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GELLED TOBACCO SHEETS AND METHOD OF MAKING SAME

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ABSTRACT OF THE DISCLOSURE

Process for preparing a tobacco sheet material having improved moisture resistance properties and improved release from the casting surface on which the sheet is formed. A tobacco slurry containing water, ground tobacco, a humectant, an Xanthomonas hydrophilic colloid and locust bean gum is formed into a continuous sheet on a casting surface such as a stainless steel surface, while either the slurry or the casting surface, or both of them, are at a temperature of about 115° F., or higher, after which the continuous sheet is dried and removed from the casting surface.

This invention relates to the preparation of self-sustaining tobacco sheet from finely ground tobacco dust. More specifically, the invention relates to a method of making an improved, self-sustaining sheet prepared from tobacco dust through the use of an improved binder material.

Various means are known for the preparation of tobacco sheets for use in the production of cigars and like smoking products. The procedure employed is to form a paste from finely ground tobacco in combination with a humecant, a cross linking agent to control moisture content, and water. The slurry or paste is laid down on a moving endless belt after which the belt is passed through a dryer and the resulting tobacco sheet is removed by, for example, a doctor blade. With binders which are presently available, it is generally necessary to re-moisten the dry tobacco sheet in order to facilitate its removal from the endless belt. If removal of the tobacco sheet is attempted without re-wetting, the sheet will generally be ruptured or torn. Also, attempted removal of the sheet without re-wetting can result in excessive wear of a doctor blade used for removing the sheet.

The endless belt employed in the presently used commercial procedure for preparing a tobacco sheet is generally constructed of steel. The present procedure for producing a tobacco sheet is described in U.S. Patent 2,747,583, which is incorporated herein by reference.

Various binders which have been suggested or used for forming a tobacco sheet include galactomannans such as guar gum or locust bean gum, and water-soluble cellulose derivatives such as methyl cellulose, carboxymethyl cellulose, hydroxyethyl cellulose, and the like. All of these binders suffer from the disadvantage that they produce a tobacco sheet material which requires remoistening in order to remove it from an endless belt on which it is formed.

An object of the present invention is to provide a method for producing a tobacco sheet material in which the sheet material is readily removed from the endless belt on which it is formed without the need for re-wetting of the sheet prior to its removal.

A further object is to provide tobacco sheets having a high degree of water resistance which contain, as the binder, a mixture of a Xanthomonas hydrophilic colloid and locust bean gum.

A still further object is to provide a tobacco paste or slurry which, when cast on an endless belt and dried, is capable of forming tobacco sheets which are readily removed from the endless belt without the need for re-wetting of the sheet prior to its removal.

Additional objects will appear from a reading of the specification and claims which follow.

In accord with my invention, I first form a slurry or paste which contains ground tobacco, water, a humectant, and a binder comprised of a Xanthomonas hydrophilic colloid in admixture with locust bean gum. The quantities of the various ingredients can be varied within the scope of my invention so long as a sufficient quantity of the Xanthomonas hydrophilic colloid-locust bean gum binder is employed to form a coherent sheet when the paste or slurry is cast onto an endless belt and passed through a dryer, which sheet can later be removed from the endless belt without the need for re-wetting. By way of illustration, I have formed satisfactory tobacco sheets through the use of a tobacco paste or slurry containing about 100 parts of water, about 15 to 25 parts of ground tobacco, a minor quantity of a humectant, such as about 1.7 to about 2.5 parts of glycerine, and from about 0.5 to about 1.5 parts of a mixture of a Xanthomonas hydrophilic colloid and locust bean gum.

As stated above, the tobacco which is used in the slurry or paste is finely ground. The mesh size of the finely ground tobacco can, of course, be varied in forming a tobacco sheet according to my invention. As shown in U.S. Patents 2,592,553 and 2,592,554 tobacco having various mesh sizes has been employed by the prior art in forming a tobacco sheet. Tobacco in which the particles will pass through a 20 mesh screen is shown in these patents as suitable for forming a tobacco sheet. I found that tobacco having a particle size which passes through an 80 mesh screen was satisfactory; however, tobacco having a larger particle size may also be employed in the practice of my invention.

The Xanthomonas hydrophilic colloid employed as a binder ingredient is produced by bacteria of the genus Xanthomonas. Illustrative of such colloidal materials is the hydrophilic colloid produced by the bacterium *Xanthomonas campestris*. This colloidal material is a polymer containing mannose, glucose, potassium glucuronate and acetyl radicals. In such a colloid, the potassium portion can be replaced by several other cations without substantial change in the property of the said material for my purpose.

