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(54) **TOBACCO PRODUCT AND METHOD FOR MANUFACTURE**

TABAKPRODUKT UND VERFAHREN ZU SEINER HERSTELLUNG

PRODUIT DE TABAC ET PROCÉDÉ DE FABRICATION DE CELUI-CI

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(73) Proprietor: **R.J. REYNOLDS TOBACCO COMPANY**
Winston-Salem, NC 27101 (US)

(72) Inventors:
- **MUA, John-Paul**
  Advance
  North Carolina 27006 (US)
- **BENFORD, Matthew William**
  Winston-Salem
  North Carolina 27107 (US)
- **MONSALUD, JR., Luis R.**
  Kernersville
  North Carolina 27284 (US)

(74) Representative: **Hoeger, Stellrecht & Partner Patentanwälte mbB**
Uhlandstrasse 14c
70182 Stuttgart (DE)

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EP-A2- 0 559 450
WO-A1-2009/048522
FR-A1- 2 276 007
US-A1- 2007 186 941

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to products made of derived from tobacco, or that otherwise incorporate tobacco, and that are intended for human consumption.

BACKGROUND OF THE INVENTION

[0002] WO 2009/048522 A1 discloses a smokeless tobacco product comprising a sheet made by extruding a hot melt shaping a nonaqeous composition comprising at least one thermoplastic polymer and tobacco, the sheet comprising a matrix comprising the at least one thermoplastic polymer and the tobacco distributed in the matrix, the matrix being soluble in a user's mouth and resulting in sustained release of nicotine to the user.

[0003] EP 0 339 658 A2 discloses a shredded tobacco leaf pallet comprising tobacco leaf shreds bound together with a nicotine-non-absorptive thermoplastic binder while retaining air permeability.

[0004] US 2007/0186941 A1 discloses a smokeless tobacco product configured for insertion into the mouth of a user of that product, the tobacco product comprising a water-permeable pouch containing a tobacco formulation, the tobacco formulation including granular tobacco, and at least one capsule disposed in the pouch.

[0005] Cigarettes, cigars, and pipes are popular smoking articles that employ tobacco in various forms. Such smoking articles are used by heating or burning tobacco, and aerosol (e.g., smoke) 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.

[0006] 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 Sensabauch, 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.; U.S. Pat. Appl. Pub. No. 2005/0244521 to Strickland et al.; PCT WO 04/095959 to Arnarp et al.; PCT WO 05/063060 to Atchley et al.; PCT WO 05/004480 to Engstrom; PCT WO 05/016036 to Bjorkholm; and PCT WO 05/041699 to Quinter et al.. See also, for example, 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.; U.S. Pat. Appl. Pub. Nos. 2002/0162562 to Williams; 2002/0162563 to Williams; 2003/0070687 to Atchley et al.; 2004/0020503 to Williams; U.S. Pat. Appl. Pub. Nos. 2005/0178398 to Breskin 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.; 2009/0095313 to Fuisz and 2009/0293889 to Kumar et al.; and US Pat. Appl. Serial No. 12/476,621, filed June 2, 2009 to Chen et al.. One type of smokeless tobacco product is referred to as "snuff." Snuff typically is formulated in "moist" or "dry" forms. Representative types of moist snuff products, commonly referred to as "snus," are manufactured in Europe, particularly in Sweden, by or through companies such as Swedish Match AB, Fiedler & Lundgren AB, Gustavus AB, Skandinavisk Tobakskompagni A/S, and Rocker Production AB. Snus products available in the U.S.A. have been marketed under the tradenames Camel Snus Frost, Camel Snus Original and Camel Snus Spice by R. J. Reynolds Tobacco Company. Representative smokeless tobacco products also have been marketed under the tradenames Oliver Twist by House of Oliver Twist A/S; Copenhagen, Skoal, SkoalDry, Rooster, Red Seal, Husky, and Revel by U.S. Smokeless Tobacco Co.; "taboka" by Philip Morris USA; and Levi Garrett, Peachy, Taylor's Pride, Kodiak, Hawken Wintergreen, Grizzly, Dental, Kentucky King, and Mammoth Cave by Conwood Sales Co., L.P. See also, 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.

[0007] It would be desirable to provide in an efficient and effective manner enjoyable forms of tobacco products, and to provide processes for preparing formed or extruded types of tobacco products.

SUMMARY OF THE INVENTION

[0008] The present invention relates to products made or derived from tobacco, or that otherwise incorporate tobacco, and are intended for human consumption. Of particular interest, are tobacco products, compositions or formulations, and methods for providing, producing or assembling those tobacco products, compositions or formulations. Certain highly preferred tobacco products can be used in a so-called smokeless form, and are formulated and/or formed so as to be suitable for insertion into the mouth of the smokeless tobacco user.

[0009] The tobacco products incorporate binder systems. As such, tobacco materials (which can have various forms, and which can be comprised of various types of tobacco), as well as other suitable ingredients, are processed in the presence of a binder system during production or assembly. Of particular interest is a binder system that possesses or

exhibits thermoplastic properties, characteristics or behaviors. The binder system can incorporate at least one type of binding agent that exhibits thermoplastic properties, characteristics or behaviors (e.g., the binding agent can be composed of at least one thermoplastic polymeric material). Additionally, the binder system can incorporate ingredients or materials so as to provide a binding agent that exhibits thermoplastic characteristics (e.g., the binding agent can be composed of at least one thermoplastic binding material in combination with a plasticizer). In certain embodiments, the thermoplastic binder system can be composed of at least one thermoplastic polymer material and a thermoplastic binding material in combination with at least one plasticizer. The amount of thermoplastic polymeric material employed to produce a representative processed tobacco product can be no more than about 20 percent of the final formed product or formulation, on a dry weight basis. Thus, the present invention in one regard relates to a tobacco product in a form suitable for insertion into the mouth of a user, and comprises tobacco and thermoplastic binder system, wherein the amount of thermoplastic binder system being present in an amount between about 10 weight percent to about 30 weight percent of the dry weight of the tobacco product. Yet other preferred tobacco products can incorporate a binder system and a plasticizer blend. The plasticizer blend can be premixed, heated, and added to a tobacco material and/or binder system to provide a chewable tobacco product.

[0010] Certain preferred methods for providing, producing or assembling those tobacco products involve contacting tobacco, together with other desired ingredients, in the presence of a binder system, and forming the resulting mixture into a shape. In certain highly preferred embodiments, the method comprises process steps that involve extruding (or otherwise physically forming, such as by molding or casting) the mixture into the form of a strip, a sheet, a rod, a tube, or other desired shape. The mixing of the tobacco formulation involves contacting the tobacco being processed with a binder system that exhibits thermoplastic properties. The processing conditions associated with the production of the tobacco product are controlled so as to efficiently and effectively provide a tobacco product having desired physical and sensory characteristics (e.g., by controlling the temperature and/or pressure experienced by the mixture during processing conditions, the moisture and/or other solvent content of the mixture being processed, mixing conditions, or the like). Of particular interest are processing conditions that most preferably involve exposing a tobacco formulation to a temperature of less than about 100°C during processing conditions (such as those experienced during extrusion), that involve use of a binding agent that can be employed in relatively low amounts, that involve use of a binding agent that exhibits desirable thermoplastic behavior (and hence can act to provide good physical integrity to the formed tobacco product) at processing conditions of less than about 100°C, and that involve the use of relatively low to moderate amounts of liquid processing aids (e.g., water or other liquid carriers). Thus, the present invention in one regard relates to a method for making a smokeless tobacco product comprising the steps of contacting tobacco material and thermoplastic binder system to provide a mixture; subjecting the mixture to elevated temperature; forming the mixture into a desired shape of a tobacco product; and cooling the tobacco product. In another aspect, a method can comprise the step of mixing a plasticizer blend, heating the plasticizer blend, and then contacting the plasticizer blend with the mixture of tobacco material and thermoplastic binder system.

[0011] As will be realized by those of skill in the art, many different embodiments of tobacco products, and methods of making or assembling a tobacco product, are possible. Additional uses, advantages, and features of the tobacco product and methods of its manufacture are set forth in the illustrative embodiments in the detailed description herein and will become more apparent to those skilled in the art upon examination of the following.

DETAILED DESCRIPTION OF THE INVENTION

[0012] The products, compositions, formulations, and methods described herein may 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).

[0013] Tobaccos used as tobacco materials for the preparation of tobacco products, compositions or formulations may vary. The tobaccos may include types of tobaccos such as flue-cured tobacco, burley tobacco, sun-cured tobacco (e.g., Oriental tobacco or Indian Kurnool), Maryland tobacco, dark tobacco, dark-fired tobacco, Indian air cured, dark air cured (e.g., passanda, cubano, jatin and bezuki tobaccos) or light air cured (e.g., North Wisconsin and galpoa tobaccos), and *Rustica* tobaccos, as well as other rare or specialty tobaccos or even green or uncured tobaccos. Descriptions of various types of tobaccos, growing practices, harvesting practices and curing practices are set forth in Tobacco Production, Chemistry and Technology, Davis et al. (Eds.) (1999). See, also, the types of tobaccos that are set forth in U.S. Pat. Nos. 4,660,577 to Sensabaugh, Jr. et al.; 5,387,416 to White et al.; and 6,730,832 to Dominguez et al., U.S. Patent Appl. Pub. Nos. 2006/0037623 to Lawrence, Jr. and PCT WO 2008/103935 to Nielsen et al.. Most preferably, the tobacco materials are those that have been appropriately cured and aged. Especially preferred techniques and conditions for curing flue-cured tobacco are set forth in Nestor et al., Beitrage Tabakforsch. Int., 20 (2003) 467-475 and U.S. Pat. No.

6,895,974 to Peele. Representative techniques and conditions for air curing tobacco are set forth in Roton et al., Beitrage Tabakforsch. Int., 21 (2005) 305-320 and Staaf et al., Beitrage Tabakforsch. Int., 21 (2005) 321-330. Certain types of unusual or rare tobaccos can be sun cured. Representative Oriental tobaccos include katerini, prelip, komotini, xanthi and yambol tobaccos. Tobacco compositions including dark air cured tobacco are set forth in U.S. Patent Appl. Pub. No. 2008/0245377 to Marshall et al.. Tobacco products may incorporate a single type of tobacco (e.g., in a so-called "straight grade" form). For example, the tobacco may be composed solely of flue-cured tobacco (e.g., all of the tobacco may be composed, or derived from, either flue-cured tobacco lamina or a mixture of flue-cured tobacco lamina and flue-cured tobacco stem). Tobacco products also (though most preferably) may have a so-called "blended" form. For example, the tobacco products may include composed of a mixture of parts or pieces of flue-cured, burley (e.g., Malawi burley tobacco) and Oriental tobaccos (e.g., as tobacco composed of, or derived from, tobacco lamina, or a mixture of tobacco lamina and tobacco stem). For example, a representative blend may incorporate about 30 parts to about 70 parts burley tobacco (e.g., lamina, or lamina and stem), and about 30 parts to about 70 parts flue cured tobacco (e.g., stem, lamina, or lamina and stem) on a dry weight basis. Other exemplary tobacco blends incorporate on a dry weight basis about 75 parts flue-cured tobacco, about 15 parts burley tobacco, and about 10 parts Oriental tobacco; or about 65 parts flue-cured tobacco, about 25 parts burley tobacco, and about 10 parts Oriental tobacco; or about 65 parts flue-cured tobacco, about 10 parts burley tobacco, and about 25 parts Oriental tobacco. Other exemplary tobacco blends incorporate about 20 to about 30 parts Oriental tobacco and about 70 to about 80 parts flue-cured tobacco.

