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PROCESS FOR PUFFING TOBACCO STEMS

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ABSTRACT OF THE DISCLOSURE

A method for puffing tobacco stems is disclosed, which comprises placing the stems in a heated gas directed from a plurality of sources to effect a fluidized suspension of the stems in the gas.

This is a continuation-in-part of application Ser. No. 516,112, filed on Dec. 23, 1965.

This invention relates to a method of manufacturing a tobacco product. More particularly, the invention relates to a method for treating stems and large veins or midribs which have been removed from tobacco leaves to convert the stems into a form in which they are available for use in smoking articles. As used herein, "stems" include tobacco stems and veins.

Tobacco stems have generally created problems in the tobacco industry and before tobacco could be utilized for the production of smoking articles, such as cigars, cigarettes, cigarillos and the like, it has been the practice to remove the stems and veins which form a part of tobacco leaves from the tobacco leaves. This removal has been accomplished by the use of threshing machines which break up the leaves and remove the stems and most of the veins from the leaves or by means of stemming machines which strip the stems from the tobacco leaves.

The stems and large veins which have been removed from tobacco leaves have not found a ready use in the tobacco industry, and many attempts have been made to convert the stems to useful products. For example, attempts have been made to incorporate stems in cigars and cigarettes by crushing the stems and thereafter steaming and rolling the stems prior to their use in the cigarette or cigar filler. It has been found, however, that the undesirable hard wood-like characteristics of the stems have not been removed by such treatment and that the stems, when incorporated in the cigarettes or cigars, have been found to result in uneven burning and in a somewhat less desirable flavor. In addition, the use of stems prepared in such a manner has resulted in minute, rigid stem particles, many of which are readily dislodged from the ends of the tobacco products and can be readily detected by the person smoking the tobacco product due to their sharp nature. In addition, some such hard stem pieces have been found to penetrate the paper wrapper of cigarettes or to deform the cigarette or cigar in an undesirable manner.

Another method which has been proposed for the treatment of stems to make them more acceptable in tobacco products has been to subject the stems, while still in the tobacco leaves, to a fluid pressure which is released to effect the expansion of the stems in the leaves. This method is disclosed in U.S. Pat. 2,344,106 to Reed, which issued on Mar. 14, 1944. It has been found, however, that such a method is difficult to operate, involving the use of pressure equipment and the like and involving the use of steam in order to prepare the product for the expansion step. Additional disadvantages of such a process include internal cell damage to the tobacco product, rupture of the epidermis and down-grading of the product resulting from the introduction of gases into the leaf. Further, the nature of such a process dictates that stems be treated batchwise so that streamline production methods cannot be employed.

Another attempt which has been made to treat tobacco sterms or tobacco leaves containing steam has involved the use of a high frequency electrostatic field in order to expand the stems. This process is disclosed in U.S. Pat. 2,739,599 to Abbott, which issued on Mar. 27, 1956. Such a process, while having the theoretical capability to eliminate some of the disadvantages of the crushing and steaming technique and of the pressure technique discussed above, has been found to have its own disadvantages. For example, when such a process is employed for the treatment of stems while still in the leaf, it has been found that the leaf itself is nearly always damaged, due to arcing between the plates which are employed to generate the high frequency electrostatic field. It is believed that such arcing occurs at areas in the leaf having a high mineral content. High spots in the leaf are also believed to be a cause of such arcing. Arcing also occurs when stems are being processed out of the leaf due to the variable dimensions of the stems. The occurrence of such arcing has been found to require frequent machine shutdowns when such a process is employed. Another disadvantage of such a process results due to the fact that tobacco leaves vary in moisture content. Thus, a highly uneven absorption of energy from the dielectric field results and a non-uniform tobacco product is produced. To overcome this disadvantage, it is necessary to employ expensive moisture control of the stem prior to utilizing the stem in such a process. Another disadvantage of such a process results in the fact that burning of the product occurs in portions of the stem which, due to their highly compacted nature, absorb more energy. The dielectric process is highly sensitive to such variations in stem content. The burned portions are charred and brittle and have been found to crumble in the course of later treatment of the stems, whereby additional degeneration of the product results. Thus, prior to the present invention, no completely satisfactory process has been found for the utilization of stems.

The present invention is an improvement over the above-described methods for utilizing tobacco stems and provides a commercially practical method for utilizing stems which have been removed from tobacco leaves by treating said stems in a manner such that they can be directly incorporated in a tobacco product, such as a cigarette or a cigar. The present invention also makes possible the use of the entire tobacco leaf by providing a method for treating the tobacco leaf in such a manner that it can be directly conditioned and cut to be utilized as filler in cigarettes, cigars and the like.

