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TOBACCO PRODUCT AND METHOD OF CONDITIONING SAME

Ernest H. Freund, Sayville, and Kelvin Domovs, Oakdale, N. Y., assignors to National Dairy Research Laboratories, Inc., Islip, N. Y., a corporation of Delaware

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This invention relates to tobacco products and a method of conditioning the same, and more particularly to tobacco products such as cigarettes, cigars, and tobacco treated with a lactositol conditioning agent and to the method of conditioning the same.

Throughout the manufacture and storage of tobacco products, the control of the moisture content is of special importance. If, in the manufacture of tobacco products, the moisture content falls too low, the tobacco becomes brittle and forms dust. If, on the other hand, the moisture content becomes too high, there is a tendency toward mold formation, or the creation of a soggy condition. Either condition is highly undesirable since the tobacco should have a moist texture.

Furthermore, after tobacco products leave the manufacturer, it is desired that the moisture content be maintained within the proper limits. The product should reach the consumer with such a moisture content that it is neither dry or brittle, and not so moist as to be in moldy or soggy condition.

To this end the manufacturer adds to the tobacco a conditioning agent or humectant calculated to maintain a proper moisture content of the product during fabrication and storage. The humectant should contribute no unpleasant taste, should be nontoxic to the human system, and its combustion products should be likewise nontoxic.

Among the important properties involved in the selection of a conditioning agent, or in the formulation of a combination of conditioning agents in case all the desired properties are not present in a single agent, are volatility, tar formation, hygroscopicity, humectant range, and dynamic hygroscopicity. The volatility should be as low as possible in order not to change the concentration of the conditioning agent in the tobacco product and to prevent volatilizing of the conditioning agent by the combustion of the tobacco. The tar formation should be as low as possible to prevent irritation of those body organs which come in contact with the smoke. The amount of water bound by the conditioning agent should be high.

The humectant range is characterized by the change in water content of a given amount of humectant caused by a given change in relative humidity. A low change in water content is indicative of a narrow humectant range. A narrow humectant range is obviously preferred.

Dynamic hygroscopicity is the rate of change in the moisture content of a humectant caused by a given change in relative humidity. It is desirable that this rate be low, since a small change in the moisture content of tobacco products is preferred when their package is temporarily opened and they are exposed to atmospheres of widely varying humidities.

Other properties of the conditioning agent to be considered are taste, viscosity, chemical reactivity, compatibility, melting point, solubility and tendency to form stable supersaturated solutions.

Generally all the requirements of an ideal conditioning agent for tobacco are not found in a single substance. Therefore, mixtures of conditioning agents are preferably used in order to have a composite conditioning agent having the most desirable properties.

Heretofore, various humectants have been employed in tobacco products and they are well described in the literature. For example, French Patent No. 847,099, dated June 26, 1939, describes the use of lithium salts, such as lithium chloride, lithium bromide, lithium nitrate and lithium salicylate, as humectants in tobacco products. Tobacco products containing a glycosimine humectant are disclosed in U. S. Patent No. 2,286,639, issued June 16, 1942. The use of sorbitol as a conditioning agent in tobacco products is set forth in U. S. Patent No. 2,067,338, issued January 12, 1937, while U. S. Patent No. 2,172,357, issued September 12, 1939, discloses the use of a mixture of hexahydric alcohols, such as sorbitol, iditol, and talitol, as humectants for tobacco products. Hexides which are dihydroxy cyclic inner ethers obtained by the intramolecular loss of two moles of water from the hexitols, are disclosed as humectants for tobacco products in U. S. Patent No. 2,371,389, issued March 13, 1945, and alphamethyl glycerine as an active humectant in tobacco products is described in U. S. Patent No. 2,483,418, issued October 4, 1949.

In addition to the above humectants, others have been employed, examples being molasses; sugars, particularly invert sugars; glycerol; diethylene glycol; and propylene glycol. While all of the above humectants have their advantages, they also suffer from certain disadvantages noted below.

In view of their cheapness, sugars are used as much as possible but the amounts employed are limited by the fact that they do not impart sufficient elasticity or life to cigarette tobaccos, their hygroscopicity is inferior to that of glycerine or glycols, their chemical reactivity causes undesired changes in their flavoring, and their combustion products do not give the most desirable smoking characteristics.

