(1) (1991) 11-17; "Determination of Benzo[a]Pyrene in Whole Tobacco," Health Canada (1999)(published on the Health Canada website, www.hc-sc.gc.ca), Aygün et al., *International Journal of Food Sciences and Nutrition* 56(8) (2005) 581-585; and McNeill et al., *Tob. Control* 15 (2006) 64-67, all of which are incorporated by reference herein.

[0023] The fire-cured tobacco used in the process of the invention can include those tobacco materials commonly utilized in fire curing, such as Narrow Leaf Madole, Improved Madole, Tom Rosson Madole, Newton's VH Madole, Little Crittenden, Green Wood, Little Wood, Small Stalk Black Mammoth, DT 508, DT 518, DT 592, KY 171, DF 911, DF 485, TN D94, TN D950, VA 309, and VA 359. However, any tobacco material could be used without departing from the invention, including those tobaccos commonly referred to as flue-cured or Virginia (e.g., K326), burley, sun-cured (e.g., Indian Kurnool and Oriental tobaccos, including Katerini, Prelip, Komotini, Xanthi and Yambol tobaccos), Maryland, dark, dark air cured (e.g., Passanda, Cubano, Jatin and Bezuki tobaccos), light air cured (e.g., North Wisconsin and Galpao tobaccos), Indian air cured, Red Russian and *Rustica* tobaccos, as well as various other rare or specialty tobaccos. Descriptions of various types of tobaccos, growing practices and harvesting practices are set forth in *Tobacco Production, Chemistry and Technology*, Davis et al. (Eds.) (1999), which is incorporated herein by reference. Various representative types of plants from the Nicotiana species are set forth in Goodspeed, *The Genus Nicotiana*, (Chonica Botanica) (1954); U.S. Pat. Nos. 4,660,577 to Sensabaugh, Jr. et al.; 5,387,416 to White et al. and 7,025,066 to Lawson et al.; US Patent Appl. Pub. Nos. 2006/0037623 to Lawrence, Jr. and **2008/0245377** to Marshall et al.; each of which is incorporated herein by reference. In one embodiment, tobacco varieties that are typically cured through curing processes other than fire curing, such as flue-curing or air-curing, are utilized in the extraction process of the invention. If desired, such tobacco materials can be optionally cured using a fire curing treatment instead of the traditional curing process used for such materials.

[0024] The particular *Nicotiana* species of material used in the invention could also vary. Of particular interest are *N. alata, N. arentsii, N. excelsior, N. forgetiana, N. glauca, N. glutinosa, N. gossei, N. kawakamii, N. knightiana, N. langsdorffi, N. otophora, N. setchelli, N. sylvestris, N. tomentosa, N. tomentosiformis, N. undulata*, and *N. x sanderae*. Also of interest are *N. africana, N. amplexicaulis, N. benavidesii, N. bonariensis, N. debneyi, N. longiflora, N. maritina, N. megalosiphon, N. occidentalis, N. paniculata, N. plumbaginifolia, N. raimondii, N. rosulata, N. rustica, N. simulans, N. stocktonii, N. suaveolens, N. tabacum, N. umbratica, N. velutina*, and *N. wigandioides*. Other plants from the *Nicotiana* species include *N. acaulis, N. acuminata, N. attenuata, N. benthamiana, N. cavicola, N. clevelandii, N. cordifolia, N. corymbosa, N. fragrans, N. goodspeedii, N. linearis, N. miersii, N. nudicaulis, N. obtusifolia, N. occidentalis* subsp. *Hersperis, N. pauciflora, N. petunioides, N. quadrivalvis, N. repanda, N. rotundifolia, N. solanifolia* and *N. spegazzinii*. The *Nicotiana* species can be derived using genetic-modification or crossbreeding techniques (e.g., tobacco plants can be genetically engineered or crossbred to increase or decrease production of certain components or to otherwise change certain characteristics or attributes). See, for example, the types of genetic

modifications of plants set forth in U.S. Pat. Nos. 5,539,093 to Fitzmaurice et al.; 5,668,295 to Wahab et al.; 5,705,624 to Fitzmaurice et al.; 5,844,119 to Weigl; 6,730,832 to Dominguez et al.; 7,173,170 to Liu et al.; 7,208,659 to Colliver et al.; and 7,230,160 to Benning et al.; US Patent Appl. Pub. No. 2006/0236434 to Conkling et al.; and PCT WO 2008/103935 to Nielsen et al.

[0025] At least a portion of the plant of the Nicotiana species can be employed in an immature form or in a mature form. The tobacco material used in the invention can also be subjected to aging conditions.