The present invention provides a novel method for treating tobacco stems, whereby stems which have been removed from the tobacco leaf are expanded or puffed to greatly increase the size of the stems and thereby decrease their density. This is accomplished by exposing the stems to a current of hot air. The temperature of the air is maintained in the range of from about 200° F. to about 950° F. and preferably 300° F. to 450° F. Exposure of the stems to this temperature causes the moisture content in the stem to vaporize and exert a radially outward force in the stem cells, thus expanding them.

Puffing stems of the bright variety according to the present invention provides a high quality puffed stem filler suitable for use in tobacco products, such as cigarettes, which retain their common characteristics and show an increased firmness. Attempts to apply to burley stems the same methodologies used in the puffing of bright stems have been unsuccessful. The inability to puff

burley stems by radiant or microwave energy, high energy electrostatic field and only to a small degree by the fluidized bed, i.e., hot air, techniques, it has been found, is attributed to high nitrate ion content of and high permeability to moisture by these stems. It has been found further that high nitrate content prevented using elevated temperatures which could evaporate the inter- and intracellular liquids at a sufficient rate to cause cellular expansion or puffing. Furthermore, the high permeability of burley stems to steam would not allow for sufficient entrapment of generated steam to cause the cellular expansion. According to a feature of the present invention, it has been found that the solvent extraction of nitrates, prior to puffing under a nitrogen atmosphere which avoids spontaneous heat buildup in the material and eliminates fire hazards on puffing from flameless explosion, significantly improves the quality of the product, facilitates puffing of burley stems and incidently and unexpectedly prolongs the life of blades during slicing. The time of extraction may vary from about 30 minutes to about 90 minutes. After about one hour of water extraction, about 75% of the nitrates are removed and about 51% of the hot water solubles are also removed. To effect the extraction of nitrate ions, tap water may be used as a solvent. In addition, a mixture of about 85% isopropyl alcohol and 15% tap water may be used as the solvent. The greater simplicity of the batch-tap water extraction of stems makes this the preferred method.

Tobacco stems of the bright or "washed" burley variety are equilibrated to a moisture content from about 8% to about 20%.

The hot air flow may be disposed vertically or may be a fluidized bed of air currents. By means of such a configuration, the stems which puff due to exposure to the hot air present a greater surface area to the stream of air and are forced upward against the pull of gravity while the stems which do not puff remain near the bottom of the hot air column.

The stems which do not puff initially are thus maintained in contact with the column or bed of hot air and either puff and rise to the top to be collected or fall into collecting means. Puffing and separation are effected in one operation, and a uniform product results with very little variance due to differences in stem moisture and mineral content.

The stem puffing process equipment, Proctor and Schwartz Puffer, consists essentially of a stainless steel belt, having a variable speed drive and round holes of about 1/16 to about 1/8 inch in diameter, distributed uniformly throughout the surface of the belt in a rectangular pattern. A heated gas or hot air from a plurality of sources, such as a gas fired oven, is directed from beneath and through the perforated stainless steel belt which sources have means to adjust the velocity of the gas or air. Tobacco stems having dimensions of from about ½ to about 4 inches in length and from about .049 to about .126 square inch in cross sectional area are fed from a vibrating feeder, metered out onto the belt conveyor and distributed randomly over the surface of the stem puffer belt. The stems are tumbled in the hot air at a height of about 2 to 3 inches above the stainless steel belt. The belt is provided with side strips to prevent the air-suspended stems from floating away from their position located directly above the belt during the puffing operation.

The puffer is divided into 2 heating zones each comprising about ½ of the belt length. The heating zones are usually maintained at the same temperature unless there is excessive moisture present in the stems, in which case the temperature of the first zone will be higher than that of the second zone. When it is desirable to have such a temperature gradient, the stems are dried during the first stage of processing; during the second phase the remaining liquid or moisture content of the cellular structure of the stems is converted to the gaseous phase, and pressure exerted by the expanding gases serves to puff the stems.

The stem grade and moisture content may necessitate making minor adjustments to the puffing temperature range in order to maintain optimum steam puffing. The rate of stem puffing and the extent to which the stems are puffed is related to the rate of heat input which is a function of the temperature, the oven configuration and the air velocity, i.e., the higher the air velocity the lower the temperature required for puffing. Thus, the extent of puffing may be controlled by regulating the residence or dwell time of the stems in the puffer by adjusting the velocity of the air flow.

The air or gas velocity preferably should be in the range of from about 200 to about 400 cubic feet per sec.

Other operating conditions may vary in the following manner: the stem feed rate, which is a subjective value based on such considerations as degree of puffing and color of puffed stems, from about 200 to 300 pounds per hour; the dwell time in the puffer from about 7 to about 400 seconds; the puffing temperature preferably from about 300° to 450° F.; and the tobacco bed thickness, which will vary with the temperature and dwell time, i.e., the thicker the bed, the higher must be the temperature and dwell time, from about 1 to about 1½ inches thick.

