

METHOD OF PRODUCING EXPANDED TOBACCO STEMS

The present invention relates to a novel method for the production of expanded tobacco stems for use in tobacco cut filler. It also relates to the production of cut filler comprising expanded tobacco stems that have been produced using such a method.

Conventionally, cut filler tobacco products for smoking articles are formed predominantly from the lamina portion of the tobacco leaf, which is separated from the stem portion of the leaf during a threshing process. The stem portion of the tobacco material that remains after the lamina has been removed and separated is not often used, and a large proportion of the stem portion of the tobacco material is therefore wasted.

In order to increase the amount of the stem portion of the tobacco material that can be used commercially, it has been previously proposed to process the removed tobacco stems and then blend the processed tobacco stems with the lamina to form cut filler. For example, a well known technique for processing tobacco stems involves moistening the stems and then rolling them to reduce the thickness.

EP-A-0,931,464 describes a process of preparing tobacco stem for use in filler in which the tobacco stem is classified by diameter to provide a plurality of stem grades and each stem grade is rolled separately to achieve a uniform rolled stem thickness, for example of 1.1 mm.

A number of methods have also previously been proposed for expanding tobacco stems to reduce their density in order to improve the burning characteristics of the stems. In the prior art, expansion of tobacco stems is typically brought about by moisturisation of the stems using steam or water, followed by heating, which in some cases is carried out under pressure.

Such processing techniques have been attempted with different types of tobacco, including for example Virginia tobacco, Oriental tobacco, or combinations thereof.

Where the stems are rolled or expanded, the resultant processed stems can be more readily blended with tobacco lamina and incorporated into the cut filler of the cigarette. However, the process of rolling the stems or expanding the stems with steam or water does not typically affect the taste characteristics of the tobacco stems. The tobacco stems may therefore have an undesired effect on the overall taste of the mainstream smoke produced when the cut filler is burned. This is particularly the case with the stems of Burley tobacco leaves.

It would be desirable to provide an improved and more efficient method for expanding tobacco stems for use as an acceptable blend component of cut filler in smoking articles. It would be particularly desirable if such a method could significantly enhance the filling power of the

tobacco stems. It would further be desirable if the expansion method could be carried out using conventional apparatus, therefore reducing the cost impact to implement such a method.

According to the invention there is provided a method of producing expanded tobacco stems for tobacco cut filler, the method comprising the steps of:

- 5 rolling tobacco stems to a rolled thickness of 0.1 mm to 0.5 mm, such that the cellular structure of the stems is at least partially broken down;
- conditioning the rolled stems;
- cutting the conditioned tobacco stems;
- impregnating the cut tobacco stems with liquid carbon dioxide;
- 10 heating the impregnated stems to bring about expansion; and
- re-conditioning the stems after heating.

Also disclosed is a method of producing expanded tobacco stems for tobacco cut filler, the method comprising the steps of:

- providing rolled tobacco stems having a rolled thickness of 0.1 to 0.5 mm;
- 15 conditioning the rolled stems to increase the moisture content;
- cutting the conditioned tobacco stems;
- impregnating the cut tobacco stems with liquid carbon dioxide;
- heating the impregnated stems to bring about expansion; and
- re-conditioning the stems after heating to increase the moisture content.

- 20 Methods according to the invention may be carried out on any type of tobacco stems, including, but not limited to, the stems from Burley tobacco, Virginia tobacco, Oriental tobacco or combinations thereof.

The term 'thickness' refers to the distance between an upper surface that has been contacted with a rolling apparatus (as described in more detail below) and a lower surface that has been contacted with a rolling apparatus. The thickness therefore corresponds to the dimension of the tobacco stems that is reduced in size during the rolling process, which is typically substantially transverse to the direction of movement of the tobacco stems through the rolling apparatus. The rolled thickness of an individual tobacco stem particle can be measured using a conventional measuring device under a microscope. The rolled thickness of an individual stem particle is taken at the point along the direction of cutting that yields the largest cross-sectional area.

It has surprisingly been found that subjecting tobacco stems to the treatment steps of the method of the present invention has a significant, positive effect on both the taste characteristics of the stems and the filling power. As a result of the rolling and expansion of the stems using liquid carbon dioxide, the tobacco stems have improved taste characteristics and after-taste and develop
5 a more appealing taste and aroma. The expansion of the stems reduces the density of the stem material so that the burning characteristics of the cut filler incorporating the stem are optimised. The positive effects of the method of the present invention are particularly apparent for Burley tobacco stems.

