⑲ Europäisches Patentamt
European Patent Office
Office européen des brevets

⑪ Publication number: **0 162 671**
A2

⑫

EUROPEAN PATENT APPLICATION

㉑ Application number: 85303459.3

㉒ Date of filing: 17.05.85

(51) Int. Cl.^{4}: **A 24 B 15/14**
A 24 B 15/28

㉚ Priority: 25.05.84 US 613935

㊸ Date of publication of application:
27.11.85 Bulletin 85/48

(84) Designated Contracting States:
CH DE IT LI NL

(71) Applicant: PHILIP MORRIS INCORPORATED
120 Park Avenue
New York, New York 10017(US)

(72) Inventor: Seligman, Robert Bernard
16, Roslyn Road
Richmond Virginia 23226(US)

(72) Inventor: Knudson, Donald B.
11451 Rochelle Road
Chester Virginia 23831(US)

(72) Inventor: Keritsis, Gus Demitrios
104, Carbe Court
Richmond Virginia 23236(US)

(72) Inventor: Osmalov, Jerome Sidney
4703 West Grace Street
Richmond Virginia 23230(US)

(74) Representative: Bass, John Henton et al,
REDDIE & GROSE 16 Theobalds Road
London WC1X 8PL(GB)

(54) Cohesive tobacco composition.

(57) A process for making a cohesive tobacco composition, in which tobacco pectins within the tobacco itself serve as the binder, by contacting dry tobacco particles with a solution containing an agent to destroy the alkaline earth metal cross-links of the tobacco pectins, under high shear conditions. The resulting cohesive composition may have a solids content greater than about 14% and a viscosity less than about 2000 centipoise. A reconstituted tobacco sheet is made by forming the resulting mixture into a sheet and drying. In one embodiment ammonia and tobacco volatiles contained in vapors from the sheet drying step are recovered and recycled into the solution.

EP 0 162 671 A2

Croydon Printing Company Ltd

COHESIVE TOBACCO COMPOSITION

BACKGROUND

The present invention relates generally to tobacco products and more particularly to an improved cohesive tobacco composition in which tobacco pectins within the tobacco itself serve as the binder, a process for making the composition, and the production of tobacco sheet from such composition.

During the production and processing of tobacco products, including aging, blending, sheet forming, cutting, drying, cooling, screening, shaping and packaging, considerable amounts of tobacco fines, dust, stems, and other small tobacco plant parts are produced. It is known that such small tobacco plant parts can be combined with a binder to form a coherent sheet, which resembles leaf tobacco and which is commonly referred to as reconstituted tobacco.

It is also known to treat the small tobacco plant parts to release tobacco pectins from within the tobacco itself and to use such pectins as the binder. Such processes are taught by US-A- 3 353 541 and 3 420 241 (Hind and Seligman), US-A- 3 386 499 (Hind) and US-A- 3 760 815 (Deszyck).

Unlike reconstituted tobacco made with non-tobacco derived binders, the reconstituted tobacco which is obtained from such pectin release processes need not contain any added cellulose or proteinaceous material which is foreign to tobacco, since the binder which is employed may be derived solely from tobacco, and may be produced in such a manner that it contains no materials other than those which naturally occur in tobacco. Thus, reconstituted tobacco produced in accordance with these processes can be so formulated as to be similar to natural tobacco in physical properties and chemical composition.

In the '541, '241 and '449 patents, diammonium acid phosphate or ammonium orthophosphate, is employed to treat the tobacco plant parts to destroy the alkaline earth metal cross-links of the tobacco pectins. The mechanism of the process involves four distinct steps: 1) the penetration of the tobacco material by the cross-link destruction agents; 2) the destruction of the alkaline earth metal cross-links and the release of the tobacco pectins; 3) the solubilization and migration of the resulting tobacco pectins from the interstices of the tobacco material; and 4) the depositing of the released tobacco pectins on the surface of the treated plant parts.

The first step of penetration of the tobacco material by the cross-link destruction agent begins upon contact of the tobacco material with the destruction agent in an aqueous mixture. Considering a single tobacco particle, the agent in aqueous form soaks into and permeates the particle over some period of time which may depend on such factors as the temperature of the mixture and the size, shape, surface area and porosity of the particles. Considering a large quantity of dry tobacco particles to be combined with an aqueous solution of pectin release agent, the time required to complete this step is increased by the mixing time required to effect contact of essentially every individual tobacco particle with the solution. Essentially complete mixing is highly desirable, for if not achieved, the result is an unacceptable sheet material containing lumps of dry tobacco. Reconstituted tobacco containing such lumps exhibits lower tensile strength and inferior appearance.