[0026] According to the invention, a tobacco material of any of the types noted above is harvested and subjected to a curing process, such as a fire curing process. The resulting cured tobacco is then subjected to an extraction process using certain polar protic solvents, such as water, formic acid, acetic acid, dilute aqueous solutions (e.g., solutions comprising greater than 70 weight percent water and minor amounts of an alcohol or other co-solvent), or mixtures thereof. The solvent typically has a dielectric constant at room temperature of at least about 6, more often at least about 30, and most often at least about 50.

[0027] Solvents having an aqueous character are particularly useful, such as deionized water, distilled water, or tap water. Such a solvent consists primarily of water, is normally greater than 90 weight percent water, and can be essentially pure water in certain circumstances. The extraction solvent can be a co-solvent mixture, such as a mixture of water and minor amounts of one or more solvents that are miscible therewith. An example of such a co-solvent mixture is a solvent consisting of about 95 weight parts water and about 5 weight parts ethanol. The extraction solvent also can include water having substances such as pH adjusters (i.e., acids or bases) or pH buffers dissolved therein.

[0028] The extraction process involves placing the tobacco material in intimate contact with the solvent at a suitable temperature and for a suitable time period. The temperature of the extraction can vary, but a typical temperature range is about room temperature to about 110° C., more often about 30° C. to about 90° C. In certain embodiments, the temperature of the extraction step can be characterized as at least about 20° C., at least about 30° C., at least about 50° C., or at least about 60° C. It may be advisable to use a relatively low temperature for the extraction process to prevent or reduce volatilization of the flavorful or aromatic compounds that are the primary targets of the extraction process.

[0029] The time period for the extraction step can vary, but is typically about 10 minutes to about 24 hours, more often about 1 hour to about 12 hours. The time period is not considered particularly critical to the invention, although very short extraction time periods may not result in extraction of a large proportion of the extractable component of the tobacco material.

[0030] The amount of solvent used in the extraction process can vary, but will typically be sufficient to place the tobacco material in the form of a slurry. In other words, the solvent is typically the predominate component of the tobacco/solvent mixture and is often present in great excess compared to the tobacco component. Weight ratios of solvent to tobacco material will typically range from about 2:1 to about 20:1 (e.g., about 4:1 to about 12:1), although other ratios (particularly even larger ratios) could be used without departing from the invention. In certain embodiments, the use of smaller amounts of water or other solvent could be advantageous because less drying would be required if the extract must be concentrated prior to use. Excessive drying of the extract could lead to loss of certain volatile flavorful or aromatic components of the extract, which could potentially result in loss of some of the distinctive sensory characteristics of the extract. Accordingly, use of weight ratios of solvent to tobacco material of less than about 5:1 or less than about 4:1 during extraction could be a useful technique to reduce or eliminate the need to dry or otherwise concentrate the resulting extract. In such an embodiment, the extract would be expected to exhibit a relatively high viscosity and can be applied to certain tobacco products without further processing.

[0031] The manner by which the solvent and the tobacco material are combined for extraction may vary. The solvent and tobacco material can be contacted, combined, or mixed together in conical-type blenders, mixing drums, ribbon blenders, or the like. The mixture can be agitated or subjected to a grinding action during the extraction step. Following extraction, the residual pulp is removed from the liquid extraction product using any method known in the art, such as filtration or centrifugation. The tobacco material is typically in shredded or particulate form during extraction, such as tobacco particles having a particle size in the range of about 0.5 mm to about 25 mm. The vessel in which the tobacco material and the solvent are mixed is typically vented such that the extraction proceeds at atmospheric pressure, or if desired, a pressurized vessel can be used. Following the extraction process, a tobacco extract is provided by separating the solvent-insoluble pulp material from the solvent and the solvent-soluble or dispersible tobacco components dissolved or dispersed therein.

[0032] Equipment, types of solvents, and techniques for obtaining extracts of tobacco, including in some cases equipment, solvents, and techniques that can be used or suitably modified for use in the method of the invention, are described in U.S. Pat. Nos. 4,144,895 to Fiore; 4,150,677 to Osborne, Jr. et al.; 4,267,847 to Reid; 4,289,147 to Wildman et al.; 4,351,346 to Brummer et al.; 4,359,059 to Brummer et al.; 4,506,682 to Muller; 4,589,428 to Keritsis; 4,605,016 to Soga et al.; 4,716,911 to Poulose et al.; 4,727,889 to Niven, Jr. et al.; 4,887,618 to Bernasek et al.; 4,941,484 to Clapp et al.; 4,967,771 to Fagg et al.; 4,986,286 to Roberts et al.; 5,005,593 to Fagg et al.; 5,018,540 to Grubbs et al.; 5,060,669 to White et al.; 5,065,775 to Fagg; 5,074,319 to White et al.; 5,099,862 to White et al.; 5,121,757 to White et al.; 5,131,414 to Fagg; 5,131,415 to Munoz et al.; 5,148,819 to Fagg; 5,197,494 to Kramer; 5,230,354 to Smith et al.; 5,234,008 to Fagg; 5,243,999 to Smith; 5,301,694 to Raymond et al.; 5,318,050 to Gonzalez-Parra et al.; 5,343,879 to Teague; 5,360,022 to Newton; 5,435,325 to Clapp et al.; 5,445,169 to Brinkley et al.; 6,131,584 to Lauterbach; 6,298,859 to Kierulff et al.; 6,772,767 to Mua et al.; and 7,337,782 to Thompson, all of which are incorporated by reference herein.