[0014] The tobacco that is processed in accordance with the present invention can have the form of previously processed tobacco parts or pieces, cured and aged tobacco in essentially natural lamina or stem form, tobacco extracts, extracted tobacco pulp (e.g., using water as a solvent), or a mixture of the foregoing (e.g., a mixture that combines extracted tobacco pulp with granulated cured and aged natural tobacco lamina, or a mixture that combines granulated tobacco lamina and stems with an aqueous tobacco extract). Portions of the tobaccos within the tobacco product may have processed forms, such as processed tobacco stems (e.g., cut-rolled stems, cut-rolled-expanded stems or cut-puffed stems), or volume expanded tobacco (e.g., puffed tobacco, such as dry ice expanded tobacco (DIET)). See, for example, the tobacco expansion processes set forth in U.S. Pat. Nos. 4,340,073 to de la Burde et al.; 5,259,403 to Guy et al.; and 5,908,032 to Poindexter, et al.; and U.S. Patent Appl. Pub. No. 2004/0182404 to Poindexter, et al.. In addition, the tobacco product optionally may incorporate tobacco that has been fermented. See, also, the types of tobacco processing techniques set forth in PCT WO 05/063060 to Atchley et al.. The tobacco that is processed most preferably includes tobacco lamina, or tobacco lamina and stem mixture. Tobacco mixtures incorporating a predominant amount of tobacco lamina, relative to tobacco stem, are preferred. Most preferably, the tobacco lamina and stem are used in an unextracted form, that is, such that the extractable portion (e.g., the water soluble portion) is present within the unextractable portion (e.g., the tobacco pulp) in a manner comparable to that of natural tobacco provided in a cured and aged form.

[0015] The tobacco that is processed can have a shredded, ground, granulated, fine particulate, or powder form. The manner by which the tobacco is provided in a finely divided or powder type of form may vary. Preferably, tobacco parts or pieces are comminuted, ground or pulverized into a powder type of form using equipment and techniques for grinding, milling, or the like. Most preferably, the tobacco is relatively dry in form during grinding or milling, using equipment such as hammer mills, cutter heads, air control mills, or the like. For example, tobacco parts or pieces may be ground or milled when the moisture content thereof is less than about 15 weight percent to less than about 5 weight percent.

[0016] Most preferably, the tobacco that is processed can be employed in the form of parts or pieces that have an average particle size less than that of the parts or pieces of shredded tobacco used in so-called "fine cut" tobacco products. Typically, the very finely divided tobacco particles or pieces can be sized to pass through a screen of about 18 Tyler mesh, generally can be sized to pass a screen of about 20 Tyler mesh, often can be sized to pass through a screen of about 50 Tyler mesh, frequently can be sized to pass through a screen of about 60 Tyler mesh, may even be sized to pass through a screen of 100 Tyler mesh, and further may be sized so as to pass through a screen of 200 Tyler mesh. If desired, air classification equipment may be used to ensure that small sized tobacco particles of the desired sizes, or range of sizes, may be collected. In one embodiment, the tobacco material is in particulate form sized to pass through an 18 Tyler mesh, but not through a 60 Tyler mesh. If desired, differently sized pieces of granulated tobacco may be mixed together. In some products or formulations, very finely divided tobacco particles or pieces have a particle size greater than -8 Tyler mesh, often -8 to +100 Tyler mesh, frequently -18 to +60 Tyler mesh. In other products or formulations, very finely divided tobacco particles or powders suitable for smokeless products described herein can have a particle size less than -8 Tyler mesh, often +100 to +250 Tyler mesh, and frequently +120 to +280 Tyler mesh.

[0017] Tobacco extracts may be used as components of the tobacco product. A tobacco extract can be used in solid form (e.g., spray-dried or freeze-dried form), in liquid form, in semi-solid form, or the like. Exemplary tobacco extracts and extraction techniques are set forth, for example, in U.S. Pat. Nos. 4,150,677 to Osborne, Jr. et al.; 4,967,771 to Fagg et al.; 5,005,593 to Fagg et al.; 5,148,819 to Fagg; and 5,435,325 to Clapp et al.. Various tobacco extraction and reconstitution methodologies are set forth in U.S. Pat. Nos. 5,065,775 to Fagg; 5,360,022 to Newton; and 5,131,414 to Fagg. See also, the tobacco extract treatment methodologies set forth in U.S. Pat. Nos. 5,131,415 to Munoz et al. and

5,318,050 to Gonzalez-Parra. The tobacco materials that are processed optionally can incorporate reconstituted tobaccos, and as such, tobacco formulations that are processed can be absent of reconstituted tobacco ingredient components. However, suitable known reconstituted tobacco processing techniques, such as paper-making techniques or casting-type processes, can be employed to provide such optional tobacco ingredient components. See, for example, the types of paper-making processes set forth in U.S. Pat. Nos. 3,398,754 to Tughan; 3,847,164 to Mattina; 4,131,117 to Kite; 4,270,552 to Jenkins; 4,308,877 to Mattina; 4,341,228 to Keritsis; 4,421,126 to Gellatly; 4,706,692 to Gellatly; 4,962,774 to Thomasson; 4,941,484 to Clapp; 4,987,906 to Young; 5,056,537 to Brown; 5,143,097 to Sohn; 5,159,942 to Brinkley et al.; 5,325,877 to Young; 5,445,169 to Brinkley; 5,501,237 to Young; 5,533,530 to Young. See, for example, the casting processes set forth in U.S. Pat. Nos. 3,353,541 to Hind; 3,399,454 to Hind; 3,483,874 to Hind; 3,760,815 to Deszyck; 4,674,519 to Keritsis; 4,972,854 to Kiernan; 5,023,354 to Hickle; 5,099,864 to Young; 5,101,839 to Jakob; 5,203,354 to Hickle; 5,327,917 to Lekwauwa; 5,339,838 to Young; 5,598,868 to Jakob; 5,715,844 to Young; 5,724,998 to Gellatly; and 6,216,706 to Kumar; and EPO 565360; EPO 1055375 and PCT WO 98/01233. If desired, prior to preparation of the tobacco product, the parts or pieces of tobacco material may be irradiated, or those parts and pieces may be pasteurized, or otherwise subjected to controlled heat treatment. Additionally, if desired, after preparation of all or a portion of a tobacco formulation, the component materials may be irradiated, or those component materials may be pasteurized, or otherwise subjected to controlled heat treatment. For example, a formulation may be prepared, followed by irradiation or pasteurization, and then flavoring ingredients and other additional components may be incorporated within the formulation. Alternatively, the tobacco product can be irradiated or pasteurized after the tobacco formulation has been processed (e.g., after an extruded tobacco product is formed, or after extruded product is sub-divided into a desired size and incorporated within a moisture-permeable packet or pouch so as to provide individual containers of snus-type smokeless tobacco product).

[0018] The tobacco materials also can be subject to other types of pre-treatment conditions prior to being used in the process steps of the present invention. For example, the tobacco materials can be treated to alter the physical or sensory characteristics of the of the tobacco material. In one regard, the tobacco material can be moistened or reordered. In another regard, the tobacco material can be pre-treated by treatment involving the application of heat, steam, cooking, or the like. In another regard, various additional components, such as those of the type set forth hereinafter, can be combined with the tobacco material during pre-treatment processing conditions (e.g., such as conditions involving heat treatment). In yet another regard, the tobacco material can be subjected to treatment processes involving the use of materials having acidic or basic characteristics. In still another regard, the tobacco material can be treated in the manner set forth in US Pat. Appl. Serial No. 12/476,621, filed June 2, 2009 to Chen et al.. The tobacco materials that are processed can be processed in combination with at least one additional component. For example, the tobacco used for the manufacture of the tobacco product also can be processed, blended, formulated, combined and mixed with other materials or ingredients. For example, the tobacco composition can incorporate salts, sweeteners, binders, colorants, pH adjusters, buffering agents, fillers, flavoring agents, disintegration aids, antioxidants, humectants, and preservatives. See, for example, those representative components, combination of components, relative amounts of those components and ingredients relative to tobacco, and manners and methods for employing those components, set forth U.S. Pat. No. 5,387,416 to White et al.; U.S. Pat. App. Pub. Nos. 2005/0244521 to Strickland et al.; 2008/0029110 to Dube et al.; 2009/0293889 to Kumar et al.; US Pat. Appl. Serial No. 12/476,621, filed June 2, 2009 to Chen et al.; and PCT WO 05/041699 to Quinter et al.. The sensory attributes of smokeless tobacco can also be enhanced by incorporation of certain flavoring materials. Exemplary flavoring agents or flavorants that can be used are components, or suitable combinations of those components, that act to alter the bitterness, sweetness, sourness, or saltiness of the smokeless tobacco product, enhance the perceived dryness or moistness of the formulation, or the degree of tobacco taste exhibited by the formulation. Types of flavoring agents 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, mannose, galactose, lactose, and the like), artificial sweeteners (e.g., sucralose, saccharin, aspartame, acesulfame K, neotame, and the like); and mixtures thereof. Flavoring agents may be natural or synthetic, and the character of these flavors imparted thereby may be described, without limitation, as fresh, sweet, herbal, confectionary, floral, fruity or spice. Specific types of flavors include, but are not limited to, vanilla, coffee, chocolate/cocoa, cream, mint, spearmint, menthol, peppermint, wintergreen, eucalyptus, lavender, cardamon, nutmeg, cinnamon, clove, cascarilla, sandalwood, honey, jasmine, ginger, anise, sage, licorice, lemon, orange, apple, peach, lime, cherry, strawberry, and any combinations thereof. See also, for example, Leffingwell et al., Tobacco Flavoring for Smoking Products, R. J. Reynolds Tobacco Company (1972), U.S. 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.; and 2008/0209586 to Neilsen et al.. The amount of flavoring agents utilized within the tobacco product can vary, but is typically up to about 10 dry weight percent, and certain embodiments are characterized by a total flavoring agent content of at least about 0.5 dry weight percent, such as about 1 to about 10 dry weight percent. Combinations of flavorants are often may be

used (e.g., about 0.1 to about 2 dry weight percent of an artificial sweetener and about 0.5 to about 8 dry weight percent of sodium chloride, based on the total dry weight of the tobacco product).

[0019] Exemplary filler materials include vegetable fiber materials such as sugar beet fiber materials (e.g., FIBREX® brand filler available from International Fiber Corporation), oats or other cereal grain (including processed or puffed grains), bran fibers, starch, or other modified or natural cellulosic materials such as microcrystalline cellulose. Additional specific examples include corn starch, maltodextrin, dextrose, calcium carbonate, calcium phosphate, lactose, manitol, xylitol, and sorbitol. An example of a commercially available maltrodextrin that can be used is Maltrin 10 DE available from Corn Products International. The amount of filler utilized in the tobacco composition or formulation can vary, but can be typically up to about 60 dry weight percent, and certain embodiments are characterized by a filler content of at least about 10 dry weight percent, such as about 20 to about 50 dry weight percent. Combinations of fillers may be used (e.g., a mixture composed of about 2 to about 8 dry weight percent of calcium carbonate, about 10 to about 20 dry weight percent of rice flour, and about 10 to about 20 dry weight percent of maltodextrin, based on the total dry weight of the tobacco product).

[0020] Preferred pH adjusters or buffering agents provide and/or buffer within a pH range of about 6 to about 10, and exemplary pH adjusting or buffering agents include metal hydroxides, metal carbonates, metal bicarbonates, and mixtures thereof. Specific exemplary materials include sodium hydroxide, potassium hydroxide, potassium carbonate, sodium carbonate, and sodium bicarbonate. The amount of pH adjuster or buffering agent utilized in the tobacco formulation can vary, but is typically at least about 0.05 dry weight percent, but up to about 5 dry weight percent, based on the total dry weight of the tobacco product. An exemplary amount of pH adjuster or buffering agent is about 1 to about 5 dry weight percent, based on the total weight of the tobacco product.