Similarly, if one begins with a mixture of dry tobacco particles and dry cross-link destruction agent to be combined with an aqueous solution to initiate the permeation, the mixing time must be sufficient to accommodate the additional time involved in dissolving the dry cross-link destruction agent into solution prior to permeation of the tobacco particles thereby.

The second step, which is release of the tobacco pectins by destruction of the alkaline earth metal cross-links, can be considered to occur somewhat concurrently with the first. As the agent permeates portions of the tobacco particles, destruction of the cross-links begins in those permeated portions.

The third step, which is solubilization of the resulting tobacco pectins and migration thereof from the interstices of the tobacco particles, involves a migration of the pectins in opposite directions to the directions of migration or permeation of the first step and thus must occur over some time period subsequent to the first step.

The fourth step, which is depositing the released tobacco pectins on the surface of the treated tobacco particles, can be considered to occur somewhat concurrently with the third. As the tobacco pectin migrates out of a tobacco particle, it may deposit onto the particle surface or dissolve into the solution and be deposited onto other particles.

Under the conditions of the '541 process such as temperature, solids content, pH and mixture proportions, agitating or stirring of the mixture is taught therein as being required for about one minute to one day. The conditions disclosed in connection with ammonium orthophosphate include a pH value between about 5.8 and 10, a temperature as high as 400° C, but preferably between about 25 and 135° C, and periods of about 1 minute to 24 hours. With diammonium acid phosphate (DAP) the preferred quantities are 0.5 to 5.0% by weight concentration of DAP in the aqueous solution, and from about 0.01 to 0.5 (most preferably about 0.05 to 0.035) part DAP by weight of tobacco being contacted. A humectant, such as glycerin or triethylene glycol, may be present at about 0.5 to 1 part by weight per part of DAP. The temperature during DAP treatment of the tobacco may vary between room temperature and about 190° F (88° C) or higher, the pH being maintained at about 7.1 to 9.0. By agitating or stirring such a mixture under these conditions for from about 1 minute to 1 day (preferably about 1 to 5 hours) the tobacco pectins are liberated, released and deposited in the tobacco parts to form a binder composition.

In the process according to the '815 patent, ammonium salts of organic acids are used as the cross-link destruction agent. However, the steps of the mechanism are essentially the same as described above. The selected acids are unsubstituted aliphatic or aromatic mono or polycarboxylic acids or such acids having only hydroxy and lower alkoxy groups as substituents. The preferred monocarboxylic acids are fatty acids having 6 to 18 carbon atoms and the preferred polycarboxylic acids are those having 2 to 12 carbon atoms. Under the conditions of the '815 process, one-half to 24 hours is required. The preferred conditions include an amount of added ammonium salt in the range of about 0.0 to 0.25 mols per 100 grams tobacco (preferably about 0.025 to 0.08 mols per 100 grams) and, additionally, sufficient ammonium hydroxide to reach an alkaline pH, preferably from about pH 9 to 10. During pectin release and salt formation, a temperature from about 25 to 110° C may be maintained for the time mentioned above. If ammonium salts are formed in situ, the same amount of the acid may be added as indicated for the salt, together with sufficient ammonium hydroxide to achieve pH 9 to 10.

For economic reasons, it is desirable to reduce the time of agitation to a minimum, but sufficient time must be allowed for the steps of the process to occur.

During long agitation times, conditions such as a temperature and pH may change, means must be provided for monitoring and controlling these conditions. Moreover, long agitation times may increase viscosity to levels that are unacceptable for casting, spraying, coating, extruding or otherwise using in the manufacture of a tobacco product. Accordingly, the viscosity of the composition must be reduced to an acceptable value prior to its utilisation. Typically, viscosity reduction is accomplished by dilution. However, such dilution increases the drying load and greatly affects the economics of the process. In the '241 patent, viscosity is kept at acceptable values by dilution with water prior to agitation. Water to a certain extent is required in any slurry making process, but the less water used, and therefore the higher solids content of the resulting composition, the lower the drying load and the more favorable the economics of the process. As a result of the dilution factor, the slurry solids content of the process of the '241 patent are in the range of about 5% to 10%. Also, with long agitation times mixing and storage vats may become necessary. The employment of such equipment adds significantly to the capital, maintenance and operating costs of the process.