As a result of these positive effects on the tobacco stems from the expansion method of the
10 present invention, the tobacco stems can be used as an acceptable component of cut filler. The expanded tobacco stems can also be added to cut filler in significantly greater proportions than previously possible, thereby improving the exploitation of the tobacco material. The use of the

method according to the present invention also has a positive environmental impact by reducing the proportion of the tobacco material that is wasted.

The use of tobacco stems in place of the tobacco lamina in cut filler is cost effective since the stems of the tobacco leaf are typically available at a lower cost than the tobacco lamina. The tobacco stems can advantageously be treated using existing apparatus that is already in use for expanding tobacco lamina. This allows the methods according to the invention to be carried out in an efficient and cost effective way without the need for additional apparatus. Furthermore, the costs that would otherwise be incurred in relation to the disposal of the tobacco stems can be reduced or eliminated.

The expanded tobacco stems may be combined with tobacco lamina or other types of tobacco material after the expansion of the stems has been carried out. In this case, the different components of the cut filler are processed on separate processing lines prior to the blending of the components. However, in preferred embodiments of the present invention, the rolled tobacco stems are combined with tobacco lamina prior to the conditioning step such that all of the subsequent steps are carried out on the combined tobacco stems and lamina. In this way, the tobacco stems can conveniently be treated together with the tobacco lamina using the same process steps and conditions. The tobacco lamina may be from any type of tobacco leaf, including but not limited to Burley tobacco, Virginia tobacco or Oriental tobacco. Tobacco lamina from one or more different types of tobacco leaf may be combined with the tobacco stems. The one or more different types of tobacco leaf from which the lamina is taken may be from the same or a different type of tobacco leaf to the tobacco stems.

In the following discussion of the method of the present invention, any references to the expansion of the tobacco stems during the steps of methods according to the invention apply equally to the blend of tobacco stems and tobacco lamina that will be produced prior to the conditioning step in certain embodiments.

The rolled tobacco stems are preferably combined with expanded tobacco lamina to produce a tobacco blend with at least 2% by weight of the stems, more preferably at least 5% by weight of the stems, more preferably at least 10% by weight of the stems. At these levels, the inclusion of the tobacco stems will have a neutral effect on the taste of the cut filler into which the expanded blend is incorporated. Due to the improved taste and burning characteristics of the expanded tobacco stems, significantly higher proportions of expanded tobacco stem can be included in cut filler.

The conditioning of the tobacco stems is necessary in order to increase the moisture content of the tobacco material. The conditioning ensures that the tobacco stems are sufficiently

-4-

pliable to be cut without damage or breakage of the stems occurring. Prior to the conditioning step, the tobacco stems will typically have a moisture content of around 10% to 11% oven volatiles (o.v.). During the conditioning step the moisture content of the tobacco stems is increased to at least 12% o.v. and more preferably to around 20% o.v. A corresponding conditioning step may also be carried out on a blend of tobacco stems and tobacco lamina.

The moisture content of the tobacco stems is expressed herein as "% oven volatiles", which is determined by measuring the percentage weight loss from the tobacco stems due to evaporation upon drying the material in an oven at 103°C for 100 minutes. The moisture content of the tobacco stems can readily be determined at any stage of the treatment method using this process.

Similarly, the re-conditioning of the tobacco stems during the re-conditioning step is also necessary in order to increase the moisture content of the tobacco material following the heating of the impregnated tobacco stems, during which a large proportion of the water content of the tobacco stems will typically evaporate. Following the heating step and prior to the re-conditioning step, the tobacco stems will typically have a moisture content of around 3% o.v. During the re-conditioning step the moisture content of the tobacco stems is increased to at least 10% o.v. A corresponding re-conditioning step may also be carried out on a blend of tobacco stems and tobacco lamina.

The conditioning and re-conditioning steps of the method of the present invention can be carried out using known techniques and apparatus. Preferably, each of the conditioning and re-conditioning steps comprises contacting the tobacco with steam, water or a mixture of steam and water. For example, in one known conditioning process, the tobacco is contacted with a counter flow of steam and water while being tumbled in a rotating cylindrical drum. The tobacco stems may alternatively be conditioned or re-conditioned in a humidity chamber.

Following the conditioning step described above, the rolled tobacco stems are cut to a suitable cut width in the cutting step. The cut width can be adjusted according to the desired use of the expanded tobacco blend. For example, a smaller, finer cut width may be preferred for cut filler intended for use in smoking articles, in particular slim cigarettes, than for a roll-your-own or pipe tobacco product. Preferably, the rolled tobacco stems are cut to a cut width of between 0.3 to 1.3 mm, more preferably between 0.65 and 0.9 mm. A corresponding cutting step may also be carried out on a blend of tobacco stems and tobacco lamina.