[0021] Exemplary colorants include various dyes and pigments. For example, suitable colorants can include caramel coloring, titanium dioxide, beta carotene, blackcurrant, annatto, grape skin, canthaxanthin, carrot powders or extracts, or the like. The amount of colorant utilized in the tobacco formulation can vary, but is typically at least about 0.1 dry weight percent, but up to about 5 dry weight percent, based on the total dry weight of the tobacco product. An exemplary amount of colorant is about 0.5 to about 3 dry weight percent, based on the total weight of the tobacco product.

[0022] Other ingredients such as preservatives (e.g., potassium or sodium sorbate, benzoate, propionate, sulfites, diacetate, parabens, and menthol), disintegration aids (e.g., microcrystalline cellulose, croscarmellose sodium, crospovidone, sodium starch glycolate, pregelatinized corn starch, and the like), or anti-sticking agents (e.g., exemplary commercially available product of Confecto™ No-Stick 'N'™ sold by International Foodcraft Corporation) can also be used. Typically, such ingredients individually are used in amounts of up to about 10 dry weight percent, and usually at least about 0.1 dry weight percent, such as about 0.5 to about 10 dry weight percent, based on the total dry weight of the tobacco product.

[0023] The tobacco product incorporates a binder system, and the binder system incorporates at least one type of binding agent that exhibits thermoplastic properties, characteristics, or behaviors (e.g., the binding agent can be composed of at least one thermoplastic polymeric material). As such, a thermoplastic binder system can incorporate ingredients or materials so as to provide a binding agent that exhibits thermoplastic characteristics (e.g., the binding agent can be composed of at least one thermoplastic polymeric material and/or at least one thermoplastic binding material in combination with a plasticizing agent). The amount of thermoplastic binder system material employed within a representative processed tobacco product typically is at least about 10 percent, of the final formed product, on a dry weight basis. The amount of thermoplastic binder system material employed within a representative processed tobacco product generally is less than about 30 percent, and sometimes less than about 25 percent of the final formed product, on a dry weight basis.

[0024] The ingredient materials of the thermoplastic binder system can vary. The term thermoplastic as used herein refers to a property of an ingredient (e.g., a polymeric material) where upon heating, the ingredient softens or melts into a liquid that when cooled, hardens or forms a gel. For example, a polymeric material that comprises thermoplastic properties, characteristics or behaviors softens or melts when exposed to heat, and then returns to its original physical type of condition when cooled (e.g., to about ambient temperature). As such, a thermoplastic binding agent can be contacted with a tobacco material and various other ingredients, mixed so as to provide physical contact of the binding agent with those ingredients, heated so as to soften or liquefy the polymeric material of the thermoplastic binder system, and then cooled so as to harden the softened thermoplastic polymeric material (and hence result in a tobacco product that is formed from the ingredients and that has a desirable physical integrity). For purposes of the present invention, desirable thermoplastic polymeric materials generally soften or melt (and hence exhibit thermoplastic characteristics) at temperatures in excess of about 50°C, often in excess of about 60°C, and frequently in excess of about 70°C.

[0025] Examples of representative suitable thermoplastic polymeric materials include hydroxypropyl cellulose, polyethylene oxide, certain cellulose ethers (e.g. ethylcellulose and hydroxypropyl methylcellulose), polyvinyl alcohol and polyvinyl acetate. Examples of commercially available hydroxypropyl cellulose include KLUCEL® EF, ELF, and LF hydroxypropyl cellulose (HPC) sold by Hercules Incorporated, Aqualon Division. Examples of commercially available polyethylene oxide include Polyox N10 sold by The Dow Chemical Company. Examples of commercially available

ethylcellulose include those available from Ronas Chemicals Ind. Examples of commercially available hydroxypropyl methylcellulose that can be used include Methocel™ E 50 sold by Hercules Incorporated, Aqualon Division. Examples of commercially available polyvinyl alcohol include Elvanol sold by E. I. DuPont de Nemours. Examples of commercially available polyvinyl acetate include Elvacet sold by E. I. DuPont de Nemours. See also, for example, the types of thermoplastic polymers, such as polymethyl acrylate, set forth in U.S. Patent Publication No. 2009/0095313 to Fuisz. Typical thermoplastic polymeric materials exhibit thermoplastic characteristics at temperatures below about 140°C, and more preferably below about 120°C. Highly preferred thermoplastic polymeric materials exhibit thermoplastic characteristics at temperatures below about 100°C, and most preferably below about 90°C.

[0026] The amount of thermoplastic polymeric materials employed within a representative processed tobacco product typically is at least about 5 percent, and often at least about 10 percent, of the final formed product, on a dry weight basis. The amount of thermoplastic polymeric material employed within a representative processed tobacco product generally is less than about 30 percent, frequently is less than about 25 percent, typically less than about 20 percent, and often less than about 15 percent of the final formed product, on a dry weight basis.

[0027] The binder system can incorporate a compound that can be characterized as a plasticizer. For example, the aforementioned thermoplastic binding materials can be combined with, and processed in combination with, at least one plasticizer. In some tobacco products, a binder system can be employed with a plasticizer blend. In some tobacco products, the plasticizer blend can be pre-mixed separate from the mixing with a binder system or other ingredients. Highly preferred plasticizers are organic non-polymeric materials, and exemplary representative plasticizers include glycerin, propylene glycol, polyethylene glycol, polypropylene glycol, and combinations thereof. Certain plasticizers can be provided by various polyols, such as medium and high molecular weight polyol-type compounds. Some exemplary representative polyols include maltitol, sorbitol, isomalt, erythritol, xylitol, mannitol, polyglycitol, and combinations thereof. The amount of plasticizer utilized within the tobacco product can vary. When employed, the amount of plasticizer employed within a representative processed tobacco product typically is at least about 1 percent, often at least about 2 percent, and frequently at least about 3 percent, of the final formed product, on a dry weight basis. When employed, the amount of plasticizer employed within a representative processed tobacco product typically is up to about 15 percent, often up to about 10 percent, and frequently up to about 5 percent, of the final formed product, on a dry weight basis.

[0028] Typically, the selection and amount of plasticizer are such that there is provided a lowering in the softening temperature of the thermoplastic binding material. The plasticizer can act to facilitate hydration, and hence facilitate liquification of thermoplastic binding material. As such, formation of the tobacco product at relatively low temperatures can be facilitated. In this way, the binder system within a tobacco formulation can lower the operating temperature at which the tobacco formulation is formed thereby reducing and/or avoiding the scalding and/or charring of the tobacco materials. In addition, the plasticizer reduces the need for large amounts of moisture, or other liquid carrier materials, that in turn need to be boiled off through drying stages after formation of the tobacco product. For example, for tobacco formulations incorporating thermoplastic binding material, liquid (e.g., water) and plasticizer, there can be provided a formulation suitable for extrusion of a desirable tobacco product, at temperatures typically lower than that of the normal melting point of the thermoplastic binding material.

[0029] Highly preferred thermoplastic binding materials that can be suitably employed in combination with at least one plasticizer can vary. Examples of such types representative thermoplastic binding materials include polyvinyl polypyrrolidone, methylcellulose, xanthan, gum arabic, maltodextrin, pullulan, certain modified starches and high molecular weight propylene glycols (e.g., propylene glycols having molecular weights above about 4000). Examples of commercially available polyvinyl polypyrrolidone that can be used include Plasdone® K-29/32 sold by FMC BioPolymer. Examples of commercially available methylcellulose that can be used include the Methocel Series of polymeric materials sold by Hercules Inc., Aqualon Division. Examples of commercially available xanthan and gum arabic that can be used include those available from TIC Gums. Examples of commercially available maltodextrin that can be used include Maltrin 10 DE available from Grain Processing Corp. Examples of suitable commercially available modified starches include Elastigel™ 1000J and INSTANT TEXTAID®-A sold by National Starch and Chemical Company. Examples of suitable high molecular weight propylene glycol that can be used include PEG 4000 sold by The Dow Chemical Company. Suitable pullulan materials are set forth in US Pat. Appl. Pub. No. 2007/0137668 to Borschke, et al.. When employed in conjunction with effective amounts of plasticizer, such types of thermoplastic binding materials typically exhibit thermoplastic characteristics at temperatures below about 140°C, and more preferably below about 120°C. Highly preferred thermoplastic binding materials exhibit thermoplastic characteristics at temperatures below about 100°C. These types of thermoplastic binding materials that can be suitably employed in combination with the aforementioned plasticizer can be employed with thermoplastic polymeric materials, and in some cases in the absence of a plasticizer.

[0030] The amount of thermoplastic binding materials employed within a representative processed tobacco product typically can be at least about 5 percent, and often at least about 10 percent, of the final formed product, on a dry weight basis. The amount of thermoplastic binding material employed within a representative processed tobacco product generally can be less than about 30 percent, frequently is less than about 25 percent, typically less than about 20 percent, and often less than about 15 percent of the final formed product, on a dry weight basis.

[0031] Thermoplastic polymeric materials, thermoplastic binding materials employed in combination with a plasticizer, and mixtures of these materials can be processed at the processing and operating conditions of the present invention described herein. Such thermoplastic polymeric materials, thermoplastic binding materials employed in combination with a plasticizer, and mixtures of these materials typically exhibit thermoplastic characteristics at temperatures below about 140°C, and more preferably below about 120°C. Highly preferred thermoplastic polymeric materials, thermoplastic binding materials employed in combination with a plasticizer, and mixtures of these materials employed in combination with a plasticizer exhibit thermoplastic characteristics at temperatures below about 100°C.

[0032] The thermoplastic binder systems can be employed in conjunction with other binding agents. Typical of such other types of binding agents are those that include, but are not limited to, carboxymethyl cellulose and certain other modified cellulosic materials, alginates such as sodium alginate, certain starch-based binders, pectins, carrageenan, zein, and the like. These types of binding agents may not substantially exhibit thermoplastic behavior or characteristics under the conditions and processes of the present invention. One exemplary carboxymethyl cellulose is commercially available as Ac-Di-Sol® sold by FMC BioPolymer. Examples of suitable alginates that include Algin 400 sold by TIC Gums and the Manucol types alginates sold by FMC Biopolymers. Examples of suitable starch-based binders include pre-gelatinized rice starches. Examples of suitable pectins and carrageenans are available from TIC Gums and FMC Biopolymers. Examples of suitable zein are available from Alfa Chemicals. The amount of the other optional binding agent employed typically is less than about 20 percent, and often less than about 15 percent, and frequently is less than about 10 percent, of the final formed product, on a dry weight basis. When employed, the amount of the other optional binding agent that employed typically is at least about 1 percent, and often at least about 3 percent, and frequently at least about 5 percent, of the final formed product, on a dry weight basis. In certain systems, these optional binding agents may require additional moisture when employed in a tobacco product.

[0033] In some tobacco products, a plasticizer blend can be employed in conjunction with a binder system. The plasticizer blend can comprise various polyols, such as maltitol, sorbitol, isomalt, erythritol, xylitol, mannitol, and polyglycitol; glycerin; propylene glycol; polyethylene glycol; polypropylene glycol; and combinations thereof. In some plasticizer blends, a syrup or liquid form of a polyol can be employed, for example, maltitol syrup or sorbitol liquid. The syrup or liquid form of the polyol can include at least 20 percent solids, at least 35 percent solids, at least 50 percent solids, at least 60 percent solids, at least 70 percent solids, or at least 75 percent solids. The amount of plasticizer blend employed typically is less than about 50 percent, often less than about 35 percent, and frequently less than about 30 percent, and yet other times is less than about 25 percent, of the final formed product, on a dry weight basis. When utilized, the amount of plasticizer blend employed within a tobacco product typically is at least about 5 percent, often at least 15 percent, and frequently at least about 20 percent, of the final formed product, on a dry weight basis.