The said colloid, which is a high molecular weight, exocellular material, may be prepared by the bacterium *Xanthomonas campestris*, by whole culture fermentation of a medium containing 2–5% commercial glucose, an organic nitrogen source, dipotassium hydrogen phosphate and appropriate trace elements. The incubation time is approximately 96 hours at 28° C. under aerobic conditions. In preparing the colloid as aforesaid, it is convenient to use corn steep liquor or distillers' dry solubles as an organic nitrogen source. It is expedient to grow the culture in two intermediate stages prior to the final inoculation in order to encourage vigorous growth of the bacteria. These stages may be carried out in media having a pH of about 7. In a first stage a transfer from an agar slant to a dilute glucose broth may be made and the bacteria cultured for 24 hours under vigorous agitation and aeration at a temperature of about 30° C. The culture so produced may then be used to inoculate a higher glucose (3%) content broth of larger volume in a second intermediate stage. In this stage the reaction may be permitted to continue for 24 hours under the same conditions as the first stage. The culture so acclimated for use with

glucose by the aforementioned first and second stages is then added to the final glucose medium.

In the aforesaid method of preparation of *Xanthomonas campestris* hydrophilic colloid, a loopful of organism from the agar slant is adequate for the first stage comprising 200 milliliters of the said glucose media. In the second stage the material resulting from the first stage may be used together with 9 times its volume of a 3% glucose media. In the final stage the material produced in the second stage may be admixed with 19 times its volume of the final media. A good final media may contain 3% glucose, 0.5% distillers' dry solubles, 0.5% dipotassium phosphate, 0.1% magnesium sulphate having 7 molecules of water of crystallization and water. The reaction in the final stage may be satisfactorily carried out for 96 hours at 30° C. with vigorous agitation and aeration. The resulting *Xanthomonas campestris* colloidal material which I have found to be particularly suitable for my purpose can be recovered by precipitation in methanol of the filtered mixture from the fermentation. This resulting material may also be designated as a pseudoplastic, heteropolysaccharide hydrophilic colloid produced by the bacterial species *Xanthomonas campestris.*

Other Xanthomonas colloidal materials may be prepared by repeating the procedure used for producing the *Xanthomonas campestris* colloidal material described above by substituting known Xanthomonas bacteria or organisms, i.e., *Xanthomonas carotae, Xanthomonas incanae, Xanthomonas begoniae,* and *Xanthomonas malvacearum,* for the bacterium, *Xanthomonas campestris.*

The Xanthomonas hydrophilic colloid, as defined above, is present in admixture with locust bean gum in the binder employed in forming tobacco sheets according to my invention. Preferably, both the Xanthomonas hydrophilic colloid and the locust bean gum are dry blended in finely divided form prior to their addition to the other ingredients employed in making up a tobacco paste or slurry. Various weight ratios of Xanthomonas hydrophilic colloid to locust bean gum can be employed in forming the binder. For example, ratios of Xanthomonas hydrophilic colloid to locust bean gum ranging from 90:10 to 10:90 may be employed. Preferably, the weight ratio of Xanthomonas colloid to locust bean gum ranges from about 80:20 to 20:80 and most preferably, the ratio of Xanthomonas hydrophilic colloid to locust bean gum is about 40:60.

In forming a tobacco sheet according to my invention, the tobacco paste or slurry is laid down on a continuous belt, which is preferably formed of steel, in the manner generally shown in U.S. Patent 2,747,583. The tobacco paste or slurry is kneaded or mixed to substantial homogeneity prior to being laid down on the endless belt. I have found that release of the tobacco sheet from the belt is obtained when the tobacco slurry or mixture is heated to a temperature in the order of about 115° F., or higher, and preferably about 125° F. to about 180° F. prior to its application to the endless belt. The endless belt is also, preferably, in a heated state when the tobacco slurry or paste is applied thereto. Less preferably, the belt is in a heated state, i.e., in the order of about 115° F., or higher, and preferably about 125° F. to about 180° F., but the tobacco slurry or paste is not heated prior to application to the belt.

Following the application of the tobacco paste or slurry to the belt to form a thin layer thereon, the belt is passed through a dryer in which warmed air impinges upon the layer of tobacco paste on the surface of the continuous belt. As described in U.S. Patent 2,747,583, the dryer may have a slitted or perforated bottom wall which is spaced a small distance above the continuous belt. The warmed air impinges upon the layer of tobacco paste on the belt and thereby dries it.

