METHODS OF MAKING RECONSTITUTED TOBACCO SHEETS

BACKGROUND

During the production and processing of tobacco products, tobacco by-products such as tobacco stems, leaf scraps, and tobacco dust produced during the manufacturing process (i.e., stemming, aging, blending, cutting, drying, cooling, screening, shaping and packaging) can be recycled to reclaim their useful tobacco content. In the past, such tobacco by-products have been formed into what is known in the industry as reconstituted tobacco sheets.

Once prepared, reconstituted tobacco sheets may be cut in a similar fashion as whole leaf tobacco to produce tobacco filler suitable for cigarettes and other smoking articles. Reconstituted tobacco sheets, methods, and/or apparatuses for production are also described in commonly assigned US-A-4 341 228 (Keritsis *et al.*), US-A-5 724 998 (Gellatly *et al.*), US-A-5 203 354 (Hickle), US-A-5 584 306 (Beauman *et al.*), and US-A-6 216 706 (Kumar *et al.*).

A process for manufacturing reconstituted tobacco sheets uses a paper-making machine in which water is drained from a fibrous slurry of tobacco particles, and sheet that is formed is subsequently treated and dried. Such paper-making machines are described in US-A-3 255 706 (Selke), US-A-4 542 755 (Selke *et al.*) and US-A-4 182 349 (Selke).

SUMMARY

A method of making a reconstituted tobacco sheet comprises preparing an aqueous slurry containing tobacco material. A sheet is formed from the aqueous slurry, followed by reducing a moisture content of the sheet to less than about 50% by weight. An aerosol former is incorporated into the sheet at a temperature below about 40°C, followed by drying the sheet.

In another embodiment, a method of making a reconstituted tobacco sheet comprises preparing an aqueous slurry containing tobacco material, wherein the tobacco material includes tobacco leaf scraps, tobacco stems, tobacco dust created during tobacco processing, and/or tobacco leaf prime lamina strip. The aqueous slurry is separated into a solubles portion and a fibrous portion. The sheet is formed by a paper-making process from the fibrous portion separated from the aqueous slurry, without incorporating the solubles portion, followed by reducing a moisture content of the sheet to between about 30% and about 50% by weight. An aerosol former comprising a glycerin solution is incorporated into the sheet at a temperature between ambient temperature and below about 40°C. The sheet is dried to provide a reconstituted tobacco sheet having a glycerin content of up to about 50% by weight of the reconstituted tobacco sheet.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a flow chart illustrating an exemplary embodiment of a method of making reconstituted tobacco sheet.

FIG. 2 is a flow chart illustrating a preferred embodiment of a method of making reconstituted tobacco sheet.

DETAILED DESCRIPTION

5 In accordance with a preferred embodiment, a method of forming a reconstituted tobacco sheet with a high aerosol forming content can provide the reconstituted sheets with up to about 50% by weight glycerin, while avoiding a tacky surface on the sheet.

FIG. 1 shows an exemplary embodiment of a method of making a reconstituted tobacco sheet. In step 10, an aqueous slurry containing tobacco materials is prepared. In the next step 10 20, a tobacco sheet is formed from the aqueous slurry. The moisture content of the aqueous slurry is reduced to under 50% by weight in step 30. After reducing the moisture content of the tobacco sheet, in step 40 an aerosol former is incorporated into the tobacco sheet at a temperature of preferably less than about 40°C. Next, in step 50, the tobacco sheet undergoes a drying process.

15 FIG. 2 shows a preferred embodiment of the method of making the reconstituted tobacco sheet. In a first step, tobacco materials 52 and water 54 are mixed to form an aqueous slurry 56. The tobacco materials 52 can be tobacco leaf scraps, tobacco stems, tobacco dust created during tobacco processing, and/or tobacco leaf prime lamina strip. For example, the tobacco material 52 can contain at least about 50% by weight stems, preferably about 70-80% 20 by weight stems, with the balance containing tobacco leaf scraps and/or tobacco dust. Tobacco materials 52 can include other additives, such as wood cellulose fibers to improve the strength of the reconstituted tobacco sheet and allowing for lower stem content.

