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METHOD OF PUFFING TOBACCO STEMS

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ABSTRACT OF THE DISCLOSURE

This disclose relates to an improved tobacco product resulting from an improved process for puffing tobacco stems. The improvement in the process involves treating the stems, prior to puffing by any of the known puffing methods, with a solution containing a water-soluble carbohydrate. The resulting puffed stems can be incorporated in tobacco products.

The invention relates to method of manufacturing a tobacco product. More particularly, the invention relates to a method for treating the stems and the large veins or midribs which have been removed from tobacco leaves to convert the stems into a form in which they can be advantageously employed in smoking articles.

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 commonly been the practice in the industry to remove from the tobacco leaves the stems and veins which form a part of tobacco leaves. The removal of the stems has been accomplished by the use of equipment such as 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 and larger veins (all of which will hereinafter be referred to as "stems") to useful products. For example, attempts have been made to incorporate stems in cigars and ciragettes 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 been found to result 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 products 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 is set forth in U.S. Patent 2,344,106 to Reed. This method involves subjecting 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. 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 downgrading of

the product resulting from the introduction of gases into the leaf. Further, the nature of such a process makes it necessary for the stems to be treated batchwise. Thus, the more efficient continuous production line methods cannot be employed.

Another attempt which has been made to treat tobacco stems or tobacco leaves containing stems is set forth in U.S. Patent 2,739,599 to Abbott. This method involves the use of a high frequency electrostatic field in order to expand the stems. 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 sometimes 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. 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, an 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 could occur in portions of the stem which, due to their highly compacted nature, could absorb more energy. Such burned portions are brittle and have been found to crumble in the course of latter treatment of the stems giving rise to undesirable "dusting or formation of dust.

For the reason set forth above, no completely satisfactory process was known for the treatment of tobacco stems prior to the present invention.

In copending application Serial No. 514,667, filed Dec. 17, 1965, there is disclosed an improvement over the above-described methods for utilizing tobacco stems and there is provided a commercially practical method for utilizing stems which have been removed from tobacco leaves by treating said stems in such a manner that they can be directly incorporated in a tobacco product, such as a cigarette or a cigar.

The invention in application Serial No. 514,667 comprises a process whereby tobacco stems are exposed to a source of radiant energy under controlled conditions. The process may be a batch process or may be a continuous process which is readily adaptable to production line techniques by carrying the stems on a conveyor belt in a manner such that they are exposed to a desired amount of radiant energy for a desired period of time past a radiant energy source. A high degree of flexibility is introduced by use of a radiant energy source. Unlike stem or gas expansion processes, radiant processing may be practiced at selected wavelengths, depending on the heat source employed. This allows a measure of control over the rate of heat energy absorption by the stems.

The puffing of tobacco stems can be accomplished by exposing the stems, for example, bright tobacco stems or burley tobacco stems, to a source of radiant energy until the stems have puffed or expanded but not to the point where the stems are burned.

The stems which are to be puffed should preferably have a moisture content of between about 5 and 18% by weight but may have a moisture content of from 4 to 23% by weight. The most preferred moisture content of the stems is from about 9 to 12% by weight.

The stems, which may be separated from the tobacco leaves and which may be in whole form or in chopped-up or particulate form, are exposed to a source of radiant energy, which may be a high intensity heat lamp, a muffle furnace, a liquid heat exchanger, a quartz lamp, an infrared lamp, a hot plate or the like, for a period of from about 10 seconds to about 20 minutes or more, depending upon the particular tobacco stems or plant parts involved and the size thereof. The source of radiant energy may, for example, be a lamp such as a 1000 watt quartz lamp placed at a distance of about 1 inch to 10 inches from the stems and must generate enough heat to bring the temperature of the tobacco stems to a level of from about 30° C. to about 240° C. and preferably from about 30° C. to about 190° C.

Puffing in a muffle furnace or on a hot plate is somewhat less efficient because of dissipation of heat, lack of adequate controls, direct contact of the heat source with the stems and the inability to utilize such heat sources in a continuous fashion. Exposure to forms of radiant energy such as liquid heat exchangers, quartz lamps and infrared lamps may be accomplished successfully in continuous fashion. The liquids in a heat exchanger can be reheated to the temperature range desired for a particular material. Quartz lamps and infrared lamps have the advantage of emanating selected wavelengths which allows close control of the desired degree of browning of the tobacco.