[0034] In some tobacco products, the plasticizer blend can be prepared separately and then added to a premixed tobacco mixture and a binder system. The plasticizer blend can be prepared by mixing its granular components with water. The plasticizer blend can be heated for a period of time and stirred until the plasticizer blend exhibits clear, viscous liquid properties. In some tobacco products, the plasticizer blend can be prepared without the mixing of its granular components with water. By mixing and heating the plasticizer blend separate from the tobacco mixture and binding system, the plasticizer blend can be heated to a higher temperature without concern of charring and/or scalding the tobacco mixture or other components. Upon subjecting the plasticizer blend to a higher temperature, the plasticizer blend can exhibit plastic-type or visco-elastic properties. The viscosity of such plasticizer blend at about 25°C is typically less than 25 Pa s (25.000 centipoise (cp)), and often less than 15 Pa s (15.000 cp). When employed in a tobacco product, the viscosity of such plasticizer blend at about 25°C is typically at least 0,1 Pa s (100 cp), and often at least 1,5 Pa s (1.500 cp). A tobacco product incorporating a plasticizer blend having such plastic-like or visco-elastic properties can provide a chewable tobacco product that does not crumble or fall apart in a user's mouth upon light to moderate chewing. Such a chewable tobacco product can change shape in the mouth when lightly to moderately chewed without disintegrating into small particles.

[0035] The manner by which the various components of the tobacco formulation can be combined may vary. The various components of the formulation may be contacted, combined, or mixed together in conical-type blenders, mixing drums, ribbon blenders, or the like. As such, the overall mixture of various components with the granulated tobacco components, and other ingredients, may be relatively uniform in nature. See also, for example, the types of methodologies set forth in U.S. Pat. No. 4,148,325 to Solomon et al.; U.S. Pat. No. 6,510,855 to Korte et al.; and U.S. Pat. No. 6,834,654 to Williams. The components of the tobacco formulation can be brought together in admixture using any mixing technique or equipment known in the art. The components noted herein, which may be in liquid or dry solid form, can be admixed with the tobacco in a pretreatment step prior to mixture with any remaining components of the composition or simply mixed with the tobacco together with all other liquid or dry ingredients. Any mixing method that brings the tobacco composition ingredients into intimate contact can be used. A mixing apparatus featuring an impeller or other structure capable of agitation is typically used. Exemplary mixing equipment includes casing drums, conditioning cylinders or drums, liquid spray apparatus, ribbon blenders, mixers available as FKM130, FKM600, FKM1200, FKM2000 and FKM3000 from Littleford Day, Inc., Plough Share types of mixer cylinders, and the like.

[0036] Components of the tobacco formulation also can be provided by liquid materials or ingredients. The liquid ingredients can be provided in a variety of ways, and can be provided from a variety of sources. The tobacco formulation can be moist, and moisture can be provided by aqueous liquid supplied as such, as moist tobacco, or as a carrier liquid for ingredients of the tobacco formulation. Other liquid ingredients, such as organic solvents (e.g., ethanol), can be carrier liquids for certain ingredients of the tobacco formulation. The plasticizers of the thermoplastic binder system also typically have a liquid form.

[0037] The tobacco formulation, when processed, can have a relatively low to moderate moisture content. The moisture content of the tobacco formulation during processing steps typically can exceed about 5 percent, frequently can exceed about 10 percent, and often can exceed about 15 percent, based on the total weight of the tobacco formulation and water. The moisture content of the tobacco formulation during processing steps typically can is less than about 35 percent, frequently is less than about 30 percent, and often is less than about 25 percent, based on the total weight of the tobacco formulation and water.

[0038] The manner that the tobacco product is formed can vary, and various methods for forming processed tobaccos or for producing processed tobacco products will be readily apparent to those skilled in the art of tobacco product manufacture. For example, suitably heated tobacco formulations incorporating thermoplastic binder systems and having a pourable, formable or generally liquid character can be cast into a sheet-like form and cooled to yield a sheet-like tobacco product of good integrity. As another example, suitably heated tobacco formulations incorporating thermoplastic binder systems can be molded into a desired shape and cooled. As yet another, but preferred, example, tobacco formulations incorporating thermoplastic binder systems can be extruded from heated extrusion devices and cooled. As another example, tobacco formulations incorporating a binder system and a pre-mixed plasticizer blend can be extruded from heated extrusion devices and cooled.

[0039] The tobacco product can be manufactured using hot melt extrusion techniques. As such, processed tobacco formulations can be subjected to sufficient heat during formation of tobacco product to eliminate the need for any additional heat treatment steps. For example, flashing off the moisture from a processed tobacco formulation during a hot melt extrusion process can eliminate any need for further heating, drying, or the like.

[0040] Processed tobacco formulations, such as multi-layered tobacco pellets, can be manufactured using a wide variety of extrusion techniques. For example, multi-layered tobacco pellets can be manufactured using co-extrusion techniques (e.g., using twin screw extruders). In such a situation, successive wet or dry components or component mixtures can be placed within separate extrusion hoppers. Steam, gases (e.g., ammonia, air, carbon dioxide, and the like), plasticizers (e.g., glycerin or propylene glycol), and a plasticizer blend can be injected into the extruder barrel as each dry mix is propelled, plasticized, and cooked. As such, the various components are processed so as to be very well mixed, and hence, come in complete contact with each other. For example, the contact of components is such that individual components can be well embedded in the extrusion matrix or extrudate. See, for example, U.S. Pat. No. 4,821,749 to Toft et al.. Multilayered materials can have the general form of films, and alternatively, multi-layered generally spherical materials can possess various layers extending from the inside outward.

[0041] Some shapes of smokeless tobacco products, such as rods or cubes, can be formed by first extruding the material through a die having the desired cross-section (e.g., round or square) and then optionally cutting the extruded material into desired lengths. For example, extruder equipment comprising single or multiple screw extruders can by employed to form the shape of a smokeless tobacco product. Some extruders can comprise twin screw extruders which comprise co-rotating twin screw extruders. Various screw configurations can be employed. For example, screws having combinations of elements for feeding, mixing, pumping, shearing, and the like, can be selected as desired for optimum results. Screws having sections or elements which provide relatively large output capacities, which have interrupted or nonconjugated flights, or which are "counterflighted" or "reversing" also can be employed. Typical screw elements as well as screws having combinations of such elements are available from extruder manufacturers. An extruder can provide a barrel for heating of the materials which are introduced within the extruder. The extruder barrel can comprise multiple barrel zones. The conditions of the extrusion set-up can vary, for example, in modifying feed rate of dry blend ingredients, feed rate of wet blend ingredients, screw RPM setting, temperature conditions, aperture die dimensions, barrel zone entry point for certain ingredients, as well as additional parameters.

[0042] Techniques and equipment for extruding tobacco materials have been set forth in US Pat. Nos. 3,098,492 to Wursburg; 4,874,000 to Tamol et al.; 4,880,018 to Graves et al.; 4,989,620 to Keritsis et al.; 5,072,744 to Luke et al.; 5,829,453 to White et al.; and 6,182,670 to White et al.. Exemplary extrusion equipment suitable for use include industrial pasta extruders such as Model TP 200/300 available from Emiliomiti, LLC of Italy.

[0043] In some methods that can be used to produce tobacco products, a portion of the ingredients can be mixed and fed into the extruder. Additional ingredients can be introduced to the extruder at a different point or barrel zone as compared to other ingredients. For example, a pre-mixed subgroup of ingredients can be fed into a first barrel zone of the extruder to contact a dry mix of other ingredients. A hopper or plurality of hoppers can be employed to facilitate the input of various ingredients into an extruder.

[0044] Processed sheet-like materials can be prepared by applying the tobacco composition onto a moving belt and

passing the moving belt through a nip formed by opposing rollers, followed by cutting the sheet into desired lengths. Alternatively, the tobacco product can be over-coated with powdered or liquid coating. Furthermore, if desired, the surface of the tobacco product can be embossed or printed.

[0045] The pH of the tobacco product can vary. Typically, the pH of that formulation is at least about 6.5, and preferably at least about 7.5. Typically, the pH of the tobacco product will not exceed about 10, and often will not exceed about 9.5. A representative tobacco product exhibits a pH of about 6.8 to about 8.2. A representative technique for determining the pH of a tobacco product involves dispersing 5 g of that product in 100 mL of deionized water, and measuring the pH of the resulting suspension/solution (e.g., with a pH meter).

[0046] The relative amount of tobacco employed in combination with the additional components and binding system components can vary. The amount of tobacco material within the tobacco product typically is at least about 10 percent, generally at least about 25 percent, often at least about 30 percent, and frequently at least about 35 percent, on a dry weight basis, based on the total dry weight of the processed formulation or final product. In certain instances, the amounts of other components and binding system components within the tobacco formulation may exceed about 40 percent, on a dry weight basis. A typical range of tobacco material within the formulation is about 10 to about 60 weight percent, more often about 20 to about 40 weight percent, on a dry basis.

[0047] The moisture content of the tobacco product prior to use by a consumer of the product may vary. Typically, the moisture content of the tobacco product, such as tobacco formulation within a snus-type pouch, prior to insertion into the mouth of the user, is less than about 55 weight percent, generally is less than about 50 weight percent, and often is less than about 45 weight percent. Certain types of tobacco products have moisture contents, prior to use, of less than about 15 weight percent, frequently less than about 10 weight percent, and often less than about 5 weight percent. A tobacco product can comprise a moisture content prior to use in the range of about 5 weight percent to about 15 weight percent. For certain tobacco products, such as those incorporating snus-types of tobacco compositions, the moisture content may exceed 20 weight percent, and often may exceed 30 weight percent. For example, a representative snus-type product may possess a tobacco composition exhibiting a moisture content of about 25 weight percent to about 50 weight percent, preferably about 30 weight percent to about 40 weight percent. For yet other tobacco products, such as those in a stick form, the tobacco product can comprise a moisture content of about 5 weight percent to about 15 weight percent.

[0048] Exemplary shapes of formed tobacco products include pill, tablet, sphere, sheet, film, coin, cube, bead, ovoid, obloid, bean, cylinder, stick, and rod. Tobacco products of the present invention can be used as smokeless tobacco compositions, such as loose moist snuff, loose dry snuff, chewing tobacco, pelletized tobacco pieces, compressed tobacco pieces, molded processed tobacco pieces, extruded or formed tobacco strips, pieces, rods or sticks, finely divided ground powders, finely divided or milled agglomerates of powdered pieces and components, flake-like pieces, pieces of tobacco-containing gum, rolls of tape-like films, readily water-dissolvable or water-dispersible films or strips (see, for example, U.S. Pat. Appl. Pub. No. 2006/0198873 to Chan et al. and U.S. Pat. Appl. Pub. No. 2009/0095313 to Fuisz), extruded or formed sticks or rods, extruded or molded tubes, layered or laminated materials (e.g., multi-layered compositions having one type of tobacco formulation surrounded by a different type of tobacco formulation), 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). As an example, pieces of extruded sheets or films can be wrapped around formed tobacco-containing pieces. As yet another example, extruded pieces can be sub-divided into small pieces and incorporated with other tobacco materials within snu-type pouches. A preferred form of a tobacco product is a product having the form of an extruded piece or pieces composed of tobacco material and other ingredients held together using a binder system. Such extruded pieces also may be processed or further sub-divided into formed pieces. For example, extruded tobacco compositions can be roll pressed or otherwise physically treated; and then rolled into a roll for storage and later use, or cut into the desired shape for packaging and use.