[0033] Following separation of the extract from the pulp, both the extract and the residual pulp can be further processed if desired. For example, the extract can be processed in a manner adapted to concentrate the dissolved or dispersed components of the tobacco material by removing at least a portion of the solvent. Various methods of solvent removal can be used, such as heat treatment to evaporate the solvent (e.g., with an evaporator and condenser arrangement), reverse osmosis membrane treatment, spray drying or freeze drying. In the case of an aqueous extract, the concentration step could

simply entail heating the extract to a temperature above the boiling point of water in a vented vessel. The extract could also be subjected to other treatment processes designed to change the chemical composition of the extract, such as reaction with acids or bases, ultrafiltration to remove high molecular weight components, treatment to remove additional components of the extract such as tobacco-specific nitrosamines (TSNAs), or the like.

[0034] In one specific embodiment, the essentially BaP-free extract is processed to reduce the concentration of TSNAs in the extract. Exemplary TSNA compounds include N-nitrosonornicotine (NNN), 4-methyl-N-nitrosamino-1-(3-pyridyl)-1-butanone (NNK), N-nitrosoanatabine (NAT), 4-methyl-N-nitrosamino-1-(3-pyridyl)-1-butanol (NNAL), and N-nitrosoanabasine (NAB). The method for reducing the TSNA level can vary. In one method, a preparative HPLC technique is used where the extract is passed through a HPLC column and the portion of the extract eluting from the column at the known retention time for TSNA compounds is simply discarded. In another method, the extract is passed through a molecularly imprinted polymer (MIP) material having functional groups that selectively sorb TSNA compounds. Exemplary TSNA-specific MIP materials include polymer sorbents offered by Sigma-Aldrich Company under the brand name SupelMIP® SPE and Affinilute™ MIP materials available from Biotage AB. The polymeric sorbent can be contacted with the extract to selectively sorb the TSNA compounds using a variety of techniques such as packing a column with the sorbent and passing the extract therethrough. In certain embodiments, the TSNA level of the extract can be reduced from greater than 1,000 ppb or even greater than 2,000 ppb to less than about 400 ppb or less than about 300 ppb or less than about 200 ppb. In some cases, the TSNA level can be reduced to less than about 100 ppb or less than about 50 ppb.

[0035] In one embodiment, the residual tobacco pulp produced in the extraction process can be treated to reduce benzo[a]pyrene concentration in order to prepare the pulp for recombination with the extract to form a reconstituted tobacco material exhibiting a reduced benzo[a]pyrene concentration. For example, the pulp could be subjected to a second extraction process using supercritical carbon dioxide or another suitable solvent (e.g., relatively non-polar solvents such as hexane, cyclohexane or methylene chloride) such that the benzo[a]pyrene dissolves in the solvent to facilitate removal from the pulp. Carbon dioxide extraction processes that could be used in the present invention, or suitably modified for use in the present invention, are set forth in, for example, U.S. Pat. Nos. 4,153,063 to Roselius et al.; 4,506,682 to Muller; 4,714,617 to Gahrs; 4,727,889 to Niven, Jr. et al.; 5,018,540 to Grubbs et al.; and 5,435,325 to Clapp et al., all of which are incorporated by reference herein. Thereafter, a reconstituted tobacco material can be formed by adding the extract from the original extraction process back to the pretreated pulp. Exemplary manners and methods for providing a reconstituted tobacco sheet, including casting and papermaking techniques, are set forth in U.S. Pat. Nos. 4,674,519 to Keritsis et al.; 4,941,484 to Clapp et al.; 4,987,906 to Young et al.; 4,972,854 to Kiernan et al.; 5,099,864 to Young et al.; 5,143,097 to Sohn et al.; 5,159,942 to Brinkley et al.; 5,322,076 to Brinkley et al.; 5,339,838 to Young et al.; 5,377,698 to Litzinger et al.; 5,501,237 to Young; and 6,216,707 to Kumar; each of which is incorporated herein by reference. See also the tobacco extraction and reconstituted tobacco processes set forth in U.S. Pat. Nos. 5,065,775 to Fagg and 5,360,022 to Newton et al., which are incorporated herein by reference.