In one known method of producing a cohesive tobacco composition as described in US-A-4 325 391, tobacco material and an aqueous adhesive material are first contacted together and mixed within a high intensity mixer. In this patent, the mixer disclosed comprises a housing cover providing two inlets, a housing providing a slurry discharge and with the cover defining a mixing chamber, a screen disposed in the chamber across the slurry discharge, and a rotor disposed in the chamber and mounted on an axis transverse to the direction of flow from the inlets to the outlet, the rotor having a plurality of series of radially disposed blades, the series of blades being equally spaced arcuately around the axis of rotation of the rotor, and the blades of each series being selectively spaced so that the ends of all the blades will provide a wiping action across the total surface of the screen and in close proximity thereto during each revolution of the rotor. A slurry box is positioned to receive slurry from the discharge and deposit the slurry in a thin continuous layer on a casting belt. Alternatively the slurry box may be eliminated and an extrusion nozzle provided to extrude the slurry onto the belt.

In the '391 process, mixing times of an order of magnitude less than one minute and slurry solids content of about 22% are achieved. In such a quick mixing process, insufficient time elapses for the tobacco material to be thoroughly permeated by the aqueous adhesive material. In processes such as the '391 process wherein an adhesive is added to rather than produced within the mixture, this is not only an acceptable result but also a desirable one because permeation is not required since only an application of the adhesive to the surface of the tobacco material is necessary for binding the tobacco particles together in the formation of the tobacco sheet or other tobacco product. Moreover, as taught in the '391 patent, permeation is undesirable in such an adhesive additive process because subsequently greater drying capacity is required to dry the tobacco sheet or other tobacco product to an acceptable moisture content and thereby effect the adherence of the tobacco particles to one another. Indeed, the objective of the '391 patent is to effect sheet formation prior to complete moisture permeation and equilibrium of the tobacco particle.

Conversely, in processes for producing a cohesive tobacco composition whereby the tobacco pectin is released from the tobacco particles and used as the adhesive, permeation of the cross-link destruction agent is absolutely essential to effect release of the tobacco pectin adhesive. Moreover, as taught in the '541 patent, heretofore a period of one minute to one day of agitation and mixing was required for this to occur.

Accordingly, there is a need in the art for a process of making a cohesive tobacco composition and a reconstituted tobacco which has the advantages of using natural adhesive released from the tobacco itself, which yields a composition with increased solids content and acceptable viscosity and which may be accomplished quickly enough to avoid the expense of mixing tubs and holding tanks and the like.

SUMMARY OF THE INVENTION

The present invention alleviates to a great extent the disadvantages of the prior art by providing a method for making a cohesive tobacco composition with desirable viscosity and solids properties for use in making a reconstituted tobacco or other tobacco product by contacting dry tobacco plant particles with an aqueous solution containing a cross-link destruction or pectin release agent under high shear conditions. Employing the present invention, the required mixing time required for the cohesive tobacco composition making processes of the type employing a pectin release mechanism is reduced to an order of magnitude less than achievable in the prior art while solids content in the composition is increased and viscosity is maintained at an acceptable level.

In Example 16 of the '241 and '541 patents, a Cowles high shear mixer is used for agitating the composition. However, the Cowles mixer is operated at low speed, thus a high shear condition was never reached. Consequently, although a minimum time of 15 minutes was stated to be sufficient, mixing was in practice required for one hour.

The present invention also provides, according to another aspect, a cohesive tobacco composition comprising tobacco particles cohered by a tobacco pectin adhesive derived from the tobacco by a solids content greater than 14% and a viscosity less than 2000 centipoise.

In one embodiment of the present invention, tobacco particles are fed into one inlet of a high shear mixer while an aqueous solution of a pectin release agent and of other ingredients is fed into another inlet. The tobacco particles and the aqueous solution are mixed together and exit from the mixer in a period of time significantly less than one minute and are deposited onto a smooth belt and dried.

In another embodiment, a mixture of tobacco particles and pectin release agent is fed into one inlet of a high shear mixture and an aqueous solution of other ingredients is fed into another inlet. The mixture of tobacco and agent is low enough in moisture content such that it is free flowing and that the pectin release agent remains inactive and no significant cross link destruction occurs. The pectin release agent becomes active upon dissolving into the aqueous solution. The tobacco particles and the solution are mixed together, exit from the mixer and are cast onto a smooth belt and dried.

In a preferred feature, ammonia and tobacco volatiles are recovered from vapors driven off the sheet during drying, and may be recycled to the aqueous solution, for example by contacting the vapors with an acid solution.