[0049] Tobacco products incorporating thermoplastic binder systems offer several advantages. In one regard, the binder system allows for efficient and effective extrusion of a tobacco product (e.g., tobacco product can be produced at a desired throughput). In another regard, extrusion of a tobacco formulation can be carried out at relatively low temperatures; and as such the tobacco formulation can be processed using reduced amounts of energy and under conditions that reduce the chances of scalding or charring the tobacco material during processing. In yet another regard, tobacco products possessing reduced amounts of binding agent can be provided, hence increasing the relative amount of tobacco and flavoring agent within the tobacco product and thereby enhancing the sensory characteristics of those products.

[0050] The incorporation of the binder system into a tobacco product according to methods described herein can provide improved user satisfaction upon use of the tobacco product as compared to a tobacco product relying upon a thermoplastic polymer in relatively high concentrations. In tobacco formulations comprising high concentrations of thermoplastic polymers, some users may experience a "gummy residue" in their mouth upon use of the tobacco product.

[0051] Tobacco products incorporating a pre-mixed plasticizer blend can provide a product that can be chewed lightly

to moderately without the product falling apart within the user's mouth. Such tobacco products may change shape in a user's mouth when lightly to moderately chewed without disintegrating into small particles. By pre-mixing the plasticizer blend, the ingredients of the plasticizer blend can be heated to a temperature where the plasticizer blend exhibits plastic-type or visco-elastic properties. Often such a temperature is greater than the desired temperature to subject the tobacco component during processing or manufacture. For example, the pre-mixed plasticizer blend can be subjected to temperatures of about 100°C to melt the plasticizer blend. The pre-mixed and pre-melted plasticizer blend can then be added to the tobacco components and processed at a temperature lower than 100°C, for example, about 70°C to about 85°C, thereby reducing and/or avoiding the danger of charring and/or scalding the tobacco.

EXAMPLES

[0052] The present invention can be more fully illustrated by the following examples, which are set forth to illustrate some embodiments of the present invention and are not to be construed as limiting thereof. All weight percentages are expressed on a dry weight basis, meaning water content is excluded, unless otherwise indicated.

EXAMPLE 1

Control Formulation

[0053] A tobacco formulation for use as a stick type of a smokeless tobacco product is provided in the manner set forth in Table 1. The smokeless tobacco product comprising the tobacco formulation of Table 1 can be used as a control formulation as compared to the additional examples of the present invention that are set forth and described hereinafter.

[0054] The tobacco powder used in Example 1 is a blend of finely divided (-100/+270 Tyler mesh) flue-cured tobacco lamina and air cured tobacco stems. All dry ingredients, in powder form, as well glycerin and propylene glycol, are added together and thoroughly mixed in a model 300D Littleford horizontal plough dough mixer (Littleford Day, Inc. Florence, KY) for about 15 to 20 minutes at about 150 rpm. The mixed dry formulation is then commuted into the hopper of a model ZSK26 Coperion extruder (Werner and Pfeidderer, Ramsey, NJ). The extruder barrel has a 30:1 LD (length to diameter) ratio, 66 cm (26 inch) internal diameter, and consists of 8 heating zones or sections, plus a heated die component.

[0055] The extruder is set at a screw speed of about 45 rpm and the barrel sections and die operated at temperatures of about 100°C. The extruder is fed at a rate of about 4,76 kg/hr (10,5 lb/hr) of dry formulation from a hopper. The formulation is extruded through a 3.0 mm diameter aperture die into 3 mm diameter cylindrical rods. Residence time of the formulation in the extruder is approximately 55 seconds. The rods are cut into approximately 61 centimeter long sticks, and allowed to harden by ambient air drying for about 10 to 20 minutes, after which the sticks are further cut into 3.5 mm long pieces.

Table 1

Ingredients	wt %	g
Tobacco Powder	36	360
Mannitol	13	180
Sodium chloride	3.6	36
Sodium hydroxide	0.4	4
Sucralose	1	10
Titanium dioxide	1	10
Calcium Carbonate	3	30
Maltodextrin	3	30
Ac-Di-Sol®	3	30
Glycerin	0.8	8
Cocoa Powder	2	20
Licorice Powder	0.5	5
Vanilla	0.2	2

(continued)

Ingredients	wt %	g
Hydroxypropyl Cellulose	28.5	285
Propylene Glycol	4	40
Total ingredients:	100%	1000.0

Binder System Formulations

[0056] Tables A-M provide various embodiments of a binder system that can be incorporated into a tobacco formulation for use in a tobacco product representative of the present invention. The binder system prepared according to the recipes shown in Tables A-M can be used within the tobacco formulations found in the examples described hereinafter.

[0057] Each batch of binder system is prepared by mixing the components in a commercially available Kitchen Aid mixer for about 3 to 5 minutes.

Table A

Batch 1 Ingredients	wt %	g
Methocel™ E 50	70	350
Propylene Glycol	30	150
Total ingredients:	100%	500

Table B

Batch 2 Ingredients	wt %	g
Methocel™ E 50	42	210
Propylene Glycol	28	140
Water	30	150
Total ingredients:	100%	500

Table C

Batch 3 Ingredients	wt %	g
Xanthan	42	210
Maltodextrin	28	140
Propylene Glycol	30	150
Total ingredients:	100%	500

Table D

Batch 4 Ingredients	wt %	g
Xanthan	29.4	147
Maltodextrin	19.6	98
Propylene Glycol	21	105
Water	30	150
Total ingredients:	100%	500

Table E

Batch 5 Ingredients	wt %	g
Gum Arabic	42	210
Propylene Glycol	28	140
Water	30	150
Total ingredients:	100%	500

Table F

Batch 6 Ingredients	wt %	g
Xanthan	21.7	108.5
Gum Arabic	33.6	168
Plasdone K29/32	14.7	73.5
Propylene Glycol	30	150
Total ingredients:	100%	500

Table G

Batch 7 Ingredients	wt %	g
Gum Arabic	60	300
Maltodextrin (Maltrin 10 DE)	15	75
Propylene Glycol	25	125
Total ingredients:	100%	500

Table H

Batch 8 Ingredients	wt %	g
Maltodextrin (Maltrin 10 DE)	73	365
Propylene Glycol	27	135
Total ingredients:	100%	500

Table I

Batch 9 Ingredients	wt %	g
Modified Starch (Elastigel™ 1000J)	75	375
Propylene Glycol	25	125
Total ingredients:	100%	500

Table J

Batch 10 Ingredients	wt %	g
Modified Starch (INSTANT TEXTAID®-A)	65	325

(continued)

Batch 10 Ingredients	wt %	g
Maltodextrin (Maltrin 10 DE)	10	50
Propylene Glycol	25	125
Total ingredients:	100%	500

Table K

Batch 11 Ingredients	wt %	g
Pullulan	42	210
Maltodextrin	28	140
Propylene Glycol	30	150
Total ingredients:	100%	500

Table L

Batch 12 Ingredients	wt%	g
Pullulan	29.4	147
Maltodextrin	19.6	98
Propylene Glycol	21	105
Water	30	150
Total ingredients:	100%	500

Batch 13 Ingredients	wt %	g
Pullulan	21.7	108.5
Gum Arabic	33.6	168
Plasdone K29/32	14.7	73.5
Propylene Glycol	30	150
Total ingredients:	100%	500

EXAMPLES 2-11

[0058] Tobacco formulations for use as a stick type of a smokeless tobacco product as set forth in Tables 2-5 are provided in the following manner.

[0059] A tobacco powder of the type as set forth in Example 1 is provided. Except for glycerin, all dry ingredients, in powder form, are added together with a batch formulation and thoroughly mixed in the model 300D Littleford horizontal plough dough mixer for about 15 to 20 minutes at about 150 rpm. Each batch formulation is prepared by mixing propylene glycol and/or water with a binder in a 6 L Kitchen Aid mixer for about 5 minutes, before being mixed with other dry ingredients in the Littleford mixer. Each mixed formulation is then commuted into the hopper of the ZSK26 Coperion extruder. Extrusion set-up and operation parameters are essentially the same as in Example 1, except that barrel heating zones are operated at about 65°C to 100°C, and the screw speed is set at 60 rpm. A wet blend is separately prepared by mixing, for about 5 minutes, glycerin with water (10 percent total ingredients formulation equivalent) in a beaker, using a stirring bar.

[0060] The mixed wet blend formulation is fed into the first barrel zone of the extruder. The extruder is fed at a rate of 6,12 kg/hr (13,5 lb/hr) of dry formulation and 0,68 kg/hr (1,5 lb/hr) of wet blend formulation. The formulations are extruded

through a 3.0 mm diameter aperture die into 3 mm diameter rods. The rods are cut into approximately 61 cm long sticks, and let to harden by ambient air drying for about 10-20 minutes, after which the rods are further cut into 3.5 mm long sticks.

Table 2

Ingredients:	Example 2			Example 3			Example 4	
	wt %	g		wt %	g		wt%	g
Tobacco Powder	36	360		36	360		36	360
Mannitol	13	130		13	130		13	130
Sodium chloride	3.6	36		3.6	36		3.6	36
Sodium hydroxide	0.4	4		0.4	4		0.4	4
Sucralose	1	10		1	10		1	10
Titanium dioxide	1	10		1	10		1	10
Calcium Carbonate	3	30		3	30		3	30
Maltodextrin	3	30		3	30		3	30
Ac-Di-Sol®	3	30		3	30		3	30
Glycerin	0.8	8		0.8	8		0.8	8
Cocoa Powder	2	20		2	20		2	20
Licorice Powder	0.5	5		0.5	5		0.5	5
Vanilla	0.2	2		0.2	2		0.2	2
Hydroxypropyl Cellulose	18.5	185		18.5	185		18.5	185
Batch 1 (Table A)	14	140		--	--		--	--
Batch 3 (Table C)	--	--		14	140		--	--
Batch 11 (Table K)	--	--		--	--		14	140
Total ingredients:	100%	1000.0		100%	1000.0		100%	1000.0

Table 3

Ingredients:	Example 5			Example 6	
	wt%	g		wt %	g
Tobacco Powder	36	360		36	360
Xylitol	5	50		5	50
Maltitol	5	50		5	50
Sorbitol	5	50		5	50
Sodium chloride	3.6	36		3.6	36
Sodium hydroxide	0.4	4		0.4	4
Sucralose	1	10		1	10
Titanium dioxide	1	10		1	10
Calcium Carbonate	3	30		3	30
Maltodextrin	3	30		3	30
Ac-Di-Sol®	3	30		3	30
Glycerin	0.8	8		0.8	8
Cocoa Powder	2	20		2	20

(continued)

Ingredients:	Example 5			Example 6	
	wt%	g		wt %	g
Licorice Powder	0.5	5		0.5	5
Vanilla	0.2	2		0.2	2
Hydroxypropyl Cellulose	18.5	185		18.5	185
Batch 1 (Table A)	12	120		--	--
Batch 2 (Table B)	--	--		12	120
Total ingredients:	100%	1000.0		100%	1000.0