[0036] The tobacco material that is subjected to the extraction process can also be subjected to pre-treatment processes adapted to modify the sensory, chemical or physical properties of the material. For example, it may be desirable to pre-treat the tobacco material to remove components of the tobacco that may generate negative sensory off-notes so that those components are not extracted in the process of the invention. Exemplary pre-treatment processes for the tobacco material include fermentation, bleaching, and the like.

[0037] In some embodiments of the invention, it is advantageous to pre-treat a fire-cured tobacco to change the sensory characteristics in a manner that can be characterized as generating a milder flavor or aroma. One exemplary process that can generate a milder flavor or aroma in certain tobacco materials, such as a fire-cured tobacco, is fermentation. During fermentation, bacteria interact with the tobacco material in a moist, temperature-controlled and pH-controlled environment to alter the chemical profile of the tobacco material. Commercially available fermented tobacco materials could be used in the extraction process of the invention, such as moist snuff tobacco compositions marketed as GRIZZLY or KODIAK smokeless tobacco. Tobacco fermentation processes are described, for example, in Giacomo et al., Appl. Environ. Microbiol. 73(3) (2007) 825-837; U.S. Pat. No. 5,372,149 to Roth et al.; and in *Tobacco Production, Chemistry and Technology*, Davis et al. (Eds.) (1999), all of which are incorporated by reference herein.

[0038] The tobacco extract can be utilized as a flavorful tobacco composition that can be incorporated into a variety of tobacco products. In particular, fire-cured tobacco extracts of the invention can impart the distinctive sensory characteristics of fire-cured tobacco to various tobacco products without introducing significant amounts of certain chemical compounds associated with unextracted or whole fire-cured tobaccos, such as BaP. The tobacco extract (e.g., the aqueous tobacco extract) can be employed in a variety of forms. For example, the tobacco extract can be isolated in an essentially solvent free form, such as can be obtained as a result of the use of a spray drying or freeze drying process, or other similar types of processing steps. Alternatively, the aqueous tobacco extract can be employed in a liquid form, and as such, the content of tobacco solubles within the liquid solvent can be controlled by selection of the amount of solvent employed for extraction, concentration of the liquid tobacco extract by removal of solvent, addition of solvent to dilute the liquid tobacco extract, or the like.

[0039] The tobacco product to which the extracts of the invention are added can vary, and include any product configured or adapted to deliver tobacco or some component thereof to the user of the product. Exemplary tobacco products include smoking articles (e.g., cigarettes), smokeless tobacco products, and aerosol-generating devices that contain a tobacco material or other plant material that is not combusted during use.

[0040] Typically, the incorporation of the extract of the invention into a tobacco product will involve use of a tobacco material or non-tobacco plant material as a carrier for the extract, such as by absorbing the extract into the tobacco or other plant material or otherwise associating the extract with the carrier material, such as by adhesion of spray-dried particles of the extract on the carrier material. The types of tobacco that can serves as the carrier for the extracts of the

invention can vary, and can include any of the tobacco types discussed herein, including various cured tobacco materials (e.g., flue-cured or air-cured tobaccos) or portions thereof (e.g., tobacco lamina or tobacco stems). In one embodiment, the tobacco to which the extract is applied is a fermented tobacco material, and the extract is applied either before, during, or after the fermentation process. The tobacco material to which the extract is applied will typically be characterized as having a relatively low BaP level, such as many air-cured or flue-cured tobacco materials or tobacco materials pre-treated to reduce BaP level. The physical configuration of the tobacco material to which the extract is added can also vary, and can include tobacco materials in shredded or particulate form, or in the form of a sheet (e.g., reconstituted tobacco sheets) or in whole leaf form. The dry weight ratio of tobacco material to extract of the invention can vary, but is typically about 4:1 to about 1:4, about 2:1 to about 1:2, and often about 1.5:1 to about 1:1.5.

[0041] In one embodiment, the extract of the invention is used as a flavorful tobacco composition in the manufacture of smoking articles. For example, the extract prepared in accordance with the present invention can be mixed with casing materials and applied to tobacco as a casing ingredient (e.g., using the types of methods set forth in U.S. Pat. No. 4,819,668 to Shelar, which is incorporated herein by reference), incorporated into smoking articles as a top dressing ingredient, or incorporated into reconstituted tobacco materials (e.g., using the types of tobacco reconstitution processes generally set forth in U.S. Pat. Nos. 5,143,097 to Sohn; 5,159,942 to Brinkley et al.; 5,598,868 to Jakob; 5,715,844 to Young; 5,724,998 to Gellatly; and 6,216,706 to Kumar, which are incorporated herein by reference). Still further, the extracts of the invention can be incorporated into a cigarette filter (e.g., in the filter plug, plug wrap, or tipping paper) or incorporated into cigarette wrapping paper, preferably on the inside surface, during the cigarette manufacturing process.