The process may be conducted at atmospheric pressure or above or may be conducted at subatmospheric pressures of from about 20 mm. Hg being satisfactory for the purposes of this invention. Obviously, higher or lower pressures may be employed, depending on the nature of the tobacco product being treated and the temperature which is employed.

A particularly preferred method for treating the tobacco stems involves the use of lower temperatures with subatmospheric pressures, a process which can be described as a "low heat" vacuum process. Such a process is conducted by placing the tobacco stems or plant parts containing stems in an atmosphere maintained at a pressure of from about 20 to 759 mm. Hg and subjecting the stems or other plant parts containing stems to a temperature of from about 140 to 170° C., preferably about 145 to 155° C., for a period of time sufficient to cause the puffing of the stems, which time may be generally from about 30 seconds to 20 minutes.

The radiant heat process in all its embodiments has considerable advantages over puffing methods known heretofore. It has been found that the dielectric process discussed earlier does not puff those stems which overlap adjacent stems while a batch was being treated in the electromagnetic field. The radiant process, on the other hand, can be used to puff stems in layers up to several inches in thickness. Because the radiant process effects puffing more slowly, damage to the epidermis noted in prior art processes is eliminated. Further, desirable changes in the chemical composition of the puffed stem can be effectuated using the radiant process. Amino acid, phenol and peptide content decreases. Nitrogen and other nitrogenous substances are also less prevalent.

Advantageous physical changes are also noted. Although macropore diameter remains unchanged, micropore diameter changes after puffing and new micropores are formed whose diameter are smaller than those encountered in unpuffed tobacco stems. These physical changes, such as surface expansion and micropore formation, give rise to improved organoleptic properties. One desirable physical change may be used to determine whether and to what extent the stems have puffed. Microscopic analysis shows that the stem expansion takes place in the mesophyll while the lignin remains substantially unchanged. Therefore, the degree of expansion or puffing in the mesophyllic cells defines the extent to which the stem has puffed. These and other advantages, to be developed below, all characterize the invention.

In accordance with the teachings of application Serial No. 514,699, filed Dec. 17, 1965, puffing can also be accomplished by exposing the stem, alone or in the leaf, to microwave energy under controlled conditions. This may be done in a batch process but is preferably accomplished by placing the stems or leaves on a conveyor belt which carries them into proximity with a microwave generator. For example, a conveyor belt may be arranged so as to carry the stems into a magnetron microwave oven. Suitable for this purpose is the Raytheon Mark III one magnetron oven or the Raytheon Mark IV two magnetron oven. Other microwave sources which will work well in accordance with the invention include the Atherton Automatic Batch Process, Model B–10 and Microwave Conveyor, Model C–30. The operation can be carried out at an ambient temperature of 0° C. to 200° C. but operates most advantageously over the range at about 20° C. to 150° C. The stems are held at the same ambient temperature as the oven before being exposed to the microwave source. The stems puff well at atmospheric pressure but the invention will also yield a suitable end product when practice at pressures of 10 to 759 mm. Hg.

The rate and degree of puffing depends on the amount of energy to which the stems are exposed. This is in turn is a function of the power input to the microwave source, the length of time the stems are exposed to the source (i.e. the rate of advance of the conveyor belt when that embodiment is used), the frequency (or wavelength) of the microwaves, the moisture content of the stem, and the orientation of the stems with respect to the source. The rate of advance of the conveyor belt is adjusted so as to expose the stems to the microwave energy for from 7 to 120 seconds. Longer periods of exposure are necessitated when using a less powerful microwave source. The range of power input to the source which is usable in accordance with the present invention is about ½ kw. to about 15 kw. While there is some puffing at about 900 mc. and at about 6000 mc. preferred conditions involve operation below 6000 mc. and above 900 mc. When a Raytheon Mark III or Mark IV is used, the Mark III may be operated at about 2,450 mc. at about 10 kw. input and the Mark IV at about 2,450 mc. at about 10 kw. input. The distances from the stems to the power source may vary from about ½ inch to about 30 inches. The moisture content of the stems chosen at random varies. Those stems having a higher moisture content tend to puff more rapidly due to the greater internal vapor pressure developed and a somewhat uneven product therefore results. Accordingly, it is desirable to pretreat the stems to bring their moisture content to a uniform level of about 4% to 25%. The invention may be practiced to puff stems having an initial moisture content of 8% to 14%. Each of these variable in turn affects the value of the other parameter. One variable which should be held constant, however, is the orientation of the stem with respect to the power source. The invention can best be practiced by aligning the axes of the stems in the direction of travel of the energy front.