The optimum operating conditions providing optimum puffing have been found to be a stem feed rate of 200 to 225 pounds per hour with a dwell time of 120 to 130 seconds at a temperature of 360° F. to 380° F. and a gas or air velocity of 200 to 400 cubic feet per second.

At the optimum puffing temperature of 360° F. to 380° F., there is approximately 6% to 7% by weight loss of the starting material. As the puffing temperature is increased up to 400° F., there is a corresponding increase in the amount of starting material lost, and the yield decreases. Moreover, there may be experienced some burning of the stems above 400° F.

The following examples are illustrative:

EXAMPLE 1

A Heat Gun (Master Appliance Corp.) was inserted in the end of a Pyrex glass tube with a wire screen between them. The apparatus was mounted in a vertical position. The temperature and air velocity were controlled by closing the circular disk on the side of the gun. The chimney was an 18 inch x 20 mm. glass cylinder. The gun was butted against the end of the cylinder. A copper screen was cut to fit in I.D. of the tube so that the stems would not fall all of the way to the heating coil. As the air and temperature are normally controlled by the same valve, it was necessary to place a screen over the end of the cylinder and open the air control wide open. This gave the lowest temperature possible and still cut down on the air flow.

The temperature range in which stems were puffed was 392° F. to 697° F., representing the range where the proper balance of heat and air velocity could be obtained with this equipment. Both bright and burley stems which had been preconditioned for several days at room conditions were puffed by this method. The stems were too heavy to be blown to the top of the cylinder initially, but after a period of 6 to 60 seconds, they began to puff and were blown to the top of the cylinder. The time interval depended on the temperature of the air stream and the nature of the stems. The extent of puffing could be controlled by regulating the residence time of the stem in the cylinder by adjusting the velocity of the air flow.

Washed burley stems were placed in the air puffer and with care the washed burley stems were found to puff. The quality of puffing was not as good as the bright but this was due to the nature of the washed stems which were very small.

Different conditions must be maintained for the air separation and puffing of burley stems as they puff at a lower temperature and are lighter than bright stems.

EXAMPLE 2

Three hundred and fifty gram samples of large sorted tobacco stems (mixed bright stems, screened once, weight 13 lbs./ft.^{3}) were thermally treated in a Jetzone particle oven (Wolverine Equipment Company). The oven used for this purpose utilizes the principle of fluidization; that is, the stems are suspended in a bed of swirling air so that all sides of each stem are exposed equally to the action of the heated air. To accomplish this, the stems were spread upon the solid base of the apparatus, and jets of heated air were directed against them in such a way that they were lifted, and kept suspended in the air above the base, forming a fluidized bed of particles and air. The base itself was vibrated, thus avoiding overdwelling in the treatment zone. This allowed the stem material to be subjected to a definite treatment time. The uniform application of heat caused the tobacco stems to puff—to expand to about three times their original size. The greatest yield of puffed stems with good color characteristic was obtained when the stems were treated in this manner for 0.90 minutes at a temperature of 500° F. Treatment conditions and results are shown below:

Sample size, g.	Temp., ° F.	Dwell time, min.	Initial moisture content, percent	Color	Yield, percent	Other observed characteristics
350	575	.85	14	A few stems dark	95	
350	600	.75	14	Very dark	95	
350	600	.50	14	Too dark	95	U of stem not fully open.
350	600	.40	14	Excellent	95	U not open.
350	550	.60	14	Good	95	U open.
350 [1]	550	.80	14	----do	80	Results good for size of particles.
350	500	.80	14	----do	90	Aeration poor—U open, volume unsatisfactory.
350 [2]	500	.90	14	----do	90	U open—probably optimum conditions.
350 [2]	525	.70	14	Very good	90–95	U open.

[1] Small particles not sorted.
[2] Optimum conditions between 500–600° F. at .9 to .4 minute.

EXAMPLE 3

Ten pound samples of large sorted tobacco stems (mixed bright stems, screened once, weight 13 lbs./ft.^{3}) were treated by a fluidized bed process in a 12 inch fluid air drier manufactured by Fuller Company. The drier consists essentially of a column having an upper and lower exit port disposed along its side wall, a stem input means at the upper mouth of the column and a hot air input at the lower mouth of the column.