Glycerine has more desirable physical characteristics with respect to hygroscopicity, power of imparting springiness or life to a cigarette tobacco, and better performance on spraying. Also, being less reactive than sugars, it produces less changes in the flavor. However, its combustion gives rise to the highly irritating acrolein, which not only affects the general smoking quality unfavorably when present in excess, but also, due to its high chemical activity, acts upon the flavoring ingredients in the butt portion of the cigarette thus altering undesirably the smoking characteristics during the later stages of the smoking period.

Diethylene glycol is advantageous from the standpoint of hygroscopicity and physical quality of the tobacco during the processing of the tobacco, but since it is more volatile than glycerine, diethylene glycol appears in the smoke as such, and hence is absorbed by the system. In view of the known toxicity of diethylene glycol, its use in tobacco is considered by many to be undesirable.

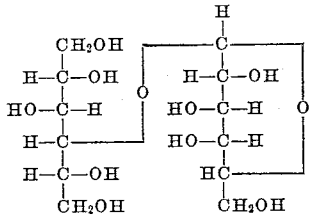
Sorbitol does not yield acrolein on combustion, and does not have the chemical reactivity towards flavoring ingredients of the sugars. While sorbitol has a quite narrow humectant range relative to the known humectants, an improvement in this respect is still desirable.

Therefore, it is an object of this invention to provide tobacco products with a humectant which develops only a

small amount of tars during its combustion. Further objects are the provision of a humectant possessing a narrow humectant range in order to maintain the moisture in the tobacco products within narrower limits and the provision of a humectant having low dynamic hygroscopicity.

The humectant of this invention is lactositol which may be employed either solely or preferably in combination with other humectants. Hence, it will be understood that the term "a lactositol conditioning agent" as used herein refers to either lactositol or lactositol admixed with at least one other humectant.

Lactositol, or lactitol, the polyhydric alcohol which is obtained by the hydrogenation of lactose, has the following structural formula:



It may be prepared either by the electro-reduction of lactose or by the catalytic hydrogenation of lactose, the latter process being preferred, since it is more economical and leads to products of higher purity. The preparation of lactositol by the catalytic hydrogenation of lactose using a nickel catalyst is set forth in Patent No. 1,990,245, issued February 5, 1935. The use of a nickel chromate catalyst is described in Patent No. 1,936,999, issued November 28, 1933, while Patent No. 2, 292,293 issued August 8, 1942, discloses the use of accelerating salts and Patent No. 2,421,416, issued June 3, 1947, discloses the acceleration by magnesium.

The lactositol conditioning agent may be advantageously incorporated into the tobacco in the form of an aqueous solution by any convenient method, for example, tumbling, dipping, or spraying, and the treated tobacco then dried and rehumidified. The amount of the conditioning agent added will depend upon the nature of the tobacco and the desired humidity conditions. Generally, from about 0.03 g. to about 0.12 g. of the lactositol conditioning agent per gram of tobacco is sufficient to give the tobacco a moist texture although it will be understood that the amount employed is not critical.

Suitable humectants which may be added to lactositol to form lactositol conditioning agents include glycerol, sorbitol, and Arlex, which is a mixture of hexitols manufactured by the Atlas Powder Co. and consisting mainly of sorbitol and having a total polyol (polyhydric alcohol) content of about 85%. The amount of each humectant present in the lactositol conditioning agent will depend upon the characteristics desired. Typical suitable lactositol conditioning agents include, for example, 30% lactositol–70% glycerol, 50% lactositol–50% glycerol, 75% lactositol–25% glycerol, 50% lactositol–50% sorbitol, and 50% lactositol–50% Arlex. The addition of other humectants to lactositol will increase the hygroscopicity thereof, enlarge the humectant range of lactositol, and lessen the chance that lactositol will crystallize.

The humectant range and the dynamic hygroscopicity of lactositol, a 2:1 by weight mixture of lactositol and glycerol, and sorbitol was ascertained by determining the changes in weight per unit time when an aqueous solution of the humectant is transferred from an atmosphere having a relative humidity which is in equilibrium with the water content of the humectant into an atmosphere which has a higher or lower relative humidity.