In other embodiment the pectin release agent may be mixed with the aqueous solution before the latter is mixed with the tobacco particles. Moreover, the tobacco particles may be mixed with a portion of the solution to form a slurry, and the agent mixed with another portion of the solution before the resulting slurry and solution are mixed together under high shear conditions.

Mixing under high shear conditions is preferably completed in under one minute and, for example, in about one-tenth of one minute.

The invention may utilize an ammonium or alkali metal orthophosphate as a cross-link destruction agent for releasing the tobacco pectins. Alternative agents include ammonium salts of carboxylic acids, or ammonium hydroxide and carboxylic acids.

In the case of diammonium monohydrogen orthophosphate (DAP) the preferred temperature of the aqueous solution is from about 15 to 121° C (60 to 250° F) and more especially from about 71 to 88° C (160 to 190° F).

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A first preferred embodiment of the present invention involves the mixing of tobacco particles with an aqueous solution of pectin release agent under high shear conditions for a period of time less than one minute to prepare a tobacco composition for making tobacco sheet.

The tobacco particles may be fines, dust, laminae, stems or other tobacco particles or mixtures thereof. The tobacco particles may be from Burley, Bright, Oriental or other types of tobacco or mixtures thereof. Generally, the particles should be small enough for the steps of permeation earth metal cross-link destruction, pectin release and deposition to be sufficiently accomplished to enable adequate binding in the resulting sheet in a process employing a short mixing time. Preferably, the particles are small enough to pass through a screen having apertures of about 14 mesh (1.4 mm) although smaller or larger particles may be used. As particle size increases, higher temperature may be required to release sufficient pectin.

The aqueous solution includes water and a cross-link destruction agent. When an ammonium or alkali metal orthophosphate such as diammonium monohydrogen orthophosphate (DAP) is used as the cross-link destruction agent, as in the '541 patent, the ranges of proportion of solution ingredients as disclosed in the '541 process is preferred. Namely, a preferred concentration of DAP in the aqueous solution is in the range of about 0.5 to about 5.0 percent by weight. In determining the rates of feed of the aqueous solution and the dry tobacco particles into the mixer, the amount of DAP should preferably be from about 0.01 to about 0.5 part by weight per part of tobacco being contacted in the mixer.

The temperature during the mixing may vary between room temperature and about 190° F. or higher depending on the type of tobacco being treated. Temperatures as high as 250° F. may be used provided that boiling of the mixture is preferably avoided. Even higher temperatures could be used as long as the tobacco is not damaged. The pH of the mixture is preferably maintained at a value of about 7.1 to about 10.0 which may be accomplished by the addition of a pH control agent such as ammonia to the solution.

Other ingredients may be added. For example, as a preservative in the finished sheet, sorbic acid, sodium benzoate, sodium propionate or others, may be added to result in a content of about 0.09% to about 0.12% by weight in the dried sheet. Also, color control agents including pigments or bleaching agents such as peroxide, calcium phosphate or magnesium phosphate may be added to the solution to lighten or darken the color of the resulting sheet as desired. A humectant, such as glycerin, triethylene glycol, propylene glycol, butanediol, sorbitol, glucose, fructose, dextrose or others, may be present if desired at about 1 to 15 weight percent of the final sheet weight after drying.

The optimum proportions of ingredients, pH and temperature will vary somewhat depending upon the particular blend of tobacco particles used. For example, when bright tobacco is used in the process, a somewhat lower temperature is preferred than when using burley tobacco. Stems may require a somewhat higher temperature than dust or filler.

The dry tobacco and the solution are fed through separate inlets into a high shear mixer. The mixer described in the '391 patent is suitable for this purpose. The shear rates experienced at a given location in such a mixer vary depending upon the local conditions. For example, where the tip of the mixer blade passes the screen with about a 320 millimeter (1/8") clearance, the instantaneous shear rate is about 31000 sec^{-1} at a rotor speed of 3500 rpm and blade tip speed of about 49 meters per second (160 feet per second) and about 47000 sec^{-1} at 5200 rpm and blade tip speed of 70 meters per second (230 feet per second). For the mixer configuration of the '391 patent, roter speeds of greater than 3500 rpm are preferred and a speed of about 5200 rpm is more preferable. Of course, required rotor speed may vary depending upon the physical properties of the mixture therein such as particle size and viscosity. Preferably, the mixer size and the feed rates are designed such that the residence time of the mixture in the mixer is minimized while achieving enough throughput to supply sufficient material directly to the sheet making apparatus such as apparatus of the type described in the '391 patent.