The aqueous slurry 56 is subjected to a pulping process 58 to produce a solubles portion 60 and a fibrous portion 62. For example, aqueous slurry 56 can be compressed or centrifuged 25 to remove the solubles portion 60. Preferably, the solubles portion 60 is not reincorporated into the reconstituted tobacco manufacturing process, but discarded.

As shown in FIG. 2, in the embodiment, the fibrous portion 62 is subjected to a refining process 64 to convert the fibrous portion 62 to more closely approximate individual fibers for paper-making. The fibrous portion 62 is formed into tobacco sheets by a paper-making process 30 66 (*e.g.*, Fourdrinier machine). During this paper-making process 66, the moisture content of the sheet is reduced by draining excess water through a wire mesh (*e.g.*, Fourdrinier wire). For example, the moisture content can be reduced from a starting moisture content of about 98-99% by weight to about 95% by weight by pure draining. In another example, the moisture content can be reduced to about 85% if draining is coupled with vacuuming of moisture.

35 After the paper-making process 66 has been completed, the tobacco sheets are subjected to a moisture reduction process 68 to reduce the moisture content of the sheet. Preferably, the moisture content is reduced to less than 50% by weight, but greater than 30% by

weight. In other exemplary embodiments, the moisture content is reduced to less than 45% by weight, less than 40% by weight, or less than 35% by weight. For example, the sheets can be placed on a steam-heated metal drum (*i.e.*, Yankee dryer) to reduce the moisture content and optionally followed by smaller steam-heated surface dryers (*i.e.* can dryers).

After the moisture reduction process 68, an aerosol former solution 72 is applied to the sheet. For example, the sheets can be passed through a size press 70, in which the sheets are fed between two vertical or horizontal rollers, configured to apply an aerosol former solution 72 to both sides of the sheet. The aerosol former solution 72 can include other additives 74. In alternative embodiments, the aerosol former solution 72 can be sprayed onto the sheet, or the sheet could be immersed in the aerosol former solution 72.

Examples of aerosol formers include glycerin, propylene glycol, ethylene glycol, dipropylene glycol, diethylene glycol, triethylene glycol, tetraethylene glycol, and/or oleyl alcohol.

In one embodiment, an aerosol former solution 72 is incorporated into the sheet at a temperature below about 40°C. In other exemplary embodiments, the aerosol former solution 72 is incorporated into the sheet at temperatures below about 35°C, *e.g.*, below about 30°C or 25°C, or at ambient temperature.

Glycerin is a preferred aerosol former for aerosol former solution 72. Glycerin forms an inert aerosol of glycerin and water vapor when combusted in a smoking article. For example, the glycerin aerosol former can be incorporated into the sheet as an aqueous glycerin solution containing about 20% to 80% glycerin by volume. In alternative embodiments, the glycerin solution can contain about 50 to 80% glycerin by volume. Preferably, the aqueous glycerin solution contains between about 75% to about 80% by volume glycerin. Attempts to use a solution of about 100% glycerin results in poor absorption of the glycerin into the tobacco material, resulting in a tacky surface, which can present difficulties in the manufacturing process.

The aerosol former solution 72 an also contain other additives 74, such as flavorants, humectants (other than glycerin), and/or acetate compounds. Examples of flavorants include licorice, sugar, fructose syrup, isosweet, cocoa, lavender, cinnamon, cardamom, apium graveolens, fenugreek, cascarilla, sandalwood, bergamot, geranium, honey essence, rose oil, vanilla, lemon oil, orange oil, mint oils, cassia, caraway, cognac, jasmine, chamomile, menthol, cassia, ylang-ylang, sage, spearmint, ginger, coriander, coffee and the like. Examples of humectants other than glycerin include propylene glycol and the like.

Tobacco materials with a higher concentration of glycerin may also contain optional additives. Acetates have been identified as possibly promoting reduction in TPM cytotoxicity of tobacco smoke, especially in combination with glycerin. Acetate compounds may further enhance the reduction of TPM or phenolics in the smoke of a combusted smoking article. In

one embodiment, the acetate compound includes ammonium acetate, calcium acetate, and/or magnesium acetate. The one or more acetate compounds are added in an amount effective to promote the reduction of catechol, hydroquinone, phenol, or TSNA in the smoke of a combusted smoking article incorporating the sheet as a cut filler.