Table 4

Ingredients:	Example 7			Example 8			Example 9	
	wt %	g		wt %	g		wt %	g
Tobacco Powder	36	360		36	360		36	360
Erythritol	7	70		7	70		7	70
Mannitol	7	70		7	70		7	70
Sodium chloride	3.6	36		3.6	36		3.6	36
Sodium hydroxide	0.4	4		0.4	4		0.4	4
Sucralose	1	10		1	10		1	10
Titanium dioxide	1	10		1	10		1	10
Calcium carbonate	3	30		3	30		3	30
Ac-Di-Sol®	3	30		3	30		3	30
Glycerin	0.8	8		0.8	8		0.8	8
Cocoa Powder	2	20		2	20		2	20
Licorice Powder	0.5	5		0.5	5		0.5	5
Vanilla	0.2	2		0.2	2		0.2	2
Hydroxypropyl Cellulose	18.5	185		18.5	185		18.5	185
Batch 3 (Table C)	16	160		--	--		--	--
Batch 4 (Table D)	--	--		16	160		--	--
Batch 5 (Table E)	--	--		--	--		16	160
Total ingredients:	100%	1000.0		100%	1000.0		100%	1000.0

Table 5

Ingredients:	Example 10			Example 11	
	wt %	g		wt %	g
Tobacco Powder	36	360		36	360
Erythritol	7	70		7	70
Mannitol	7	70		7	70
Sodium chloride	3.6	36		3.6	36

(continued)

Ingredients:	Example 10			Example 11	
	wt %	g		wt %	g
Sodium hydroxide	0.4	4		0.4	4
Sucralose	1	10		1	10
Titanium dioxide	1	10		1	10
Calcium carbonate	3	30		3	30
Ac-Di-Sol®	3	30		3	30
Glycerin	0.8	8		0.8	8
Cocoa Powder	2	20		2	20
Licorice Powder	0.5	5		0.5	5
Vanilla	0.2	2		0.2	2
Hydroxypropyl Cellulose	18.5	185		18.5	185
Batch 11 (Table K)	16	160		--	--
Batch 12 (Table L)	--	--		16	160
Total ingredients:	100%	1000.0		100%	1000.0

[0061] A tobacco product prepared as set forth in Examples 2-11 are prepared under extrusion conditions at operating temperatures less than that of Example 1, thereby reducing and/or avoiding the possibility of charring or scalding the tobacco material, as well as requiring less energy to maintain higher temperatures. Additionally, the tobacco products prepared as set forth in Examples 2-11 have shorter residence times in the extruder, as well as a higher throughput of product as compared to Example 1.

EXAMPLES 12-22

[0062] Tobacco formulations for use as a sheet type of a smokeless tobacco product as set forth in Tables 6-10 are provided in the following manner.

[0063] A tobacco powder essentially as set forth in Example 1 is provided. Each of Examples 12-22 include a flavor emulsion component having a recipe as set forth in Table N. For Examples 12-15, all ingredients, including the flavor emulsion are added together and thoroughly mixed in the model 300D series Littleford plough dough mixer for about 15 to 20 minutes, at about 150 rpm, before being commuted into the Coperion extruder hopper. For Examples 16-22, all ingredients including the flavor emulsion (see Table N) and the batch formulations are similarly mixed in the Littleford mixer as described for Examples 12-15.

[0064] For Examples 12-13, the extruder is set at a screw speed of 45 rpm and the barrel sections and die operated at temperatures of about 100°C. A sheeting die of 75 mm x 0.85 mm aperture is employed. The extruder is fed at a rate of 3,4 kg/hr (7,5 lb/hr) of dry formulation. No wet blend formulation is used for the Examples 12-13. The dry formulation is extruded into a continuous sheet that is about 0.85 mm thick. The sheet is extruded onto a conveyor belt and transferred through a 9,14 m (30 ft) long cooling tunnel (ABCO Automation, Inc, Greensboro, NC). The sheet is further reduced in thickness by passage through three sets of pin rolls, and is flattened into a sheet having a thickness of less than 0.4 mm. The sheets are finally cut into bite-size strip pieces of various shapes (e.g., pieces of about 2 cm by 2 cm).

[0065] For Examples 14-15, pre and post extrusion set-up is similar to that set forth for Example 12-13, except that extruder screw speed is set at 50 rpm and a wet blend formulation is employed. Feed rate is 4,76 kg/hr (10,5 lb/hr) for the dry blend formulation, and 0,68 kg/hr (1,5 lb/hr) for the wet blend formulation.

[0066] For Examples 16-22, pre and post extrusion set up is similar to that set forth in Examples 12-13, except that extruder barrel temperatures are operated at 75°C to 100°C, screw speed is set at 60 rpm, and a wet blend formulation is employed. Feed rate is 6,12 kg/hr (13,5 lb/hr) for dry blend formulation, and 0,68 kg/hr (1,5 lb/hr) wet blend formulation.

Table 6

Ingredients:	Example 12			Example 13	
	wt %	g		wt %	g
Tobacco Powder	37	370		37	370
Mannitol	13.4	134		15	150
Sodium chloride	3.5	35		3.5	35
Sucralose	0.8	8		0.8	8
Titanium dioxide	1	10		1	10
Polyethylene Glycol 4000	10	100		7.5	75
Maltodextrin	4	40		--	--
Propylene Glycol	--	--		5	50
Flavor Emulsion Ingredients (see Table N)	7.8	78		7.8	78
Ac-Di-Sol®	2.5	25		2.4	24
Hydroxypropyl Cellulose (Klucel®)	18.6	186		18.6	186
Sodium Hydroxide	0.4	4		0.4	4
Sodium Bicarbonate	1	10		1	10
Total ingredients:	100%	1000.0		100%	1000.0

Table 7

Ingredients:	Example 14			Example 15	
	wt %	g		wt %	g
Tobacco Powder	37	370		37	370
Sorbitol	5	50		5	50
Mannitol	9.4	94		10	100
Sodium chloride	3.5	35		3.5	35
Sucralose	0.8	8		0.8	8
Titanium dioxide	1	10		1	10
Polyethylene Glycol 4000	10	100		7.5	75
Propylene Glycol	--	--		2	20
Confecto™ No-Stick 'N'™	3	30		3	30
Flavor Emulsion Ingredients (see Table N)	7.8	78		7.8	78
Ac-Di-Sol®	2.5	25		2.4	24
Hydroxypropyl Cellulose (Klucel®)	18.6	186		18.6	186
Sodium Hydroxide	0.4	4		0.4	4
Sodium Bicarbonate	1	10		1	10
Total ingredients:	100%	1000.0		100%	1000.0

Table 8

Ingredients:	Example 16			Example 17			Example 18	
	wt %	g		wt %	g		wt %	g
Tobacco Powder	37	370		37	370		37	370
Mannitol	10.4	104		10.4	104		10.4	104
Sodium chloride	3.5	35		3.5	35		3.5	35
Sucralose	0.8	8		0.8	8		0.8	8
Titanium dioxide	1	10		1	10		1	10
Polyethylene Glycol 4000	7	70		7	70		7	70
Flavor Emulsion Ingredients (see Table N)	7.8	78		7.8	78		5.8	58
Ac-Di-Sol®	2.5	25		2.5	25		2.5	25
Hydroxypropyl Cellulose (Klucel®)	18.6	186		18.6	186		13.5	135
Batch 1 (Table A)	10	100		--	--		--	--
Batch 6 (Table F)	--	--		10	100		--	--
Batch 7 (Table G)	--	--		--	--		17.1	171
Sodium Hydroxide	0.4	4		0.4	4		0.4	4
Sodium Bicarbonate	1	10		1	10		1	10
Total ingredients:	100%	1000.0		100%	1000.0		100%	1000.0

Table 9

Ingredients:	Example 19			Example 20	
	wt %	g		wt %	g
Tobacco Powder	37	370		37	370
Mannitol	10.4	104		10.4	104
Sodium chloride	3.5	35		3.5	35
Sucralose	0.8	8		0.8	8
Titanium dioxide	1	10		1	10
Polyethylene Glycol 4000	7	70		7	70
Flavor Emulsion Ingredients (see Table N)	7.8	78		7.8	78
Ac-Di-Sol®	2.5	25		2.5	25
Hydroxypropyl Cellulose (Klucel®)	13.5	135		18.6	186
Batch 8 (Table H)	15.1	151		--	--
Batch 13 (Table M)	--	--		10	100
Sodium Hydroxide	0.4	4		0.4	4
Sodium Bicarbonate	1	10		1	10
Total ingredients:	100%	1000.0		100%	1000.0

Table 10

Ingredients:	Example 21			Example 22	
	wt %	g		wt %	g
Tobacco Powder	37	370		37	370
Erythritol	15.4	154		--	
Sorbitol liquid (75% solids)	--	--		18	180
Sodium chloride	3.5	35		3.5	35
Sucralose	0.8	8		0.8	8
Titanium dioxide	1	10		1	10
Flavor Emulsion Ingredients (see Table N)	5.8	58		5.8	58
Ac-Di-Sol®	2.5	25		2.5	25
Pullulan	13.5	135		13.5	135
Batch 9 (Table I)	17.1	171		--	--
Batch 10 (Table J)	--			14.5	145
Sodium Hydroxide	0.4	4		0.4	4
Sodium Bicarbonate	1	10		1	10
Glycerin	2	20		2	20
Total ingredients:	100%	1000.0		100%	1000.0

Table N

Flavor Emulsion Ingredients	wt %	g
Water	70	1050
Gum Arabic	20	300
Flavor key (Menthol Flavor)	10	150
Total ingredients:	100%	1500

[0067] A tobacco formulation or tobacco product prepared as set forth in Examples 12-22 can have a lower operating temperature than that of conventional methods for forming tobacco products, thereby reducing and/or avoiding the possibility of charring or scalding the tobacco material as well as requiring less energy to maintain higher temperatures. Additionally, the tobacco formulations and tobacco products prepared as set forth in Examples 12-22 can have relatively short residence times in the extruder as well as relatively high throughput of processed tobacco product.

EXAMPLES 23-30

[0068] Tobacco formulation for use as a dissolvable cylinder, rod, stick, bean, ovoid, sphere or strip type of a smokeless tobacco product is provided in the manner set forth in Table 11. The smokeless product comprising the tobacco formulation of Table 11 can be used as a control formulation as compared to the additional examples described in Tables 12-18 that are set forth and described hereinafter.

[0069] The tobacco powder used in Example 23 show in Table 11 is a blend of finely divided (-100/+200 Tyler mesh) flue-cured tobacco lamina, flue-cured derived tobacco starch fraction, and air cured tobacco stems. All dry ingredients, in powder form, as well as liquid mint flavor, are added together and thoroughly mixed in a model 300D Littleford horizontal plough dough mixer (Littleford Day, Inc. Florence, KY) for about 10 minutes at about 150 rpm.

[0070] The plasticizer blend shown in Table 11 is also used within the tobacco formulation. It is fed and added to the premixed tobacco and binder formulation in the extruder's first barrel zone. The plasticizer blend is prepared separately by mixing its granular components with water (about 7.5 percent to about 13 percent total ingredients formulation equivalent) in a stainless steel vessel. The vessel is heated up to about 100°C and held at about 80°C to about 100°C for 10

minutes, or until the contents become a clear viscous liquid (up to 12,000 cP). The contents are stirred constantly during the heating period. The plasticizer blend is then transferred into a heat controlled jacketed K-Tron tank connected in-line with a model ZSK26 Coperion extruder (Werner and Pfeidderer, Ramsey, NJ).

[0071] The extruder barrel has a 30:1 LD (length to diameter) ratio, 66 cm (26 inch) internal diameter, and consists of eight heating zones or sections, plus a heated die component. The extruder is set at a screw speed of about 60 to about 70 rpm, while the eight barrel zones and the die are operated at about 70°C to about 85°C. The extruder is fed at a rate of about 6,12 kg/hr (13,5 lb/hr) of dry formulation from the hopper and about 3,4 kg/h (7,6 lb/hr) plasticizer solution from the K-Tron holding tank. The formulation is extruded either through a 7.5 mm diameter aperture die into 7.5 to 8.0 mm cylindrical rods, or via a 2.5 mm sheet die into 2.5 to 3 mm thick sheets. Residence time of the formulation in the extruder is approximately 55 to 60 seconds.