The process is not, however, as sensitive to variation in leaf moisture content and to "hot spots" as are those of the prior art, for example the dielectric process.

In application Ser. No. 516,112, filed Dec. 23, 1965, another method for puffing stems is disclosed comprising exposing the stems to a current of hot air. The temperature of the air is maintained in the range of from about 200° C. to about 500° C. and preferably 200° C. to 400° C. 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.

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 no 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.

It has been found that for any of the above-described puffing methods, stems from bright tobacco will generally puff more satisfactorily than stems from burley tobacco. The stems from burley tobacco, when treated in the same manner as the stems from bright tobacco, tend to soften only slightly and puff very little, if at all. Furthermore, it has been found that when water-washed bright or burley stems are subject to any of the above-described treatments for puffing of the stems, such stems will generally remain brittle and will generally not puff in a satisfactory manner.

I have discovered a method for the pretreatment of tobacco stems, either bright or burley or a mixture of the same, and either washed or unwashed, which pretreatment results in an improved tobacco product. By employing the process of my invention, whereby the tobacco stems are pretreated as will be set forth in more detail below, the above-mentioned problems of the known puffing methods are greatly minimized or completely eliminated.

In accordance with my invention, the tobacco stems, prior to puffing by any of the known puffing techniques, as illustrated earlier in this specification, are impregnated with a treating solution comprising from 2 to 60 percent, and preferably from 10 to 30 percent, by weight of a water-soluble carbohydrate. The water-soluble carbohydrate may be a water-soluble monosaccharide or polysaccharide. Preferably the carbohydrate is a sugar containing from 4 to 12 carbon atoms.

Illustrative of the sugars which can be employed in the present invention include monosaccharides, disaccharides and mixtures of monosaccharides and/or disaccharides.

Among the monosaccharides which can be employed in accordance with the present invention are (1) tetroses, which include erythrose and threose; (2) pentoses, which include arabinose, ribose, cyclose, lyxose and xylose; (3) methylpentoses, which include fucose, styracitol, rhamnose and rhodeose; (4) hexoses, which include aldoses, such as mannose, cocaose, glucose (dextrose), galactose and gulose, and ketoses, such as fructose and sorbose; (5) methylhexoses, which include rhamnohexose; (6) heptoses, which include α-glucoheptose, β-glucoheptose, β-galaheptose, perseulose and mannoheptose; (7) methylheptoses, which include rhamnoheptose; (8) octoses, which include αα - gluco - octose, αα - glucose-octose (α-form) and αα-gluco-octose (β-form); (9) nonoses, which include ααα-gluconononose; and (10) decoses, which include glucodecose.

Among the disaccharides which can be employed in accordance with the present invention are (1) pentose-hexoses, which include vicanose and primeverose; (2) methylpentose-hexoses, which include strophanthobiose; and (3) hexose-hexoses, which include gentiobiose lactose, cellobiose, sucrose, revertose, maltose, melibiose and trehalose.

The sugars can be employed alone or as mixtures and can also be products of the hydrolysis of di- and tri-saccharides. A particularly preferred sugar is invert sugar, which is an equimolar mixture of glucose and fructose obtained by hydrolysis of sucrose.

The solution also preferably contains from about 1 to about 150% by weight, based on the amount of water-soluble carbohydrate, of one or more of the following materials: a sodium or potassium salt of an inorganic or organic acid, sodium or potassium hydroxides, mono- and di-basic acids and mixtures of the same. Particularly preferred materials are citric acid, malic acid, monobasic potassium phosphate, ammonium hydroxide, calcium chloride, potassium hydroxide, potassium nitrate, potassium acid phosphate, sodium chloride, and mixtures of the same. The inclusion in the solution of these materials, in addition to the carbohydrates can provide benefits, in terms of improved flavor and smoking qualities in the ultimate tobacco product in which the treated stems are employed.

The stems may be either bright or burley stems or stems of other types of tobacco or may be a mixture of the same in any proportion.

The treating solution should be an aqueous solution having a pH of from 3.0 to 11.0 and preferably from 4.5 to 7.0. Sufficient solution should be employed so that the stems are impregnated with from 5 to 65 percent of the water-soluble carbohydrate, based on the weight of the stems being treated.