If desired, the tobacco paste layer on the continuous belt may be dried in several stages in which it is contacted with warmed air. As described in U.S. Patent 2,747,583, the drying air may be warmed to temperatures as high as 160° F., although drying air of a lower temperature such as 110° F. may be employed. Following passage of the endless belt through the dryer, the tobacco sheet may be removed from the endless belt and passed to a roller where it is rolled up. If desired, a doctor blade can be employed in assisting the removal of the tobacco sheet from the endless belt.

To further illustrate the scope of my invention, there are presented the following examples, in which all parts and percentages are by weight unless otherwise indicated.

Example I

0.6 gram of finely divided locust bean gum and 0.4 g. of finely divided *Xanthomonas campestris* hydrophilic colloid were dissolved in 150 ml. of distilled water. The solution temperature was elevated to 170° F. After 20 minutes 22 g. of ground pipe tobacco (80 mesh) were added while agitating the solution. 2.5 grams of glycerin were then added. Agitation of the slurry was continued until it appeared to be smooth.

While maintaining the temperature at 170° F. the slurry was cast into a thin sheet on a stainless steel plate which had been pre-heated to about 150° F. The casting was carried out by means of a metering bar which deposits a film of uniform thickness when drawn down over a puddle of the slurry.

The sheet was dried by exposing it to a current of hot air. When completely dry, the sheet released easily from the steel plate. The sheet thickness was approximately 9 mils and had sufficient strength and water resistance to be judged suitable for use as either a cigar binder sheet or as a source of reconstituted cigarette or pipe tobacco.

Example II

Example I was repeated except that the slurry temperature was maintained at about 90° F. The slurry consistency was more gelatinous than in Example I and it was more difficult to cast a continuous sheet. The dried sheet did not release as easily from the steel plate as in Example I and its water resistance was also lower.

As shown in Example II, the application of the tobacco slurry in an unheated or lesser heated state; i.e., below about 115° F. to the heated steel plate was less satisfactory than the procedure employed in Example I. The consistency of the slurry at lower temperatures was more gelatinous and thus more difficult to apply as a continuous sheet. Moreover, the sheet which was formed was more difficult to release from the steel plate and did not exhibit as high a degree of water resistance as the tobacco sheet of Example I. For these reasons, the procedure of Example I, where both the tobacco slurry and the surface onto which it is cast are in a heated state at temperatures of about 115° F., or higher, is a preferred procedure for practicing my invention. More preferably, both the temperature of the slurry and the surface onto which it is cast are about 125° F. to about 180° F.

Example III

Example II was repeated except that the slurry was cast on a steel plate which was not pre-heated. A continuous sheet could not be cast in this manner since a firm gel was formed at the slurry-stainless steel interface upon contact. The dried gel did not release from the steel surface without mechanical scraping. Strength and water resistance properties of the dry gel were poor.

As shown in Example III, a satisfactory tobacco sheet was not formed when both the slurry and the casting surface were in an unheated or lesser heated state. On casting of the slurry onto the casting surface, a firm gel was formed at the slurry-stainless steel interface which prevented formation of a continuous tobacco sheet. The gel which formed did not release from the steel plate on drying and the strength and water resistance properties of the dry tobacco gel were poor.

As shown by the foregoing specification, my invention provides a novel method of preparing tobacco sheets which are readily removed from the casting surface upon which the sheets are formed. Moreover, the tobacco sheets, formed according to my invention, have good water resistance. Water resistance of the tobacco sheet may be obtained without the use of a relatively large quantity of a cross-linking agent, such as glyoxal, as required by the prior art. Suitable water resistance of the tobacco sheets prepared according to my process can be obtained while using little or no cross-linking agent.

It should be understood that various additional ingredients which are commonly employed in sheet tobacco may be incorporated in sheet tobacco prepared according to my method. To illustrate, sulfite pulp may be added to the tobacco paste or slurry to improve the tensile strength of the resulting tobacco sheets. Likewise, various other common tobacco ingredients such as siliceous catalysts (U.S. Patent 2,706,695), fine glass fibers, diatomaceous earth, etc. may be present. The inclusion of these additional ingredients does not affect the action of the binder which I employ which makes possible the unique properties of the tobacco sheet and its easy release from the casting surface on which it is formed.

As stated previously, the best release properties of the tobacco sheet prepared according to my invention are obtained when the tobacco paste or slurry is heated to a temperature of about 125° F. to about 180° F. and applied to a similarly heated casting surface to form a tobacco sheet in which the binder is a gel containing a Xanthomonas hydrophilic colloid and locust bean gum. Higher temperatures up to about 212° F. may be used with the only limitation being the formation of steam at temperatures above the boiling point of water. I have found that this same procedure gives the greatest degree of water resistance to the tobacco sheet formed according to my invention. As will be appreciated, water resistance is a very important property in tobacco sheet material used as a cigar wrapper, one end of which is exposed to saliva as the cigar is consumed. If the tobacco sheet material forming the cigar wrapper does not have good moisture resistance, the end of the cigar which is held in the smoker's mouth will soon become frayed to result in an unsuitable product.