The mixture exits the mixer through a screen having apertures of preferably about 0.25 to about 1.5 millimeters and is deposited into a head box and cast, or otherwise coated, at a thickness of preferably about 0.5 millimeters to about 1.0 millimeters onto a moving smooth surface belt. The cast sheet is then dried to an OV of about 14 percent and removed from the belt. OV, oven volatiles, is defined as those volatiles in tobacco that are evolved by treatment in a forced draft oven at 100° C. for 3 hours.

During the drying operation, significant quantities of ammonia evaporate from the sheet. Therefore, it is preferable to use a hooded dryer to capture and exhaust the evaporating vapor from the sheet making line. The ammonia may be recovered from the exhaust vapor by contacting the vapor with an acid solution such as a solution of phosphoric acid or citric acid, or the like and preferably made with deionized water. In the case of phosphoric acid, the reaction of ammonia with phosphates will result in a mixture of ammonium phosphates including hypophosphate, orthophosphate, orthodihydrogen phosphate and ortho-monohydrogen phosphate. These ammonium phosphates may be used as a source of pectin release agent in preparing the aqueous solution as described above resulting in a cost savings for the overall process. Moreover, tobacco volatiles present in the vapor are also recovered with the ammonia and recirculated back into the process.

In a second preferred embodiment of the invention ammonium salts of carboxylic acids, or ammonium hydroxide and a carboxylic acid are employed as the cross-link destruction agent. Conditions such as temperature, pH and ingredient proportions of the process are preferably the same as taught in the '815 process except that the tobacco and the aqueous solution containing the destruction agent are first contacted in a high shear mixer. The apparatus used in the process is similar to that described in the previous embodiments.

In a third preferred embodiment the tobacco particles are mixed with an aqueous solution to form a slurry prior to introduction into the mixer. The aqueous solution is essentially free from pectin release agent but may contain other additives as mentioned in regard to the first embodiment. The water content of the aqueous solution may be decreased accordingly to avoid an unduly thin resulting composition exiting from the mixer.

In a fourth preferred embodiment of the invention, the cross-link destruction agent is combined with the tobacco particles prior to being introduced into the mixer. For ease of handling and feeding, the tobacco and destruction agent are preferably low enough in moisture to be granular and free flowing. Additionally, the moisture content should be low enough such that no significant reaction of the cross-link destruction agent with the tobacco occurs prior to introduction into the mixer. Tobacco and agent having a moisture content of less than about 18% OV has been used successfully although higher moisture contents may be used. For example, in the case where DAP is used as the cross-link destruction agent, the proportion of DAP to tobacco is the same as in the previously described embodiment. The DAP does not become active and permeate the tobacco particles to any significant degree until the DAP-tobacco mixture is contacted with the aqueous solution of the balance of the ingredients and the DAP dissolves into the solution and is thereafter absorbed by the tobacco particles. The other features of the process of this embodiment are the same as in the previously described embodiment. As a further feature of this embodiment, some or all of the other ingredients, such as sorbic acid and the like as mentioned regarding the first embodiment, may also be added in dry form to the tobacco prior to being introduced into the mixer.

The cohesive tobacco composition product formed by the process yields higher solids content at a given viscosity than was obtained heretofore.

In a sheet forming process where the slurry is deposited onto a moving surface from a headbox through an aperture formed between the belt and the downstream side of the box, for typical sheet thicknesses, the maximum slurry viscosity is about 2000 centipoise. Viscosity values herein are as measured by a Fann viscometer at 75° F. using Rotor #3, Bob #1 and a shear rate of 113 sec^{-1} (or 300 RPM). The cohesive tobacco product of the present invention has an observed viscosity lower than the aforementioned maximum in that satisfactory casting with such an apparatus was achieved. Moreover, the solids content of the product was as high as 26 percent as illustrated by Example 9 hereinbelow, well over the maximum achievable solids content of about 12 percent of previous products employing a released tobacco pectin binder.

The following examples are illustrative:

Example 1

A 2.5 percent solids solution of 7.5 parts diammonium orthophosphate, 4.6 parts triethylene glycol, 0.25 parts potassium sorbate, 2 parts corn syrup, and 15 parts aqueous ammonia (29.4 percent NH_3) in 71 degrees Celsius (160 degrees Fahrenheit) water was prepared. Simultaneously, this solution and tobacco plant parts which had been passed through a 14 mesh screen were metered at the combined rate of 734 kilograms per hour and at the ratio of 23.3 kilograms of tobacco per 100 kilograms of solution into a Fitzmill model No. DKAS06 high shear mixer having a mixing volume of 2.26 liters (138 $inches^3$) and a blade speed of about 5200 revolutions per minute.