[0072] The rods or sheets are extruded onto a conveyor belt and transferred through a 9,14 m (30 ft) long cooling tunnel (available through ABCO Automation, Inc, Greensboro, NC). The rods and sheets are cut into approximately 65 centimeter long pieces, and transferred onto perforated drying trays (75 cm x 75 cm). The trays are transferred into a forced air oven and dried at about 127°C for 5 minutes, after which they are let to cool to ambient temperature (15-20 min.) for case hardening. The sticks are further cut into 14.5 mm rod shaped pieces, or roll pressed and cut into 5.5 to 6.0 mm (height) by 8.5 to 9.0 mm (wide) by 14.5 mm (length) pillow shaped pieces. The sheets (single, double or triple layered) are fed through an automated drop roller press (available through Statatol Jr.™, General Electric Co, USA) that molds and cuts the sheets into strips, bean, spheres, or ovoid pieces.

Table 11

Ingredients:	Example 23	
	wt%	g
Tobacco Powder	36	3265.9
Sucralose	0.5	45.4
Sodium chloride	3	272.2
Oat fiber	3	272.2
Hydroxypropyl Cellulose (Klucel® EF)	5.7	517.1
Sodium bicarbonate	1.5	136.1
Sodium hydroxide granules	0.4	36.3
Flavor (Mint)	1.3	117.9
Vegetable fat (Confecto No Stick N)	2.5	226.8
Binder System		
Xanthan	2	181.4
Gum arabic	5	453.6
Hydroxypropyl Cellulose (Klucel® EF)	10.1	916.3
Propylene glycol	4	362.9
Plasticizer Blend		
Erythritol	8	725.8
Isomalt	8	725.8
Maltitol syrup @ 70% solids	9	1166.4
Total ingredients:	100.0	9421.92

[0073] A tobacco formulation for use as a dissolvable cylinder, rod, stick, bean, ovoid, sphere or strip type of a smokeless tobacco product is provided in the manner set forth in Table 12. The tobacco formulation described in Example 24 of Table 12 is processed as set forth in Example 23, except that the extruder feed rate is set at about 6,8 kg/hr (15 lb/ hr)

of dry formulation and the plasticizer blend feed rate is set at about 3,76 kg/hr (8,3 lb/hr).

Table 12

Ingredients:	Example 24	
	wt%	g
Tobacco Powder	36	3265.9
Sucralose	0.5	45.4
Sodium chloride	3	272.2
Hydroxypropyl Cellulose (Klucel® EF)	16	1451.5
Sodium bicarbonate	1.5	136.1
Sodium hydroxide granules	0.4	36.3
Flavor (Mint)	1.5	136.1
Vegetable fat (Confecto No Stick N)	2.5	226.8
Binder System		
Oat fiber	2.1	190.5
Xanthan	2	181.4
Gum arabic	7	635.0
Propylene glycol/glycerin (3:1)	4	362.9
Plasticizer Blend		
Erythritol	7.5	680.4
Isomalt	8	725.8
Maltitol syrup @ 75% solids	8	725.8
Total ingredients:	100.0	9072.00

[0074] A tobacco formulation for use as a dissolvable cylinder, rod, stick, bean, ovoid, sphere or strip type of a smokeless tobacco product is provided in the manner set forth in Table 13. The tobacco formulation described in Example 25 is processed as set forth in Example 23, except that the extruder feed rate is set at about 6,8 kg/hr (15 lb/hr) of dry formulation and the plasticizer blend feed rate is set at about 3,76 kg/hr (8,3 lb/hr). Additionally, the flavor in Example 25 is introduced into the formulation via the binder system in contrast to Example 23.

Table 13

Ingredients:	Example 25	
	wt %	g
Tobacco (finely milled)	36	3265.9
Sucralose	0.5	45.4
Titanium dioxide	1	90.7
Sodium chloride	3	272.2
Hydroxypropyl Cellulose (Klucel® EF)	10.5	952.6
Sodium bicarbonate	1.5	136.1
Vegetable fat (Confecto No Stick N)	2.1	190.5

(continued)

Binder System		
Gum arabic	8	725.8
Pullulan	9.5	861.8
Propylene glycol	3	272.2
Mint flavor	0.5	45.4
Plasticizer Blend		
Erythritol	11	997.9
Sorbitol liquid @ 60% solids	12	1088.6
Glycerin	1.4	127.0
Total ingredients:	100.0	9072.00

[0075] A tobacco formulation for use as a dissolvable cylinder, rod, stick, bean, ovoid, sphere or strip type of a smokeless tobacco product is provided in the manner set forth in Table 14. The tobacco formulation described in Example 26 is processed as set forth in Example 23, except that the plasticizer blend feed rate is set at 2,72 kg/hr (6 lb/hr). Additionally, the flavor in Example 26 is introduced into the formulation via the binder system in contrast to Example 23.

Table 14

Ingredients:	Example 26	
	wt %	g
Tobacco (finely milled)	35	3175.2
Sucralose	0.5	45.4
Sodium chloride	3	272.2
Sodium bicarbonate	1.3	117.9
Sodium hydroxide granules	0.5	45.4
Hydroxypropyl Cellulose (Klucel® EF)	16	1451.5
Vegetable fat (Confecto No Stick N)	2.5	226.8
Binder System		
Oat Fiber	3	272.2
Xanthan	3	272.2
Gum arabic	6.2	562.5
Propylene glycol	4	362.9
Flavor (Mint)	2	181.4
Plasticizer Blend		
Erythritol	7	635.0
Isomalt	7	635.0
Maltitol syrup @ 70% solids	8	1036.8
Glycerin	1	90.7
Total ingredients:	100.0	9292.32

[0076] A tobacco formulation for use as a dissolvable cylinder, rod, stick, bean, ovoid, sphere or strip type of a smokeless tobacco product is provided in the manner set forth in Table 15. The tobacco formulation described in Example 27 is processed as set forth in Example 23, except that the plasticizer solution is not preheated before introduction of the plasticizer blend into the extruder, the extruder feed rate is set at about 6,8 kg/hr (15 lb/hr) of dry formulation, and the plasticizer blend feed rate is set at about 2,72 kg/hr (7,25 lb/hr).

Table 15

Ingredients:	Example 27	
	wt %	g
Tobacco powder	36.5	3311.3
Sucralose	0.5	45.4
Sodium chloride	3	272.2
Hydroxypropyl Cellulose (Klucel® EF)	16	1451.5
Sodium bicarbonate	1.4	127.0
Vegetable fat (Confecto No Stick N)	2.8	254.0
Erythritol	5	453.6
Binder System		
Oat Fiber	3	272.2
Xanthan	2	181.4
Gum arabic	5	453.6
Propylene glycol	3	272.2
Flavor (Mint)	1.5	136.1
Plasticizer Blend		
Maltitol syrup @ 70% solids	19.3	2501.3
Glycerin	1	90.7
Total ingredients:	100.0	9731.66

[0077] A tobacco formulation for use as a dissolvable cylinder, rod, stick, bean, ovoid, sphere or strip type of a smokeless tobacco product is provided in the manner set forth in Table 16. The tobacco formulation described in Example 28 is processed as set forth in Example 23, except that the plasticizer blend is prepared by melting the granular components of the plasticizer blend without the addition of water; the extruder feed rate is set at about 5,21 kg/hr (5,21 lb/hr) of dry formulation; and the plasticizer blend feed rate is set at about 1,68 kg/hr (3,71 lb/hr).

Table 16

Ingredients:	Example 28	
	wt %	g
Tobacco extract (spray dried)	12	1088.6
Tobacco powder	24	2177.3
Titanium dioxide	1	90.7
Sucralose	0.5	45.4
Sodium Chloride	3	272.2
Hydroxypropyl Cellulose (Klucel® EF)	9	816.5

(continued)

Ingredients:	Example 28	
	wt %	g
Sodium bicarbonate	2	181.4
Citric acid	1	90.7
Vegetable fat (Confecto No Stick N)	2	181.4
Binder System		
Gum arabic	6	544.3
Xanthan gum	2	181.4
Pullulan	9	816.5
Propylene glycol	3	272.2
Flavor (Mint)	1.5	136.1
Plasticizer Blend		
Erythritol	11.5	1043.3
Sorbitol	11	997.9
Glycerin	1.5	136.1
Total ingredients:	100.0	8935.92

[0078] A tobacco formulation for use as a dissolvable cylinder, rod, stick, bean, ovoid, sphere or strip type of a smokeless tobacco product is provided in the manner set forth in Examples 29 and 30 (show in Tables 17 and 18 respectively). In Examples 29 and 30, the binder system is hydrated with about 8 to about 10 times its weight of water by high shear mixing using a commercially available mixer (model 28bl62 Waring blender available from Waring Co. of Tarrington, CT) for about 15 to 20 minutes. The plasticizer blend of Examples 29 and 30, prepared as set forth in Example 23, is added to the high shear mixture, and thoroughly mixed for an additional about 10 to 15 minutes. The binder system and plasticizer blend mixture is than transferred to a mixer, for example a commercially available Kitchen Aid or Hobart mixer, equipped with mixing spindles. The tobacco composition is then transferred to the mixer and thoroughly mixed for about 5 to 10 minutes to form a semi to solid visco-elastic mass or dough like composition. The dough-like composition is flattened via a manually operated twin roll press into a 4 to 5 mm thick sheet. The sheet is stored under ambient temperature to about 60°C and about 25 percent to about 40 percent relative humidity for about 12 to 18 hours. After storage, the sheet is fed through a drop roller press which molds and cuts the sheet into various sizes and shapes as described in Example 23.

Table 17

Ingredients:	Example 29	
	wt %	g
Tobacco (finely milled)	35	317.5
Sucralose	0.5	4.5
Titanium dioxide	1	9.1
Sodium chloride	3	27.2
Sodium bicarbonate	1	9.1
Flavor (mint)	1.5	13.6

(continued)

Binder System		
Gum arabic	11	99.8
Food starch (Elastigel 1000J)	7.5	68.0
Methocel E50	6.5	59.0
Glycerin	3	27.2
Plasticizer Blend		
Erythritol	10	90.7
Isomalt	10	90.7
Maltitol	10	90.7
Total ingredients:	100.0	907.0

Table 18

Ingredients:	Example 30	
	wt%	g
Tobacco (finely milled)	36	326.5
Sucralose	0.5	4.5
Titanium dioxide	1	9.1
Sodium chloride	3	27.2
Flavor (mint)	1.5	13.6
Binder System		
Gum arabic	10	90.7
Food starch (Elastigel 1000J)	8	72.6
Pullulan	9	81.6
Vegetable oil	2	18.1
Plasticizer Blend		
Erythritol	15	136.1
Sorbitol liquid @ 60% solids	14	127.0
Total ingredients:	100.0	907.0

[0079] A tobacco formulation or tobacco product prepared as set forth in Examples 23-30 can have a lower operating temperature of the extruder than that of conventional methods for forming tobacco products, thereby reducing and/or avoiding the possibility of charring or scalding the tobacco material while still producing a chewable tobacco product. By pre-mixing the plasticizer blend, the ingredients of the plasticizer blend can be heated to a temperature where the plasticizer blend exhibits plastic-type or visco-elastic properties outside of the extruder barrel zone.