[0042] Referring to FIG. **1**, there is shown a smoking article **10** in the form of a cigarette and possessing certain representative components of a smoking article that can contain the extract of the present invention. The cigarette **10** includes a generally cylindrical rod **12** of a charge or roll of smokable filler material (e.g., about 0.3 to about 1.0 g of smokable filler material such as tobacco material) contained in a circumscribing wrapping material **16**. The rod **12** is conventionally referred to as a "tobacco rod." The ends of the tobacco rod **12** are open to expose the smokable filler material. The cigarette **10** is shown as having one optional band **22** (e.g., a printed coating including a film-forming agent, such as starch, ethylcellulose, or sodium alginate) applied to the wrapping material **16**, and that band circumscribes the cigarette rod in a direction transverse to the longitudinal axis of the cigarette. The band **22** can be printed on the inner surface of the wrapping material (i.e., facing the smokable filler material), or less preferably, on the outer surface of the wrapping material.

[0043] At one end of the tobacco rod **12** is the lighting end **18**, and at the mouth end **20** is positioned a filter element **26**. The filter element **26** positioned adjacent one end of the tobacco rod **12** such that the filter element and tobacco rod are axially aligned in an end-to-end relationship, preferably abutting one another. Filter element **26** may have a generally cylindrical shape, and the diameter thereof may be essentially equal to the diameter of the tobacco rod. The ends of the filter element **26** permit the passage of air and smoke therethrough.

[0044] A ventilated or air diluted smoking article can be provided with an optional air dilution means, such as a series of perforations **30**, each of which extend through the tipping material and plug wrap. The optional perforations **30** can be made by various techniques known to those of ordinary skill in the art, such as laser perforation techniques. Alternatively, so-called off-line air dilution techniques can be used (e.g., through the use of porous paper plug wrap and pre-perforated tipping paper).

[0045] The extracts of the invention can also be incorporated into aerosol-generating devices that contain tobacco material (or some portion or component thereof) that is not intended to be combusted during use. Exemplary references that describe smoking articles of a type that generate flavored vapor, visible aerosol, or a mixture of flavored vapor and visible aerosol, include U.S. Pat. Nos. 3,258,015 to Ellis et al.; 3,356,094 to Ellis et al.; 3,516,417 to Moses; 4,347,855 to Lanzellotti et al.; 4,340,072 to Bolt et al.; 4,391,285 to Burnett et al.; 4,917,121 to Riehl et al.; 4,924,886 to Litzinger; and 5,060,676 to Hearn et al., all of which are incorporated by reference herein. Many of these types of smoking articles employ a combustible fuel source that is burned to provide an aerosol and/or to heat an aerosol-forming material. See, for example, U.S. Pat. Nos. 4,756,318 to Clearman et al.; 4,714,082 to Banerjee et al.; 4,771,795 to White et al.; 4,793,365 to Sensabaugh et al.; 4,917,128 to Clearman et al.; 4,961,438 to Korte; 4,966,171 to Serrano et al.; 4,969,476 to Bale et al.; 4,991,606 to Serrano et al.; 5,020,548 to Farrier et al.; 5,033,483 to Clearman et al.; 5,040,551 to Schlatter et al.; 5,050,621 to Creighton et al.; 5,065,776 to Lawson; 5,076,296 to Nystrom et al.; 5,076,297 to Farrier et al.; 5,099,861 to Clearman et al.; 5,105,835 to Drewett et al.; 5,105,837 to Barnes et al.; 5,115,820 to Hauser et al.; 5,148,821 to Best et al.; 5,159,940 to Hayward et al.; 5,178,167 to Riggs et al.; 5,183,062 to Clearman et al.; 5,211,684 to Shannon et al.; 5,240,014 to Deevi et al.; 5,240,016 to Nichols et al.; 5,345,955 to Clearman et al.; 5,551,451 to Riggs et al.; 5,595,577 to Bensalem et al.; 5,819,751 to Barnes et al.; 6,089,857 to Matsuura et al.; 6,095,152 to Beven et al; 6,578,584 to Beven; and 6,730,832 to Dominguez; which are incorporated herein by reference. Furthermore, certain types of cigarettes that employ carbonaceous fuel elements have been commercially marketed under the brand names "Premier" and "Eclipse" by R. J. Reynolds Tobacco Company. See, for example, those types of cigarettes described in *Chemical and Biological Studies on New Cigarette Prototypes that Heat Instead of Burn Tobacco*, R. J. Reynolds Tobacco Company Monograph (1988) and *Inhalation Toxicology,* 12:5, p. 1-58 (2000). Addition types of aerosol-generating devices are described in U.S. Pat. No. 7,726,320 to Robinson et al. and US Pat. Appl. Pub. Nos. 2006/0196518 and 2007/0267031, both to Hon, all of which are incorporated by reference herein.