The 'cut width' of the tobacco stems refers to the width of the stem in the direction along which the tobacco stem has been cut. When looking at a stem particle under a microscope, it will generally be possible to observe the direction along which the stem particle has been run through the cutting apparatus. The cut width corresponds to the distance between the two sides of a

particle of tobacco stem along this direction of cutting. The cut width of an individual tobacco stem particle can be accurately measured using a conventional measuring device under a microscope. The cut width of an individual stem particle is taken at the point along the direction of cutting that yields the largest cross-sectional area.

5 Where the tobacco stem has been cut in two directions, the cut width for the purposes of the present invention corresponds to the largest of the measured cut widths in the two directions.

10 Once the tobacco stems have been cut, they are impregnated with liquid carbon dioxide at high pressure up to 30 bar, in a suitable impregnation vessel. Preferably, the impregnation vessel is sealed and the air is evacuated from the vessel before the liquid carbon dioxide is transferred into the vessel. In this way, the impregnation step of methods according to the present invention is carried out under a vacuum. Preferably, the liquid carbon dioxide is at a temperature of around minus 55°C (-55°C) and is transferred into the impregnation vessel under pressure. This is done to optimise the penetration of the liquid carbon dioxide into the cellular structure of the tobacco stems where it forms hydrates with the moisture inside the cells. A corresponding impregnation
15 step may be carried out on a blend of tobacco stems and tobacco lamina.

20 Following the impregnation step the remaining free liquid carbon dioxide is drained and recovered. The impregnation vessel is depressurised and the liquid carbon dioxide in the cellular structure turns into dry ice and freezes the tobacco to a temperature of minus 79°C (-79°C) at its sublimation point. The frozen tobacco stems are heated in order to bring about vaporisation of the carbon dioxide within the tobacco material. The vaporisation of the carbon dioxide causes the inner cells of the tobacco stems to open up, resulting in the expansion of the tobacco stems. Preferably, the heating step is carried out by contacting the frozen, impregnated tobacco stems with a stream of hot gas, preferably a stream of hot air and steam, which is preferably at a temperature of between 150°C and 400°C. A corresponding expansion step may also be carried out on a blend of
25 tobacco stems and tobacco lamina.

30 During the expansion step the tobacco stems are preferably expanded such that the filling power of the tobacco material is increased by at least 50% and more preferably, by at least 100%. The 'filling power' of a tobacco material describes the volume of space taken up by a given weight or mass of the material. The greater the filling power of a tobacco material, the lower the weight of the material required to fill a tobacco rod of standard dimensions. The expansion process significantly increases the volume of a mass of the tobacco stems and reduces the density of the tobacco material. The reduction of the density of the tobacco stems is particularly advantageous since it makes the stems more suitable and acceptable for incorporation into cut filler.

In certain preferred methods according to the present invention, the method further comprises the step of applying a casing solution to the rolled, conditioned stems prior to the cutting and expansion steps. The casing solution may be applied using any suitable means, including for example, spraying. *The casing solution is preferably an aqueous solution comprising a humectant,*
5 such as glycerine.

Methods according to the present invention comprising the steps described above may be carried out on pre-rolled stems which have been rolled offline in a previous rolling process to the required thickness of 0.1 mm to 0.5 mm. For example, the rolling may take place at a separate leaf processing plant or stemmer, so that the starting material of the treatment process described
10 above is the pre-rolled stems.

However, certain embodiments of the present invention are adapted to incorporate the rolling process as part of production process of cut filler so that the rolling is carried out at the same factory or production facility as the remaining treatment steps. The rolled stems can then be introduced directly into the production line for cut filler. Such methods according to the present
15 invention further comprise the additional steps of: conditioning the stems to increase the moisture content; and rolling the stems to a thickness of between 0.1 mm and 0.5 mm. Where the starting material is the tobacco stems which have already been separated from the rest of the tobacco leaf, these additional steps can be carried out prior to the conditioning and expansion steps described above. However, the method of the present invention may be further adapted to incorporate the
20 threshing step so that the starting material of the treatment process is the unprocessed tobacco leaves. In this case, the method further comprises the additional steps of removing the stems from the tobacco leaf; and cutting the stems to an average length of between 10 mm and 80 mm, wherein these steps are carried out prior to the conditioning and rolling of the stems, as described above.