I claim:

1. The process of claim **24** wherein the weight ratio of said Xanthomonas hydrophilic colloid to said locust bean gum in said tobacco slurry ranges from about 80:20 to about 20:80.

2. The process of claim **24** wherein the weight ratio of said Xanthomonas hydrophilic colloid to said locust bean gum in said slurry is about 40:60.

3. The process of claim **24** wherein said Xanthomonas hydrophilic colloid is produced by the bacterium *Xanthomonas campestris.*

4. The process of claim **24** wherein said slurry is heated to a temperature of about 125° F. to about 180° F.

5. The process of claim **1** wherein said Xanthomonas hydrophilic colloid is produced by the bacterium *Xanthomonas campestris.*

6. The process of claim **24** wherein said casting surface is heated to a temperature in the order of about 115° F., or higher, prior to the application thereto of said slurry.

7. The process of claim **1** wherein said casting surface is heated to a temperature in the order of about 115° F., or higher, prior to the application thereto of said slurry.

8. The process of claim **5** wherein said casting surface is made of steel.

9. The process of claim **4** wherein said casting surface is heated to a temperature in the order of about 115° F., or higher, prior to the application thereto of said slurry.

10. The process of claim **1** wherein said casting surface is made of steel and said tobacco slurry contains about 100 parts of water, about 15 to 25 parts of ground tobacco, a minor quantity of a humectant, and from about 0.5 to about 1.5 parts of said mixture of a Xanthomonas hydrophilic colloid with lucust bean gum.

11. The process of claim **10** wherein said Xanthomonas hydrophilic colloid is produced by the bacterium *Xanthomonas campestris.*

12. The process of claim **11** wherein said casting surface is heated to a temperature in the order of about 115° F., or higher, prior to the application thereto of said slurry.

13. The process of claim **25** wherein the weight ratio of said Xanthomonas hydrophilic colloid to said locust bean gum in said slurry ranges from about 80:20 to about 20:80.

14. The process of claim **25** wherein the weight ratio of said Xanthomonas hydrophilic colloid to said locust bean gum in said tobacco slurry is about 40:60.

15. The process of claim **25** wherein said casting surface is made of steel.

16. The process of claim **13** wherein said casting surface is made of steel.

17. The process of claim **25** wherein said Xanthomonas hydrophilic colloid is produced by the bacterium *Xanthomonas campestris.*

18. The process of claim **25** wherein said casting surface is heated to a temperature of about 125° F. to about 180° F.

19. The process of claim **13** wherein said Xanthomonas hydrophilic colloid is produced by the bacterium *Xanthomonas campestris.*

20. A moisture resistant tobacco sheet prepared according to the method of claim **24.**

21. A moisture resistant tobacco sheet prepared according to the method of claim **6.**

22. A moisture resistant tobacco sheet prepared according to the method of claim **25.**

23. A moisture resistant tobacco sheet prepared according to the method of claim **13.**

24. A process for preparing a continuous thin film of tobacco suitable for tobacco sheet and filler, said process comprising: forming a slurry containing ground tobacco, water, a humectant, and a binder comprising a Xanthomonas hydrophilic colloid in admixture with locust bean gum wherein the weight ratio of said Xanthomonas hydrophilic colloid to said locust bean gum in said slurry ranges from about 90:10 to about 10:90, heating said slurry to a temperature in the order of about 115° F. or higher and applying said heated slurry to a casting surface to form a continuous film thereon, drying said film on said casting surface, and removing said tobacco film from said casting surface such that easy release of said film may be effected without the necessity for rewetting said film or incorporating a belt-release agent in said film.

25. A process for forming a continuous thin film of tobacco suitable for tobacco sheet and filler, said process comprising: forming a slurry containing ground tobacco, water, a humectant, and a binder composed of a Xanthomonas hydrophilic colloid in admixture with locust bean gum, wherein the weight ratio of said Xanthomonas hydrophilic colloid to said locust bean gum in said slurry ranges from about 90:10 to about 10:90, applying said slurry in a film to a casting surface, said casting surface being heated to a temperature in the order of about 115° F., or higher, prior to the application of said slurry thereto, drying said film on said casting surface, and removing said film from said casting surface such that easy release of said film may be effected without the necessity for rewetting said film or incorporating a belt release agent in said film.

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