Table I illustrates the weight gained by these solutions per unit time when dispersed on sand and transferred at 75° F. from an atmosphere of 32% relative humidity to one of 79% relative humidity.

TABLE I

Lactositol		Lactositol-Glycerol (2:1)		Sorbitol	
Time (Hrs.)	Percent Weight Gain	Time (Hrs.)	Percent Weight Gain	Time (Hrs.)	Percent Weight Gain
2	23	2	34	2	37
4	27	4	38	4	41
8	28	8	39	8	43
29	28	29	39.5	29	44
40	28	40	39.5	40	44.5

Table II illustrates the weight lost by these solutions when transferred from an atmosphere of 58% relative humidity to one of 32% relative humidity. These solutions were also dispersed on sand.

TABLE II

Lactositol		Lactositol-Glycerol (2:1)		Sorbitol	
Time (Hrs.)	Percent Weight Loss	Time (Hrs.)	Percent Weight Loss	Time (Hrs.)	Percent Weight Loss
2.5	5.5	2.5	10.25	2.5	9.75
4	7.5	4	11	4	12.5
8	8	8	11	8	14
29	8	29	11	29	14
40	8	40	11.25	40	14

Table III shows the weight lost for the same three solutions when transferred from an atmosphere of 79% relative humidity to one of 32% relative humidity. These solutions were also dispersed on sand.

TABLE III

Lactositol		Lactositol-Glycerol (2:1)		Sorbitol	
Time (Hrs.)	Percent Weight Loss	Time (Hrs.)	Percent Weight Loss	Time (Hrs.)	Percent Weight Loss
2.5	20.25	2.5	28.25	2.5	27
4	21.5	4	29	4	30
8	22	8	29	8	31
29	22	29	29	29	31
40	22	40	29	40	31

From a comparison of the data in Tables I, II, and III it can be seen readily that lactositol has a narrower humectant range and a lower dynamic hygroscopicity than the 2:1 mixture of lactositol and glycerol, which in turn has a narrower humectant range and a lower dynamic hygroscopicity than sorbitol.

The equilibrium hygroscopicity of lactositol at relative humidities below 50% was found to be higher than that of sorbitol thus enabling lactositol to keep tobacco products more moist at lower relative humidities than can sorbitol. Thus at about 30% relative humidity the equilibrium hygroscopicity of lactositol was found to be 9% water whereas that for sorbitol is 4.5% water. Such a finding is unexpected and directly contrary to the predictions made in an article titled "Hygroscopic agents and their use in cosmetics" by Girffin et al. appearing in the December 1949 issue of the Journal of the Society of Cosmetic Chemists.

In order to determine the amount of tar formed upon combustion of tobacco conditioned with lactositol in comparison with that formed upon combustion of tobacco conditioned with another humectant, 2.5 g. of lactositol and 2.5 g. of sorbitol were applied respectively to two 10 gram charges of tobacco and the composition burned in a smoking machine. Higher concentrations of the humectants than normally used were applied to the

tobacco to allow a more exact determination of the differences.

While generally an addition of 0.06 g. of the humectant per gram of the tobacco would be satisfactory for conditioning purposes, a concentration of 0.25 g. of humectant per gram of tobacco was used for the tar determinations.

The smoking machine consisted of a train assembled in the following sequence: a Pyrex tulip funnel head, containing the tobacco charge on top of a loose mat of glass wool, connected to a 600 ml. gas washing bottle containing 300 ml. trichloroethylene; a 300 ml. gas washing bottle containing 200 ml. of trichloroethylene; two 200 ml. gas washing bottles containing 150 ml. each of trichloroethylene; a 1 liter gas washing flask containing 500 ml. of isopropyl alcohol; a solenoid valve controlled by an electronic timer switch; an open tube mercury manometer; a vacuum storage bottle; a Cartesian manostat vacuum regulator; a second vacuum storage bottle; a one-way all glass check valve; and a tube to an aspirator.