Claims

1. A tobacco product in a form suitable for insertion into the mouth of a user comprising: tobacco and a thermoplastic

binder system, the amount of the thermoplastic binder system being present in an amount between about 10 weight percent to about 30 weight percent of the dry weight of the tobacco product,
wherein the thermoplastic binder system comprises a thermoplastic polymeric material in an amount less than about 20 weight percent of the dry weight of the tobacco product.

2. The tobacco product of claim 1, wherein the thermoplastic polymeric material exhibits thermoplastic behavior at temperatures less than about 100°C.

3. The tobacco product of claim 1 or 2, wherein the thermoplastic binder system incorporates at least one plasticizer.

4. The tobacco product of claim 3, wherein the thermoplastic binding material comprises pullulan, gum arabic, and xanthan.

5. The tobacco product of claim 3 or 4, wherein the tobacco product further comprises a plasticizer blend and wherein the plasticizer blend comprises

at least one of sorbitol liquid, maltitol syrup, or polyglycitol;
at least one of erythritol, isomalt, xylitol, or mannitol; and
at least one of glycerin, propylene glycol, polypropylene glycol, or polyethylene glycol.

6. The tobacco product of one of claims 3 to 5, wherein the thermoplastic binding material exhibits thermoplastic behavior at temperatures less than about 100°C.

7. The tobacco product of one of claims 1 to 6, wherein the thermoplastic binder system exhibits thermoplastic behavior at temperatures less than about 100°C.

8. The tobacco product of one of claims 1 to 7, further comprising: a binder system and a plasticizer blend, wherein the plasticizer blend is melted prior to mixing with the tobacco and the binder system.

9. The tobacco product of one of claims 1 to 8, wherein the thermoplastic binder system further comprises:

at least one thermoplastic binding material in an amount between about 5 weight percent to about 20 weight percent of the dry weight of the tobacco product; and
at least one plasticizer in an amount between about 3 weight percent to about 15 weight percent of the dry weight of the tobacco product.

10. A method for making a smokeless tobacco product comprising:

contacting tobacco material and a thermoplastic binder system to provide a mixture, wherein the amount of the thermoplastic binder system being present in an amount between about 10 weight percent to about 30 weight percent of the dry weight of the tobacco product and wherein the thermoplastic binder system comprises a thermoplastic polymeric material in an amount less than about 20 weight percent of the dry weight of the tobacco product;
subjecting the mixture to an elevated temperature;
forming the mixture into a desired shape of a tobacco product; and
cooling the tobacco product.

11. The method of claim 10, whereby the thermoplastic binder system incorporates at least one thermoplastic binding material and at least one plasticizer.

12. The method of claim 10 or 11, whereby the forming of the mixture involves subjecting the mixture to a temperature of less than about 100°C.

13. The method of one of claims 10 to 12, whereby during forming, the mixture possesses a moisture content greater than about 5 weight percent, based on a total weight of the tobacco product and moisture.

14. The method of one of claims 10 to 13, further comprising contacting a plasticizer blend with the mixture, prior to subjecting the mixture to an elevated temperature.

15. The method of one of claims 10 to 14, wherein the plasticizer blend is heated prior to contacting the plasticizer blend with the mixture.

Patentansprüche

1. Tabakprodukt in einer Form geeignet zur Einführung in den Mund eines Konsumenten, umfassend: Tabak und ein thermoplastisches Bindemittel-System, wobei das thermoplastische Bindemittel-System in einem Anteil zwischen etwa 10 Gewichtsprozent bis etwa 30 Gewichtsprozent des Trockengewichts des Tabakprodukts vorliegt, wobei das thermoplastische Bindemittel-System ein thermoplastisches Polymermaterial in einem Anteil von weniger als etwa 20 Gewichtsprozent des Trockengewichts des Tabakprodukts umfasst.

2. Tabakprodukt nach Anspruch 1, wobei das thermoplastische Polymermaterial thermoplastisches Verhalten bei Temperaturen von weniger als etwa 100°C zeigt.

3. Tabakprodukt nach Anspruch 1 oder 2, wobei das thermoplastische Bindemittel-System mindestens einen Plastifikator enthält.

4. Tabakprodukt nach Anspruch 3, wobei das thermoplastische Bindemittel Pullulan, Gummiarabikum, und Xanthan umfasst.

5. Tabakprodukt nach Anspruch 3 oder 4, wobei das Tabakprodukt ferner ein Plastifikator-Blend umfasst und wobei das Plastifikator-Blend

   mindestens eines von Sorbit-Flüssigkeit, Maltit-Sirup, oder Polyglycitol;
   mindestens eines von Erythritol, Isomalt, Xylitol, oder Mannitol; und
   mindestens eines von Glycerin, Propylenglykol, Polypropylenglykol, oder Polyethylenglykol umfasst.

6. Tabakprodukt nach einem der Ansprüche 3 bis 5, wobei das thermoplastische Bindemittel thermoplastisches Verhalten bei Temperaturen von weniger als etwa 100°C zeigt.

7. Tabakprodukt nach einem der Ansprüche 1 bis 6, wobei das thermoplastische Bindersystem thermoplastisches Verhalten bei Temperaturen von weniger als etwa 100°C zeigt.

8. Tabakprodukt nach einem der Ansprüche 1 bis 7, ferner umfassend ein Bindemittel-System und ein Plastifikator-Blend, wobei das Plastifikator-Blend vor einem Vermischen mit dem Bindemittel-System geschmolzen ist.

9. Tabakprodukt nach einem der Ansprüche 1 bis 8, wobei das thermoplastische Bindemittel-System ferner

   mindestens ein thermoplastisches Bindemittel in einem Anteil zwischen etwa 5 Gewichtsprozent bis etwa 20 Gewichtsprozent des Trockengewichts des Tabakprodukts; und
   mindestens einen Plastifikator in einem Anteil zwischen etwa 3 Gewichtsprozent bis etwa 15 Gewichtsprozent des Trockengewichts des Tabakprodukts umfasst.

10. Verfahren zur Herstellung eines rauchfreien Tabakprodukts, umfassend:

    In-Kontakt-bringen von Tabakmaterial und einem thermoplastischen Bindemittel-System um ein Gemisch bereitzustellen, wobei das thermoplastische Bindemittel-System in einem Anteil zwischen etwa 10 Gewichtsprozent bis etwa 30 Gewichtsprozent des Trockengewichts des Tabakprodukts vorhanden ist und wobei das thermoplastische Bindemittel-System ein thermoplastisches Polymermaterial in einem Anteil von weniger als etwa 20 Gewichtsprozent des Trockengewichts des Tabakprodukts umfasst;
    Aussetzen des Gemischs mit einer erhöhten Temperatur;
    Formen des Gemischs in eine gewünschte Form eines Tabakprodukts; und
    Kühlen des Tabakprodukts.

11. Verfahren nach Anspruch 10, wobei das thermoplastische Bindemittel-System mindestens ein thermoplastisches Bindemittel und mindestens einen Plastifikator enthält.

12. Verfahren nach Anspruch 10 oder 11, wobei das Formen des Gemischs Aussetzen des Gemischs mit einer Temperatur von weniger als etwa 100°C beinhaltet.

13. Verfahren nach einem der Ansprüche 10 bis 12, wobei während des Formens das Gemisch einen Feuchtigkeitsgehalt von mehr als etwa 5 Gewichtsprozent, basierend auf einem Gesamtgewicht des Tabakprodukts und Feuchtigkeit, besitzt.

14. Verfahren nach einem der Ansprüche 10 bis 13, ferner umfassend In-Kontakt-bringen eines Plastifikator-Blends vor dem Aussetzen des Gemischs mit einer erhöhten Temperatur.

15. Verfahren nach einem der Ansprüche 10 bis 14, wobei das Plastifikator-Blend vor dem In-Kontakt-bringen des Plastifikator-Blends mit dem Gemisch erwärmt wird.

Revendications

1. Produit de tabac sous une forme appropriée à l'insertion dans la bouche d'un utilisateur, comprenant : du tabac et un système de liant thermoplastique, le système de liant thermoplastique étant présent en une quantité d'entre environ 10 % en poids à environ 30 % en poids de la matière sèche du produit de tabac,
dans lequel le système de liant thermoplastique comprend une matière polymère thermoplastique en une quantité inférieure à environ 20 % en poids de la matière sèche du produit de tabac.

2. Produit de tabac selon la revendication 1, dans lequel la matière polymère thermoplastique présente un comportement thermoplastique à des températures inférieures à environ 100°C.

3. Produit de tabac selon la revendication 1 ou 2, dans lequel le système de liant thermoplastique inclut au moins un plastifiant.

4. Produit de tabac selon la revendication 3, dans lequel la matière liante thermoplastique comprend le pullulane, la gomme arabique, et le xanthane.

5. Produit de tabac selon la revendication 3 ou 4, dans lequel le produit de tabac comprend en outre une combinaison plastifiante et dans lequel la combinaison plastifiante comprend
au moins un parmi le sorbitol liquide, le sirop de maltitol, ou le polyglycitol ;
au moins un parmi l'érythritol, l'isomalt, le xylitol, ou le mannitol ; et
au moins un parmi la glycérine, le propylène glycol, le polypropylène glycol ou le polyéthylène glycol.

6. Produit de tabac selon l'une quelconque des revendications 3 à 5, dans lequel la matière liante thermoplastique présente un comportement thermoplastique à des températures inférieures à environ 100°C.

7. Produit de tabac selon l'une quelconque des revendications 1 à 6, dans lequel le système de liant thermoplastique présente un comportement thermoplastique à des températures inférieures à environ 100°C.

8. Produit de tabac selon l'une quelconque des revendications 1 à 7, comprenant en outre : un système de liant et une combinaison plastifiante, dans lequel la combinaison plastifiante est fondue avant le mélange avec le tabac et le système de liant.

9. Produit de tabac selon l'une quelconque des revendications 1 à 8, dans lequel le système de liant thermoplastique comprend en outre :

   au moins une matière liante thermoplastique en une quantité d'entre environ 5 % en poids à environ 20 % en poids de la matière sèche du produit de tabac ; et
   au moins un plastifiant en une quantité d'entre environ 3 % en poids à environ 15 % en poids de la matière sèche du produit de tabac.

10. Procédé de fabrication d'un produit de tabac sans fumée, comprenant :

    la mise en contact de la matière de tabac et d'un système de liant thermoplastique pour donner un mélange,

dans lequel le système de liant thermoplastique est présent en une quantité d'entre environ 10 % en poids à environ 30 % en poids de la matière sèche du produit de tabac et dans lequel le système de liant thermoplastique comprend une matière polymère thermoplastique en une quantité inférieure à environ 20 % en poids de matière sèche du produit de tabac ;
la soumission du mélange à une température élevée ;
le formage du mélange en une forme désirée d'un produit de tabac ; et
le refroidissement du produit de tabac.

11. Procédé selon la revendication 10, moyennant quoi le système de liant thermoplastique inclut au moins une matière liante thermoplastique et au moins un plastifiant.

12. Procédé selon la revendication 10 ou 11, moyennant quoi le formage du mélange implique la soumission du mélange à une température inférieure à environ 100°C.

13. Procédé selon l'une quelconque des revendications 10 à 12, moyennant quoi, durant le formage, le mélange possède une teneur en humidité supérieure à environ 5 % en poids, sur la base du poids total du produit de tabac et de l'humidité.

14. Procédé selon l'une quelconque des revendications 10 à 13, comprenant en outre la mise en contact d'une combinaison plastifiante avec le mélange, avant la soumission du mélange à une température élevée.

15. Procédé selon l'une quelconque des revendications 10 à 14, dans lequel la combinaison plastifiante est chauffée avant la mise en contact de la combinaison plastifiante avec le mélange.

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