After the tobacco stems have been treated with the treating solution, which treatment may involve spraying the stems with the solution, painting the stems, immersing the stems in the solution and the like, the stems are preferably dried to less than about 20% moisture content at a temperature of 50° to 95°, generally for a period of from 1 to 4 hours and may then be puffed in the manner indicated above.

The following examples are illustrative:

Example 1

A solution having a pH of 5.3 and containing approximately 25% solids was prepared by mixing the following ingredients in the order listed, while the mixture was heated to a temperature of 50° C.:

	Grams
(1) Water	150.0
(2) "Nulomoline" 80% invert sugar syrup	50.0
(3) Magnesium sulfate heptahydrate	10.7
(4) Citric acid	6.0
(5) Malic acid	40.0
(6) Monobasic potassium phosphate	7.2
(7) Aqueous ammonia, 30% NH_3	2.0
(8) Calcium chloride	7.0
(9) Potassium hydroxide dissolved in 153 g. water	31.4
(10) Water	222.0

The resulting solution was found to be clear and to be stable after storage at room temperature for more than a week.

A portion of washed burley and bright tobacco stems were soaked at room temperature for over 12 hours in the solution and the stems were then dried at room temperature. The stems were weighed before and after drying and were found to have adsorbed approximately their own weight of soluble materials. When dry, the treated stems were heated on a hot plate at a temperature of 300° C. for 20 seconds. All of the stems were observed to have expanded or puffed in a satisfactory manner.

The puffed treated stems could be sliced or otherwise broken up, or used in a smoking product without further treatment. When the treated puffed stems were combined with tobacco leaf, in the ratio of 1:10 by weight, respectively, a blend resulted which, when made into cigarettes, gave a satisfactory and pleasing smoke.

The puffed stems were found to possess excellent filling power, having a large bulk volume as compared with shredded leaf.

For comparison, another portion of the same washed and dried stems was not treated with the treating solution. The stems treated in this manner failed to puff when heated in the same manner as the treated stems.

Example 2

A portion of burley tobacco stems which had been washed to a low water soluble content (1% by weight) and which were then dried showed no tendency to puff when heated on a hot plate at 300° C. for 2 minutes. Another portion of the same stems was separated into four smaller (10 gram) portions and each 10 gram portion was immersed in a solution containing 150 g. of water and 50 g. of solute as set forth below, for 22 hours:

Portion *a*: sucrose.

Portion *b*: sucrose, 4 parts+citric acid monohydrate, 1 part.

Portion *c*: sucrose, 4 parts+potassium chloride, 1 part.

Portion *d*: sucrose, 4 parts+calcium chloride, 1 part.

The uptake of additive by the stems, in each case, was calculated on a dry basis from the wet weight of stems after removal of excess liquid. The results are set forth, below, as percent of total weight:

Portion:	Percent
a	51.2
b	53.4
c	52.8
d	47.3

Each portion of the treated (impregnated) stems was air-dried for 72 hours at a temperature of 25° C. and at 60% relative humidity and was tested for puffing on a hot plate maintained at about 232° C.

Each of the samples showed some puffing activity and was rated as follows:

Portion *a*: very slight.

Portion *b*: moderate puffing, moderate rate.

Portion *c*: good puffing, somewhat slower than unwashed bright stems.

Portion *d*: very slight, quite slow.

I claim:

1. The improvement in the puffing of tobacco stems which comprises pretreating the tobacco stems before puffing with a composition which in turn comprises water, from 1 to 200 parts by weight of a water-soluble carbohydrate and from 0 to 200 parts by weight of the member selected from the group consisting of citric acid, malic acid, phosphoric acid, monobasic potassium phosphate, ammonium hydroxide, calcium chloride, potassium hydroxide, potassium nitrate, potassium acid phosphate, sodium chloride and mixtures of the same, per 100 parts of water.

2. An improved method for puffing tobacco stems which comprises contacting tobacco stems with a treating solution comprising water, from 1 to 200 parts by weight of a water-soluble carbohydrate and from 0 to 200 parts by weight of a member selected from the group consisting of citric acid, malic acid, phosphoric acid, monobasic potassium phosphate, ammonium hydroxide, calcium chloride, potassium hydroxide, potassium nitrate, potassium acid phosphate, sodium chloride and mixtures of the same, per 100 parts of water, said treating solution being employed in amounts of from 0.1 to 400 parts by weight per part of tobacco stems being treated, and thereafter puffing said tobacco stems.

References Cited

UNITED STATES PATENTS

1,789,435	1/1931	Hawkins.
2,590,580	3/1952	Schiavone.

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