[0046] The extracts of the invention can be incorporated into smokeless tobacco products, such as loose moist snuff (e.g., snus), loose dry snuff, chewing tobacco, pelletized tobacco pieces (e.g., having the shapes of pills, tablets, spheres, coins, beads, obloids or beans), extruded or formed tobacco strips, pieces, rods, cylinders or sticks, finely divided ground powders, finely divided or milled agglomerates of powdered pieces and components, flake-like pieces, molded processed tobacco pieces, pieces of tobacco-containing gum, rolls of tape-like films, readily water-dissolvable or water-dispersible films or strips (e.g., US Pat. App. Pub. No. 2006/0198873 to Chan et al.), or capsule-like materials possessing

an outer shell (e.g., a pliable or hard outer shell that can be clear, colorless, translucent or highly colored in nature) and an inner region possessing tobacco or tobacco flavor (e.g., a Newtonian fluid or a thixotropic fluid incorporating tobacco of some form). Various types of smokeless tobacco products are set forth in U.S. Pat. Nos. 1,376,586 to Schwartz; 3,696,917 to Levi; 4,513,756 to Pittman et al.; 4,528,993 to Sensabaugh, Jr. et al.; 4,624,269 to Story et al.; 4,987,907 to Townsend; 5,092,352 to Sprinkle, III et al.; and 5,387,416 to White et al.; US Pat. App. Pub. Nos. 2005/0244521 to Strickland et al. and **2008/0196730** to Engstrom et al.; PCT WO 04/095959 to Arnarp et al.; PCT WO 05/063060 to Atchley et al.; PCT WO 05/016036 to Bjorkholm; and PCT WO 05/041699 to Quinter et al., each of which is incorporated herein by reference. See also, the types of smokeless tobacco formulations, ingredients, and processing methodologies set forth in U.S. Pat. Nos. 6,953,040 to Atchley et al. and 7,032,601 to Atchley et al.; US Pat. Appl. Pub. Nos. 2002/0162562 to Williams; 2002/0162563 to Williams; 2003/0070687 to Atchley et al.; 2004/0020503 to Williams, 2005/0178398 to Breslin et al.; 2006/0191548 to Strickland et al.; 2007/0062549 to Holton, Jr. et al.; 2007/0186941 to Holton, Jr. et al.; 2007/0186942 to Strickland et al.; 2008/0029110 to Dube et al.; 2008/0029116 to Robinson et al.; 2008/0029117 to Mua et al.; 2008/0173317 to Robinson et al.; 2008/0209586 to Neilsen et al.; 2010/0018541 to Gerardi et al.; 2010/0018540 to Doolittle et al.; and 2010/0116281 to Marshall et al., each of which is incorporated herein by reference.

[0047] Referring to FIG. **2**, a representative snus type of tobacco product comprising the extract of the present invention is shown. In particular, FIG. **2** illustrates a smokeless tobacco product **40** having a water-permeable outer pouch **42** containing a smokeless tobacco composition **44**, wherein the tobacco composition includes a shredded or particulate tobacco material serving as a carrier for the extract of the invention.

[0048] Many exemplary smokeless tobacco compositions that can benefit from use of the extract of the invention comprise shredded or particulate tobacco material that can serve as a carrier for the flavorful extract of the invention. The smokeless tobacco compositions of the invention can also include a water-soluble polymeric binder material and optionally other ingredients that provide a dissolvable composition that will slowly disintegrate in the oral cavity during use. In certain embodiments, the smokeless tobacco composition can include lipid components that provide a meltable composition that melts (as opposed to merely dissolving) in the oral cavity, such as compositions set forth in U.S. application Ser. No. 12/854,342 to Cantrell et al., filed Aug. 11, 2010, and which is incorporated by reference herein.

[0049] In one particular smokeless tobacco product embodiment, the extract of the invention is added to a non-tobacco plant material, such as a plant material selected from potato, beet (e.g., sugar beet), grain, pea, apple, and the like. The non-tobacco plant material can be used in a processed form. In certain preferred embodiments, the non-tobacco plant material can be used in an extracted form, and as such, at least a portion of certain solvent soluble components are removed from that material. The non-tobacco extracted plant material is typically highly extracted, meaning a substantial amount of the aqueous soluble portion of the plant material has been removed. For example, a water-extracted pulp can be obtained by extracting significant amounts of water soluble components from the plant material. For example, certain water-extracted plant materials can comprise less than about 20 weight percent, and often less than about 10 weight percent water soluble components; and depending upon processing conditions, certain water-extracted plant materials can be virtually free of water soluble components (e.g., less than about 1 weight percent water soluble components). One preferred water-extracted plant material is water extracted sugar beet pulp (e.g., water extracted sugar beet leaf pulp). The extracted non-tobacco plant material is typically used in a form that can be described as shredded, ground, granulated, fine particulate, or powder form. The dry weight ratio of non-tobacco plant material to tobacco extract of the invention is typically about 4:1 to about 1:4, about 2:1 to about 1:2, and often about 1.5:1 to about 1:1.5. Smokeless tobacco products of this type are set forth in U.S. application Ser. No. 12/756,656 to Beeson et al, filed Apr. 8, 2010, which is incorporated by reference herein.