The hot air tumbled the stems in the chamber and as the stems were puffed, they became less dense and were forced by the heated air toward the upper overflow window and out of the drier. Conditions and results on the air separation and puffing are given below:

Sample weight lbs.	Temp., ° F.	Dwell time	Moisture content, percent	Color	Yield, percent	Observation
10	350	1½ hrs.	14		10	Did not flow out windows.
10	400	3 min.	14	Uniform	70	Flowed out bottom window.
10	450	3 min.	14	----do	80	Do.
10	470	2 min.	14	----do	40	Flowed out upper window.
180	450–540	(1)	14	Nonuniform	70–80	Do.

[1] Continuous until stems all puffed.

EXAMPLES 4 TO 7

Burley stems were prewashed in bulk with tap water prior to puffing. Burley stems prewashed for about 30 and 90 minutes extracted an average of about 75% of their nitrates and about 50% of their hot water solubles. Burley stems subjected to extraction times of 5 and 15 minutes removed about 35% and 52% of the nitrates, respectively. At these levels of nitrate removal the previous problems of puffing and slicing were minimized but not completely eliminated as they were when stems were extracted for longer times, e.g., 30 and 90 minutes. The water-extracted samples were puffed under nitrogen atmosphere using a McEwen grain pressure puffing unit (McEwen Manufacturing Company, Portland, Oreg.). The puffed burley stems were judged to be "well" to 100% puffed.

The extracted puffed burley stems were sliced without difficulty. Increased blade life was observed as a result of the extraction. A yield of sliced products was obtained in a ratio of "Large Fibers" strips, i.e., +8 mesh particle size, to "Presized Fibers" strips, i.e., +20 mesh particle size, of from about 1 to 1½ to about 1 to 2.

These results are shown below:

Sample identification	Extraction time, min.	Nitrates as NO_3 Percent	Nitrates as NO_3 Percent extracted	Hot water solubles Percent	Hot water solubles Percent extracted	Degree of puffing
Burley stems (control)	0	1.85		45.2		Unsatisfactory explosion.
Burley stems (sample)	5	1.21	34.6	31.6	30.1	Well—no explosion.
Do	15	0.88	52.4	39.6	34.5	Do.
Do	30	0.68	63.2	25.8	42.9	100%—no explosion.
Do	90	0.25	86.5	18.5	59.1	Do.

We claim:

1. A method of puffing tobacco stems which comprises placing the stems in a heated gas stream wherein the gas is directed at the stems from a plurality of sources so as to effect a fluidized suspension of the stems in the gas at temperatures of from about 200° to about 950° F.

2. The method of claim **1** wherein the gas is directed at the stems from a plurality of sources so as to effect a fluidized suspension of the stems in the gas at temperatures of from about 300° F. to about 450° F. so that all sides of each stem are exposed equally to the action of the heated gas until the stems which puff, rise and pass into collecting means and the stems which do not puff fall into collecting means.

3. The method of claim **1** wherein the stems are fed at a rate of from about 200 to about 300 pounds per hour and remain in the puffer for a puffing dwell time of from about 7 to about 400 seconds at a temperature of from about 360° to about 380° F.

4. The method of claim **1** wherein the stems are fed at a rate of from about 200 to about 225 pounds per hour and the stems remain in the puffer for a puffing dwell time of from about 120 to about 130 seconds at a temperature of from about 360° to about 380° F.

5. The method according to claim **1** wherein stems

are puffed by being tumbled by and suspended in a gas from a plurality of sources and at a temperature of from about 300° to about 450° F. at a height of about 2 to 3 inches above a solid base having a plurality of holes of about 1/16 to about 1/8 inch in diameter distributed in regular pattern over the surface of the base, said stems being fed at a rate of from about 200 to about 225 pounds per hour and having a dwell time in the puffer of from about 120 to about 130 seconds.

6. The method of claim 1 wherein the gas is air.

7. The method of claim 1 wherein burley stems are subjected to solvent extraction for from about 30 to about 90 minutes, whereby a substantial amount of nitrates are removed, prior to puffing under a nitrogen atmosphere.

8. The method of claim 7 wherein the solvent is tap water.

9. The method of puffing tobacco stems which comprises placing stems in a heated gas stream wherein the gas is directed at the stems from a plurality of sources so as to effect a fluidized suspension of the stems in the gas at temperatures of from about 500° F. to about 600° F. so that all sides of each stem are exposed equally to the action of the heated gas until the stems which puff, rise and pass into collecting means and the stems which do not puff fall into collecting means.

10. A method of puffing tobacco stems which comprises placing the stems in a gas at a temperature of from about 200° C. to 500° C.

11. The method of claim 10 wherein the gas is directed at the stems from a plurality of sources so as to effect a fluidized suspension of the stems in the gas at temperatures of from about 500° F. to about 600° F. so that all sides of each stem are exposed equally to the action of the heated gas until the stems which puff, rise and pass into collecting means and the stems which do not puff fall into collecting means.

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