The solution and the tobacco were metered into the mixer through corresponding separate inlets and first contacted one another within the mixer to form a calculated 21% solids content slurry. The average residence time of the ingredients within the mixer was 11.2 seconds. The slurry exited the mixer through a screen having 1.0 millimeter (40 mil) openings and was cast at a 0.64 millimeter (25 mil) wet thickness onto a continuous stainless steel belt moving at 30 centimeters per second (60 feet per minute) and dried to about 17 percent OV. The formed sheet was very streaky in appearance, had a tensile strength of 16 kilograms per meter (0.40 kilograms per inch), a sheet weight of 137 grams per meter^2 (12.7 grams per foot^2) and an equilibrated OV of 13 percent.

Example 2

Example 1 was repeated except that the ingredients were metered into the mixer at a combined rate of 883 kilograms per hour, the average residence time of the ingredients within the mixer was 9.30 seconds and the sheet was cast at a 0.76 millimeter (30 mil) wet thickness. The properties of formed sheet differed significantly from those of Example 1 only in that the sheet was less streaky and more acceptable in appearance.

Example 3

A 2.3 percent solids solution of 4 parts triethylene glycol, 0.25 parts potassium sorbate, 2 parts corn syrup and 13.5 parts aqueous ammonia (29.4 percent NH_3) in 71 degrees Celsius (160 degrees Fahrenheit) water was prepared. One hundred parts tobacco which had been passed through an 80 mesh screen was mixed with 7.5 parts diammonium orthophosphate. Simultaneously, the solution and the mixture of tobacco and agent were metered at a combined rate of 734 kilograms per hour and a ratio of 25.7 kilograms of dry mixture to 100 kilograms of solution into the mixer of Example 1. As in the prior examples, the solution and the mixture were metered into the mixer through corresponding separate inlets and first contacted one another within the mixer to form a calculated 22% solids content slurry. The average residence time of the ingredients within the mixer was 11.2 seconds.

The slurry exited the mixer through a screen having 1 millimeter (40 mil) openings and was cast at 0.64 millieters (25 mil) wet sheet thickness onto a continuous stainless steel belt moving 30 centimeters per second (60 feet per minute) and dried to about 17 percent OV. The formed sheet had a number of gelled particles, although otherwise it had an acceptable appearance, had a tensile strength of 17 kilograms per meter (0.42 kilograms per inch), a sheet weight of 110 grams per meter^2 (9.8 grams per foot^2), a breaking elongation of 3.2 percent and an equilibrated OV of 13.9 percent.

Example 4

Example 3 was repeated except that the slurry exited the mixer through a screen having .69 millimeter (27 mil) openings. The formed sheet had practically no gelled particles, had a tensile strength of 20 kilograms per meter (0.51 kilograms per inch) a sheet weight of 115 grams per meter^2 (10.7 grams per foot^2), a breaking elongation of 4.8 percent and an equilibrated OV of 14.1 percent.

Example 5

Example 4 was repeated except that the slurry was cast at a thickness of .76 millimeter (30 mils). Again, the formed sheet had practically no gelled particles, had a tensile strength of 34 kilograms per meter (.86 kilograms per inch), a sheet weight of 165 grams per meter^2 (15.3 grams per foot^2), a breaking elongation of 5.5 percent and an equilibrated OV of 13.7 percent.

Example 6

A 4.1 percent solids solution of the proportion of ingredients of Example 1 in 82 degrees Celsius (180 degrees Fahrenheit) water was prepared. Simultaneously, this solution and tobacco plant parts which had been passed through a 60 mesh screen were metered at the combined rate of 926 kilograms per hour and at the ratio of 22.4 kilograms of tobacco per 100 kilograms of solution into the mixer of Example 1.

The solution and the tobacco were metered into the mixer through corresponding separate inlets and first contacted one another within the mixer to form slurry having a calculated 22 percent solids. The average residence time of the ingredients within the mixer was 8.4 seconds. The slurry exited the mixer through a screen having 0.69 millimeter (27 mil) openings and was cast at a 0.62 millimeter (24 mil) wet thickness onto a continuous stainless steel belt moving at 38 centimeters per second (75 feet per minute) and dried to about 13.2 percent OV. The formed sheet was acceptable in appearance, had a tensile strength of 31 kilograms per inch

(0.78 kilograms per inch), sheet weight of 130 grams per meter^2 (12 grams per foot^2), a breaking elongation of 4.6 percent and an equilibrated OV of 13.5 percent.