[0050] Further additives can be admixed with, or otherwise incorporated within, the smokeless tobacco compositions according to the invention. The additives can be artificial, or can be obtained or derived from herbal or biological sources. Exemplary types of additives include salts (e.g., sodium chloride, potassium chloride, sodium citrate, potassium citrate, sodium acetate, potassium acetate, and the like), natural sweeteners (e.g., fructose, sucrose, glucose, maltose, vanillin, ethylvanillin glucoside, mannose, galactose, lactose, and the like), artificial sweeteners (e.g., sucralose, saccharin, aspartame, acesulfame K, neotame and the like), organic and inorganic fillers (e.g., grains, processed grains, puffed grains, maltodextrin, dextrose, calcium carbonate, calcium phosphate, corn starch, lactose, manitol, xylitol, sorbitol, finely divided cellulose, and the like), binders (e.g., povidone, sodium carboxymethylcellulose and other modified cellulosic types of binders, sodium alginate, xanthan gum, starch-based binders, gum arabic, lecithin, and the like), pH adjusters or buffering agents (e.g., metal hydroxides, preferably alkali metal hydroxides such as sodium hydroxide and potassium hydroxide, and other alkali metal buffers such as metal carbonates, preferably potassium carbonate or sodium carbonate, or metal bicarbonates such as sodium bicarbonate, and the like), colorants (e.g., dyes and pigments, including caramel coloring and titanium dioxide, and the like), humectants (e.g., glycerin, propylene glycol, and the like), oral care additives (e.g., thyme oil, eucalyptus oil, and zinc), preservatives (e.g., potassium sorbate, and the like), syrups (e.g., honey, high fructose corn syrup, and the like), disintegration aids (e.g., microcrystalline cellulose, croscarmellose sodium, crospovidone, sodium starch glycolate, pregelatinized corn starch, and the like), flavorant and flavoring mixtures, antioxidants, and mixtures thereof. If desired, the additive can be microencapsulated as set forth in US Patent Appl. Pub. No. 2008/0029110 to Dube et al., which is incorporated by reference herein.

[0051] The amount of tobacco extract that is added to a tobacco composition or tobacco product can vary, and will depend in part on the desired function of the extract, the chemical makeup of the extract, and the type of tobacco composition or product to which the extract is added. Unless otherwise indicated herein, the amount added to a tobacco product will typically not exceed about 25 weight percent based on the total dry weight of the tobacco composition to which the extract is added. When the extract is employed within a smoking article, the amount of extract will typically be at least about 5 ppm, generally at least about 10 ppm, and

often at least about 100 ppm, based on the total dry weight of the tobacco material within the smoking article; but will typically be less than about 5 percent, generally less than about 2 percent, and often less than about 1 percent, based on the total dry weight of the tobacco material within the smoking article. When the extract is employed within a smokeless tobacco product, the amount of extract will typically be at least about 5 ppm, generally at least about 10 ppm, and often at least about 100 ppm, based on the total dry weight of the tobacco material within the smokeless tobacco product; but will typically be less than about 10 percent, generally less than about 5 percent, and often less than about 1 percent, based on the total dry weight of the tobacco material within the smokeless tobacco product.

EXPERIMENTAL

[0052] Aspects of the present invention are more fully illustrated by the following examples, which are set forth to illustrate certain aspects of the present invention and are not to be construed as limiting thereof. Unless otherwise noted, all parts and percentages are by weight.

Example 1

[0053] A fire-cured tobacco is extracted using water. A typical extraction process combines milled tobacco (e.g., 100% pass 0.250 inch screen) with water at a ratio of 8 parts water to 1 part tobacco at a temperature of about 72° C. The mixture is agitated for one hour and the suspended solids removed by filtration using a 5 micron filter bag. The resulting tobacco extract retains the aroma and sensory characteristics of the fire-cured tobacco. The original fire-cured tobacco has a BaP level prior to extraction of about 150 to 800 parts per billion and the separated liquid extract has a BaP level of less than about 1 part per billion.

Example 2

[0054] An air-cured tobacco is subjected to the same extraction process as set forth in Example 1. The original air-cured tobacco has a BaP level prior to extraction of about 10-150 parts per billion and the separated liquid extract has a BaP level of less than about 1 part per billion.

[0055] Many modifications and other embodiments of the invention will come to mind to one skilled in the art to which this invention pertains having the benefit of the teachings presented in the foregoing description. Therefore, it is to be understood that the invention is not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

We claim:

1. A tobacco product comprising a flavorful tobacco composition in the form of an extract of a fire-cured tobacco material.