As shown in FIG. 2, after passing the sheet through the size press 70, in which the aerosol former solution 72 is incorporated, the sheet is exposed to a drying process 76. For example, the drying process 76 can include passing the sheet through a tunnel or apron dryer.

In one embodiment in which the aerosol former solution 72 is glycerin, the glycerin solution is added in an amount effective to produce a non-tacky sheet upon drying. In another embodiment, the glycerin solution is added in an amount up to 50% by weight of the tobacco sheet after drying.

The ammonium acetate can be incorporated into the tobacco sheet in an amount between about 5 to 20% by weight of the sheet after drying, preferably about 10 to 12%. Calcium acetate can be incorporated in an amount between about 1 to 10% by weight of the sheet after drying, preferably about 4%. Magnesium acetate can incorporated in an amount between about 5-20% by weight of the sheet after drying, preferably about 8 to 10%.

After the drying process 76, in step 78 the sheet containing an aerosol former (e.g., glycerin) is thrashed or flayed with mechanical fingers into sized pieces similar to natural tobacco lamina strips or cut into diamond shaped pieces, between about two to four inches on a side. The reconstituted tobacco sheet pieces are blended with natural tobacco strips and the entire blend is shredded into a cut filler and incorporated into a smoking article. The overall reduction in TPM due to the dilution of tar in the tobacco smoke with an inert aerosol is proportional to the amount of glycerin incorporated in a smoking article.

The shredded tobacco sheet pieces ("STSP") may comprise approximately 5% to 60% of the blend of tobacco filler that is incorporated into the tobacco rod portion of the smoking article. At the upper end of the aforementioned blend inclusion range, the elevated glycerin content may tend to spot the wrapper of the tobacco rod, especially in humid conditions. The spotting effect can be ameliorated by selection of a wrapper paper having low spotting-propensity and/or by using a double wrap for the tobacco rod.

With respect to the smoke biological activity, cigarettes made from blends containing 20% to 30% STSP (comprising 2/3 base web, 1/3 glycerin) demonstrated that the biological activity, Ames and cytotoxicity, of total particulate matter (TPM), is reduced compared to a control cigarette without STSP, of similar filter construction and similar firmness.

In particular, at 20% inclusion rate of STSP, specific mutagenicity (Ames TA98 w/S9) was reduced by 35% and specific Neutral Red Uptake (NRU) cytotoxicity (1/EC50, ml/mg-TPM) was reduced by 27%. At 30% inclusion rate of STSP, specific mutagenicity (Ames TA98 w/S9)

was reduced by 35% and specific Neutral Red Uptake (NRU) cytotoxicity (1/EC50, ml/mg TPM) was reduced by 39%.

Preferably, STSP may comprise approximately 20% to 30% of the blend filler, wherein the aformentioned reduction in biological activity can be achieved, the tendency for spotting is reduced and unfavorable impact on sensory perceptions from inclusion of the STSP is ameliorated.

While the embodiments described above have been described in detail, it will be apparent to those skilled in the art that various changes and modifications can be made, and equivalents employed, without departing from the scope of the appended claims.

CLAIMS:

1. A method of making a reconstituted tobacco sheet, comprising:
preparing an aqueous slurry containing tobacco material;
forming a sheet from the aqueous slurry;
reducing a moisture content of the sheet to less than about 50% by weight;
incorporating an aerosol former into the sheet, wherein the aerosol former is at a temperature below about 40°C; and
drying the sheet.

2. The method of Claim 1, wherein the aerosol former is a glycerin solution.

3. The method of Claim 2, wherein the glycerin is added in an amount of up to about 50% by weight of the dried sheet.

4. The method of Claim 1, wherein forming the sheet further comprises:
separating the tobacco material into a solubles portion and a fibrous portion; and
forming the sheet from the fibrous portion without incorporating the solubles portion.

5. The method of Claim 2, wherein the glycerin solution is added in an amount effective to produce a non-tacky sheet after drying.