25 The stems can be removed from the tobacco leaves using a conventional threshing process. The stems can be broken or cut within the threshing machine, or in a separate step to reduce the length of the stem portions in order to optimise the rolling process.

The conditioning of the stems prior to rolling is necessary in order to increase the moisture content, so that the stems are sufficiently pliable to be rolled without breakage or damage
30 occurring. Prior to the conditioning step, the tobacco stems will typically have a moisture content of approximately 17% to 20% oven volatiles (o.v.). The conditioning step preferably increases the moisture content to 35% o.v. or less, more preferably 30% o.v. or less. In certain cases, a moisture content as low as 25% to 28% o.v. may be sufficient to prevent damage to the stems during rolling.

-7-

The conditioning of the tobacco stems is preferably carried out by contacting the stems with water, steam, or a mixture of water and steam. Preferably, the stems are left to soak for a period of time in order to allow the moisture to penetrate into the core of the stems.

After the conditioning step, the tobacco stems are rolled using a conventional one step or
5 two step rolling process to reduce the thickness of the stems to between 0.1 mm and 0.5 mm. The thickness of the rolled stems is reduced to a level that is close to the thickness of the tobacco lamina. Preferably, the tobacco stems are rolled to a thickness of 0.2 mm to 0.3 mm. The tobacco stems are therefore rolled to a thickness that is lower than the customary thickness for cut rolled tobacco stems.

10 By rolling the stems down to a thickness of between 0.1 mm and 0.5 mm, the cellular structure of the stems is at least partially broken down. In particular, the epidermis of the cells of the tobacco stems is at least partially crushed. The breakdown of the cellular structure of the tobacco stems is clearly visible when the rolled tobacco stems are view through a microscope. Further, it will be visually apparent that the rolled tobacco stems have been expanded due to the
15 different texture of the stems compared to the stems prior to expansion. Where tobacco stems have been treated in methods according to the invention this will therefore be apparent from both the rolled thickness and the evidence of the expansion of the tobacco stems.

As described above, the expanded tobacco stem is intended for use as a component of cut filler. According to the present invention there is also provided a method of producing cut filler
20 comprising expanded tobacco stems, the method comprising: expanding tobacco stems using a method according to the present invention, as described above; and blending the expanded tobacco stems with at least one other type of tobacco lamina, expanded tobacco or reconstituted tobacco to form a cut filler. The other type of tobacco lamina may be, for example, Oriental tobacco lamina, Virginia tobacco lamina, or a combination thereof. The expanded and
25 reconstituted tobacco, where present, may be formed of any suitable tobacco type using known apparatus and methods. The blending of the expanded tobacco stems with the other types of tobacco material will typically take place after the reconditioning step, so that the blending is the final step in the production of the cut filler.

The present invention also provides a corresponding method of producing cut filler from a
30 blend of expanded stems and expanded lamina.

Preferably, the cut filler comprises around 12% to 27% by weight of an expanded tobacco blend, wherein the blend is formed of at least 2% by weight, more preferably at least 5% by weight and up to 100% by weight expanded tobacco stems, with the remainder of the blend formed of the expanded tobacco lamina. The cut filler may therefore comprise between about 0.3% and 27% by

weight of the expanded tobacco stems produced using the method according to the present invention.

Cut fillers comprising expanded tobacco stems produced using methods according to the invention may be incorporated into a variety of smoking articles. For example, the cut filler may be used in the tobacco rod of a combustible smoking article, such as a filter cigarette, cigarillo or cigar. Alternatively, the cut filler may be used to provide the tobacco aerosol generating substrate in a distillation based smoking article, or an electrically heated smoking system. Alternatively, the cut filler may be used as a roll-your-own product, or loose tobacco product for example, for use in a pipe.

Smoking articles comprising cut filler including expanded tobacco stems produced using methods according to the invention may be packaged in containers, for example, containers formed of one or more folded laminar blanks. Suitable containers include but are not limited to hinge lid containers and slide and shell containers.

The invention will be further described, by way of example only.

Example

A method according to the present invention is carried out on a blend of pre-rolled Burley and flue-cured tobacco stems which have already been separated from the rest of the tobacco leaf and rolled to a thickness of 0.2 mm. The rolled tobacco stems are combined with a blend of Burley and Bright tobacco lamina to form a tobacco blend prior to the further processing steps. The tobacco blend contains around 5% by weight of the rolled tobacco stems. It will be appreciated that the combination of the tobacco stems with the lamina is optional and in alternative examples, the tobacco stems may be processed in the same way without the tobacco lamina.