2. The tobacco product of claim **1**, wherein the flavorful tobacco composition is an aqueous extract of a fire-cured tobacco material.

3. The tobacco product of claim **1**, wherein the flavorful tobacco composition has distinctive sensory characteristics associated with fire-cured tobacco and a reduced benzo[a] pyrene concentration as compared to an unextracted fire-cured tobacco material.

4. The tobacco product of claim **3**, wherein the concentration of benzo[a]pyrene in the extract of a fire-cured tobacco material is no more than about 10 ppb.

5. The tobacco product of claim **4**, wherein the concentration of benzo[a]pyrene in the extract of a fire-cured tobacco material is no more than about 5 ppb.

6. The tobacco product of claim **1**, further comprising a tobacco material or a non-tobacco plant material as a carrier for the extract of a fire-cured tobacco material.

7. The tobacco product of claim **1**, wherein the tobacco product is in the form of a smokeless tobacco composition.

8. The tobacco product of claim **7**, wherein the form of the smokeless tobacco composition is selected from the group consisting of moist snuff, dry snuff, chewing tobacco, tobacco-containing gums, and dissolvable or meltable tobacco products.

9. The tobacco product of claim **1**, wherein the tobacco product is in the form of a smoking article.

10. The tobacco product of claim **1**, wherein the tobacco product is in the form of an aerosol-generating device configured for non-combustion of plant material.

11. The tobacco product of claim **1**, wherein the extract of a fire-cured tobacco material is in combination with a fire-cured tobacco extracted pulp pre-treated to reduce benzo[a] pyrene concentration.

12. A method of producing a flavorful tobacco composition for use in a tobacco product, the flavorful tobacco composition characterized by sensory attributes associated with a cured tobacco material and a reduced benzo[a]pyrene concentration, comprising:

mixing a cured tobacco material having a first benzo[a] pyrene concentration with a polar protic solvent to produce a slurry, the slurry providing intimate contact between the cured tobacco material and the polar protic solvent;

maintaining the slurry for a time and at a temperature sufficient to form an extract comprising components of the cured tobacco material soluble in the polar protic solvent, the extract exhibiting a second benzo[a]pyrene concentration lower than the first benzo[a]pyrene concentration; and

separating the extract from a residual pulp material comprising components of the cured tobacco material that are insoluble in the polar protic solvent.

13. The method of claim **12**, further comprising introducing the separated extract into a tobacco product as a flavorful tobacco composition.

14. The method of claim **13**, wherein the separated extract is applied to a tobacco material or non-tobacco plant material to form a treated material, and wherein the treated material is incorporated into the tobacco product.

15. The method of claim **13**, wherein the tobacco product is selected form the group consisting of smoking articles, smokeless tobacco products, and aerosol-generating devices configured for non-combustion of plant material.

16. The method of claim **15**, wherein the tobacco product is a smokeless tobacco composition selected from the group consisting of moist snuff, dry snuff, chewing tobacco, tobacco-containing gums, and dissolvable or meltable tobacco products.

17. The method of claim **12**, further comprising the step of concentrating the separated extract by removing at least a portion of the polar protic solvent.

18. The method of claim **12**, wherein the cured tobacco material is a fire-cured tobacco material.

19. The method of claim **18**, wherein the separated extract is characterized by sensory attributes associated with fire-cured tobacco material.

20. The method of claim **12**, wherein the first benzo[a] pyrene concentration is at least about 100 ppb and the second benzo[a]pyrene concentration is less than about 10 ppb.

21. The method of claim **12**, wherein the polar protic solvent is water or a co-solvent mixture comprising water.

22. A process for preparing a composition suitable for use as a smokeless tobacco composition, comprising:

mixing a fire-cured tobacco material having a first benzo [a]pyrene concentration with water to produce an aqueous slurry, the slurry providing intimate contact between the fire-cured tobacco material and the water;

maintaining the slurry for a time and at a temperature sufficient to form a fire-cured tobacco extract comprising flavorful and aromatic components of the fire-cured tobacco material soluble in water, the aqueous fire-cured tobacco extract exhibiting a second benzo[a]pyrene concentration lower than the first benzo[a]pyrene concentration; separating the aqueous fire-cured tobacco extract from a residual pulp material comprising components of the fire-cured tobacco material that are insoluble in water; and

mixing the aqueous fire-cured tobacco extract with a tobacco or non-tobacco plant material to form a smokeless tobacco composition.

23. The method of claim **22**, wherein the first benzo[a] pyrene concentration is at least about 100 ppb and the second benzo[a]pyrene concentration is less than about 10 ppb.

24. The method of claim **22**, wherein the smokeless tobacco composition is selected from the group consisting of moist snuff, dry snuff, chewing tobacco, tobacco-containing gums, and dissolvable or meltable tobacco products.

* * * * *