Example 7

Under the conditions of the run of Example 6, except with a feed rate of 845 kilograms per hour, a slurry solids content of 19.2 percent, and an average residence time in the mixer of 9.2 seconds and a dried sheet OV of 13.9 percent, the formed sheet was acceptable in appearance, had a sheet weight of 98 grams per meter^2 (9.1 grams per foot^2), but unchanged values for equilibrium OV, tensile strength and breaking elongation.

Example 8

The conditions of Example 7 were repeated except that tobacco dust which had been passed through a 14 mesh screen was used. The resulting sheet was acceptable in appearance, had an equilibrium OV of 17.2 percent, sheet weight of 98 grams per meter^2 (9.1 grams per foot^2), tensile strength of 19 kilograms per meter (0.48 kilograms per inch) and breaking elongation of 9.8 percent.

Example 9

A 4 percent solution of the proportion of ingredients of Example 1 in 71 degrees Celsius (160 degrees Fahrenheit) water was prepared. Simultaneously, this solution and tobacco plant parts being factory dust which had been passed through a 60 mesh screen were metered at the combined rate of 764 kilograms per hour and at the ratio of 30 kilograms of tobacco per 100 kilograms of solution into the mixer of Example 1 in the manner of Example 1 to form a slurry having a calculated 26 percent solids content. The average residence time of the ingredients within the mixer was 10.6 seconds. The slurry exited the mixer through a screen having 1 millimeter openings and was cast at a 0.64 millimeter (25 mil) wet thickness onto a continuous stainless steel belt moving at 31.8 centimeters per second (62.5 feet per minute) and dried to about 17 percent OV. The formed sheet was acceptable in appearance, had an equilibrium OV of 15.3 percent, a sheet weight of 121 grams per meter^2 (11.2 grams per foot^2), a tensile strength of 26 kilograms per meter (0.67 kilograms per inch) and a breaking elongation of 7.6 percent.

Example 10

Example 9 was repeated except that the solution and tobacco dust were metered at the combined rate of 905 kilograms per hour and at the ratio of 26 kilograms of tobacco per 100 kilograms of solution to form a slurry having a calculated 24 percent solids content.

The average residence time of the ingredients within the mixer was 8.9 seconds. The formed sheet was aceptable in appearance, had an equilibrium OV of 15.4 percent, a sheet weight of 118 grams per meter^2 (11.0 grams per foot^2), a tensile strength of 24 kilograms per meter (0.62 kilograms per inch) and a breaking elongation of 7.6 percent.

Example 11

A portion of the slurry exiting the mixer of Example 10 was aged for one hour at 60-71 degrees Celsius (140-160 degrees Fahrenheit) prior to casting. The formed sheet was acceptable in appearance, had an equilibrium OV of 15.1 percent, a sheet weight of 126 grams per meter^2 (11.7 grams per foot^2), a tensile strength of 25 kilograms per meter (0.63 kilograms per inch) and a breaking elongation of 6.9 percent.

Example 12

Example 9 was repeated except that the tobacco included 70 percent dust and 30 percent stems, the solution and the tobacco parts were metered at the combined rate of 1000 kilograms per hour and at the ratio of 24 kilograms of tobacco per 100 kilograms of solution to form a slurry having a calculated 23 percent solids content. The average residence time of the ingredients within the mixer was 8.1 seconds. The slurry solids content was 19 percent. The formed sheet was acceptable in appearance, had an equilibrium OV of 15.5 percent, a sheet weight of 94 grams per meter^2 (8.7 grams per foot^2), a tensile strength of 23 kilograms per meter (0.59 kilograms per inch) and a breaking elongation of 6.6 percent.

Example 13

A portion of the slurry exiting the mixer of Example 12 was aged for 45 minutes at 71 degrees Celsius (160 degrees Fahrenheit) prior to casting. The formed sheet was acceptable in appearance, had an equilibrium OV of 15.5 percent, a sheet weight of 139 grams per meter^2 (12.9 grams per foot^2), a tensile strength of 25 kilograms per meter (0.63 kilograms per inch) and a breaking elongation of 7.1 percent.