In the conditioning step, the tobacco blend is placed into a cylindrical drum which is rotated to continuously move the tobacco stems and lamina. A counter flow of steam and water is passed through the cylinder into contact with the tobacco blend until the moisture content of the rolled tobacco stems reaches approximately 20% o.v.

The conditioned tobacco blend is then sprayed with a casing solution of glycerine in water. The casing solution additionally includes glycerine, which acts as a humectant.

The tobacco blend is then cut to a cut width of 0.9 mm and subsequently transferred into an impregnation vessel. The air is evacuated from the vessel and liquid carbon dioxide at a temperature of around minus 55 °C is then pumped under pressure into the impregnation vessel. The tobacco blend is impregnated with the liquid carbon dioxide for approximately 2-3 minutes.

Once the tobacco blend has been impregnated with the liquid carbon dioxide, which turns to a solid within the tobacco material, the blend is then transferred to a tower and heated rapidly with hot gas at a temperature of around 350°C to bring about approximately 100% expansion of the tobacco blend. The gas is a mixture of steam and air, with approximately 80% steam.

5 After the heating step, the tobacco blend is cooled and re-conditioned using in a humidification chamber, until the moisture content of the tobacco stems is brought back to approximately 12% o.v.

10 The expanded tobacco blend is then mixed with other tobacco materials, including non-expanded tobacco lamina and reconstituted tobacco, to form the cut filler blend. The expanded tobacco blend provides up to 25% by weight of the total cut filler.

It will be appreciated that the moisture levels, rolled stem thickness, cut width, proportion of tobacco stems and other parameters of the expansion process may be varied, as described above, depending upon the desired characteristics and intended use of the final cut filler.

CLAIMS

1. A method of producing expanded tobacco stems for tobacco cut filler, the method comprising the steps of:
 - 5 rolling tobacco stems to a rolled thickness of 0.1 mm to 0.5 mm, such that the cellular structure of the stems is at least partially broken down;
 - conditioning the rolled stems;
 - cutting the conditioned tobacco stems;
 - impregnating the cut tobacco stems with liquid carbon dioxide;
 - 10 heating the impregnated stems to bring about expansion; and
 - re-conditioning the stems after heating.
2. A method according to claim 1, wherein during the rolling step the stems are rolled to a rolled thickness of 0.2 mm to 0.3 mm.
- 15 3. A method according to claim 1 or 2 wherein the rolled tobacco stems are combined with tobacco lamina prior to the conditioning step such that the subsequent steps are carried out on the combined tobacco stems and lamina.
- 20 4. A method according to any one of claims 1 to 3 wherein during the conditioning step the moisture content of the tobacco stems is increased to at least 12 % oven volatiles (o.v.).
5. A method according to any of claims 1 to 4 wherein during the re-conditioning step the moisture content of the tobacco stems is increased to at least 10 % o.v.
- 25 6. A method according to any preceding claim wherein each of the conditioning and re-conditioning steps comprises contacting the tobacco with steam, water or a mixture of steam and water.
- 30 7. A method according to any preceding claim wherein the impregnation of the tobacco stems with liquid carbon dioxide is carried out under a vacuum.
8. A method according to any preceding claim wherein during the heating step the tobacco stems are heated in a stream of hot gas at a temperature of between 150°C and 400°C.

9. A method according to any preceding claim wherein the tobacco stems are expanded such that the filling power of the stems is increased by at least 20%.

5 10. A method according to any preceding claim wherein the cutting step comprises cutting the rolled stems to a cut width of between 0.3 to 1.3 mm.

11. A method according to any preceding claim further comprising the step of applying a casing solution to the rolled, conditioned stems prior to the cutting step.

10

12. A method according to claim 10 comprising applying an aqueous casing solution comprising a humectant.

13. A method according to any preceding claim further comprising the additional steps of:

15

removing the stems from the tobacco leaf;

cutting the stems to an average length of between 15 mm and 80 mm; and

conditioning the stems to increase the moisture content;

wherein the additional steps are carried out prior to the steps of claim 1.

20

14. A method according to claim 13 wherein the conditioning of the stems increases the moisture content to 35 % o.v. or less.

15. A method of producing cut filler comprising expanded tobacco stems, the method comprising:

25

producing expanded tobacco stems using a method according to any preceding claim; and

blending the expanded tobacco stems with at least one type of tobacco lamina, expanded tobacco or reconstituted tobacco to produce cut filler.

30