6. The method of Claim 2, wherein:
(a) the glycerin solution contains about 20% to 80% glycerin by volume;
(b) the glycerin solution contains about 50% to 80% glycerin by volume;
(c) the glycerin solution contains about 75% to 80% glycerin by volume; or
(d) the glycerin solution contains about 50% glycerin by volume.

7. The method of Claim 1, comprising:
(a) reducing a moisture content of the sheet to about 45% or less by weight prior to incorporating the aerosol former; or
(b) reducing a moisture content of the sheet to less than about 30% by weight prior to incorporating the aerosol former.

8. The method of Claim 1, comprising reducing a moisture content of the sheet to less than about 30% by weight.

9. The method of Claim 1, wherein:

(a) the aerosol former is at a temperature below about 35°C;

(b) the aerosol former is at a temperature below about 30°C; or

(c) the aerosol former is at a temperature below about 25°C.

10. The method of Claim 1, wherein the tobacco material is tobacco leaf scraps, tobacco stems, tobacco dust created during tobacco processing, and/or tobacco leaf prime lamina strip; incorporating wood cellulose fibers into the aqueous slurry; and/or
forming the sheet is performed by a paper-making process.

11. The method of Claim 1, wherein the aerosol former further comprises a flavorant.

12. The method of Claim 11, wherein the flavorant is licorice, sugar, fructose syrup, isosweet, cocoa, lavender, cinnamon, cardamom, apium graveolens, fenugreek, cascarilla, sandalwood, bergamot, geranium, honey essence, rose oil, vanilla, lemon oil, orange oil, mint oils, cassia, caraway, cognac, jasmine, chamomile, menthol, cassia, ylang-ylang, sage, spearmint, ginger, coriander or coffee.

13. The method of Claim 1, wherein the aerosol former further comprises a humectant other than glycerin.

14. The method of Claim 13, wherein the humectant is propylene glycol.

15. The method of Claim 2, wherein the glycerin solution further comprises an acetate compound.

16. The method of Claim 15, wherein:

(a) the acetate compound is added in an amount effective to promote the reduction of one or more constituents of the smoke of a combusted smoking article incorporating the sheet as a cut filler;

(b) the acetate compound is ammonium acetate, calcium acetate, or magnesium acetate;

(c) the acetate compound is ammonium acetate, which is added in an amount between about 7% to about 11% by weight of the sheet after drying the sheet;

(d) the acetate compound is magnesium acetate, which is added in an amount between about 2.5% to about 5% by weight of the sheet after drying the sheet; or

(e) the acetate compound is calcium acetate, which is added in an amount between about 7% to about 9% by weight of the sheet after drying the sheet.

17. A method of making a smoking article, comprising:

thrashing the sheet of Claim 1, blending the sheet with natural tobacco strips, and shredding into a cut filler; and

incorporating the cut filler into a smoking article.

18. A method of making a reconstituted tobacco sheet, comprising:

preparing an aqueous slurry containing tobacco material, wherein the tobacco material includes tobacco leaf scraps, tobacco stems, tobacco dust created during tobacco processing, and/or tobacco leaf prime lamina strip;

separating the aqueous slurry into a solubles portion and a fibrous portion;

forming the sheet by a paper-making process from the fibrous portion separated from the aqueous slurry, without incorporating the solubles portion;

reducing a moisture content of the sheet to between about 30% and about 50% by weight;

incorporating an aerosol former comprising a glycerin solution into the sheet at a temperature between ambient temperature and below about 40°C; and

drying the sheet to provide a reconstituted tobacco sheet having a glycerin content of up to about 50% by weight of the reconstituted tobacco sheet.

19. The method of Claim 18, wherein the glycerin solution contains about 50% glycerin by volume;

the glycerin solution contains a flavorant, humectant and/or an acetate compound; and/or

incorporating wood cellulose fibers into the aqueous slurry.

20. A method of making a smoking article, comprising:

thrashing the sheet of Claim 18, blending the sheet with natural tobacco strips, and shredding into a cut filler; and

incorporating the cut filler into a smoking article.

21. A smoking article comprising a tobacco rod, said tobacco rod comprising cut filler disposed in a wrapper; said cut filler comprising a blend of tobacco, 20% to 30% of said blend comprising shreds of reconstituted tobacco sheet made by the method of Claim 18.