Example 14

Example 9 was repeated except the solution was brought to a temperature of 88 degrees Celsius (190 degrees Fahrenheit) and tobacco dust which had been passed through a 14 mesh screen was used. The solution and dust were metered in at the combined rate of 1841 kilograms per hour and at the ratio of 24 kilograms of tobacco per 100 kilograms of solution to form a slurry of 22 percent solids (calculated). The average residence time of the ingredients within the mixer was 4.4 seconds. The slurry exited the mixer through a screen having 0.69 millimeter (27 mil) openings and was cast at a 0.65 millimeter (25 mil) wet thickness onto a continuous steel belt moving at 76 centimeters per second (150 feet per minute) and dried to about 19 percent OV. The formed sheet was acceptable in appearance, had an equilibrium OV of 15.5 percent, a sheet weight of 122 grams per meter^2 (11.3 grams per foot^2), a tensile strength of 19 kilograms per meter (0.47 kilograms per inch), a breaking elongation of 8.2 percent and a wet tensile strength of 4 kilograms per meter (0.1 kilograms per inch).

Example 15

Example 14 was repeated except that 70 percent tobacco fines and 30 percent burley stem were used. The formed sheet was acceptable in appearance, had an equilibrium OV of 13.2 percent, a sheet weight of 126 grams per meter^2 (11.7 grams per foot^2), a tensile strength of 35 kilograms per meter (0.90 kilograms per inch), a breaking elongation of 6.4 percent and a wet tensile strength of 10 kilograms per meter (0.3 kilograms per inch).

The above description includes examples directed to the forming of reconstituted tobacco sheet, however, the invention is not limited thereto. The cohesive tobacco composition may be otherwise utilized by extruding or by application as a coating, or by spraying or otherwise in the formation of a tobacco product.

The above description is only illustrative of a number of preferred embodiments which achieve the objects, features and advantages of the present invention and it is not intended that the present invention be limited thereto. Any modification of the present invention which comes within the spirit and scope of the following claims are considered part of the present invention.

CLAIMS

1. A process for making a cohesive tobacco composition using natural pectin adhesive released from the tobacco, characterised in that tobacco particles, an alkaline earth metal cross-link destruction agent and an aqueous solution are mixed together under high shear conditions.

2. A process according to claim 1 wherein the high shear mixing is completed in less than one minute, and preferably in about one-tenth of one minute.

3. A process according to claim 1 or 2 wherein the tobacco particles and the cross-link destruction agent are mixed together, preferably forming a granular and free flowing mixture, before being mixed with the aqueous solution under high shear conditions.

4. A process according to claim 1 or 2 further characterised by mixing together at least a portion of the aqueous solution and the cross-link destruction agent prior to the high shear mixing.

5. A process according to claim 1, 2 or 4 further characterised by admixing the tobacco particles and at least a portion of the aqueous solution to form a slurry prior to high shear mixing.

6. A process according to any of claims 1 to 5 wherein the tobacco particles provided are small enough to pass through a 5 mesh (4 mm) screen.

7. A process according to any of claims 1 to 6 wherein the cross-link destruction agent is an ammonium or alkali metal orthophosphate.

8. A process according to claim 7 wherein the said agent is diammonium monohydrogen orthophosphate.

9. A process according to claim 8 wherein from 0.01 to 0.5 part by weight of agent is mixed with one part of tobacco.

10. A process according to claim 8 or 9 wherein the temperature of the solution is from 15 to 121°C, and preferably from 71 to 88°C.

11. A process according to claim 8, 9 or 10 wherein the aqueous solution includes a pH control agent, preferably ammonia.

12. A process according to any of claims 1 to 6 wherein the cross-link destruction agent either is an ammonium salt of a carboxylic acid or ammonium hydroxide and a carboxylic acid, wherein the carboxylic acid is a monobasic fatty acid of six to 18 carbon atoms or a polybasic acid of two to 12 carbon atoms, or is mixture thereof, and the solution includes sufficient ammonium hydroxide to bring the mixture to a pH of 9 to 10.

13. A process according to any of claims 1 to 12 wherein the aqueous solution includes a humectant and/or a preservative and/or a color control agent.

14. A process according to any of claims 1 to 13 wherein the resulting cohesive tobacco composition has a solids content greater than 14% and a viscosity less than 2000 centipoise.

15. A process according to any of claims 1 to 14 further characterised in that the resulting cohesive tobacco composition is deposited onto a surface to form a sheet which is subsequently dried.

16. A process according to claim 15 further characterised by recovering ammonia and tobacco volatiles from vapor evaporated from the sheet during drying, by contacting said vapor with an acid solution, and using the resulting mixture in forming the said aqueous solution.

17. A cohesive tobacco composition comprising tobacco particles cohered by a tobacco pectin adhesive derived from the tobacco characterised by a solids content greater than 14% and a viscosity less than 2000 centipoise.