Ten grams of the humectant-treated moist tobacco were packed lightly into the "tulip" bowl on top of a loose mat of glass wool. The tobacco was then ignited with the aid of a microburner and the intermittent suction of the control system. The suction period was one second, with a holding interval of six seconds following each puff. The vacuum during the suction period was controlled as closely as possible to give an average of 5 inches of vacuum as measured on a Bourdon gauge placed after the last gas washing bottle. At the end of the burning period, the air flow was stopped, the ash and glass wool removed from the tulip, and extra trichloroethylene placed in the tulip and allowed to drain slowly into the first trap carrying the tar with it.

The contents of each trap was filtered through a medium filter paper into a two-liter balloon flask and the entire filtrate was evaporated under vacuum until only a dark brown viscous residue remained. The two-liter balloon flask containing the vacuum concentrated residue was treated to a light heating by being jacketed in a double heating mantle connected to a variable transformer set at 20 volts. A vacuum was pulled on this flask occasionally during the heating period of approximately six hours required to remove a golden colored "dew" which gradually rose up the sides of the flask and was finally largely dispelled. The remaining residue was essentially nonvolatile and approached constant weight. This material has been considered the "tar" fraction. It was weighed in the balloon flask on a new Ohaus balance which offered a reciprocal sensitiivty by the method of swings of approximately 0.05 gm. The weight of the empty and dry flask was again taken.

In a series of five tar determinations on each of the two humectant-treated tobaccos, an average of only 0.130 gram of tar was produced per gram of lactositol treated tobacco as compared to 0.203 gram of tar per gram of sorbitol treated tobacco. The data thus shows that a lactositol-treated tobacco produces substantially less tar than a sorbitol-treated tobacco.

The following two examples illustrate the preparation of tobacco products containing lactositol.

Example 1

Two hundred grams of tobacco were treated with 200 ml. of a 6% lactositol solution by pouring the solution over the tobacco in a large stainless steel tray at room temperature, and then tumbling the tobacco for more uniform mixing for 60 minutes. This preparation was heated to dryness in a circulating oven at 130° F., and rehumidified over a 33.5% sulfuric acid solution in a sealed container for 72 hours. The tobacco product contained 6 grams of lactositol per gram of tobacco.

Example 2

The procedure and amounts given in Example 1 were followed execpt that the lactositol conditioning agent contained 3% lactositol and 3% glycerol. The tobacco product contained 3 grams of lactositol conditioning agent per gram of tobacco.

Various modifications and changes may be made in the invention described herein without departing from the spirit thereof or sacrificing any of the beneficial advantages. Hence, it will be understood that the invention is to be limited only within the scope of the appended claims.

We claim:

1. A tobacco product containing tobacco and a lactositol conditioning agent in an amount sufficient to give the tobacco a moist texture.

2. A tobacco product containing tobacco and lactositol as the conditioning agent in an amount sufficient to give the tobacco a moist texture.

3. A tobacco product containing tobacco and a mixture of lactositol and at least one other humectant as the conditioning agent in an amount sufficient to give the tobacco a moist texture.

4. A tobacco product containing tobacco and a mixture of lactositol and glycerol as the conditioning agent in an amount sufficient to give the tobacco a moist texture.

5. The process of conditioning tobacco comprising adding a lactositol conditioning agent to tobacco.

6. The process of conditioning tobacco comprising adding lactositol as the conditioning agent to tobacco.

7. The process of conditioning tobacco comprising adding a mixture of lactositol and at least one other humectant as the conditioning agent to tobacco.

8. The process of conditioning tobacco comprising adding a mixture of lactositol and glycerol as the conditioning agent to tobacco.

9. The process as set forth in claim 5 wherein said resulting conditioned tobacco is dried and rehumidified.

10. The process as set forth in claim 6 wherein said resulting conditioned tobacco is dried and rehumidified.

11. The process as set forth in claim 7 wherein said resulting conditioned tobacco is dried and rehumidified.

12. The process as set forth in claim 8 wherein said resulting conditioned tobacco is dried and rehumidified.

References Cited in the file of this patent

UNITED STATES PATENTS

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2,298,088	Swain	Oct. 6, 1942