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[72] Inventor **William E. Rosen**
Lafayette Hills, Pa.

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[73] Assignee **Creative Enterprises, Inc.**
Narbeth, Pa.

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[54] METHOD OF PUFFING TOBACCO AND REDUCING NICOTINE CONTENT THEREOF

15 Claims, No Drawings

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[50] **Field of Search** 131/17, 140–144

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Primary Examiner—Melvin D. Rein
Attorney—Paul & Paul

ABSTRACT: A method is provided for treating tobacco to increase the volume of the tobacco and reduce the nicotine and tar content of the tobacco. In the method of this invention, the tobacco is initially treated with catalase and then treated with an aqueous solution of hydrogen peroxide. The treated tobacco produced in accordance with this invention is especially useful in the manufacture of cigarettes and the like.

METHOD OF PUFFING TOBACCO AND REDUCING NICOTINE CONTENT THEREOF

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to a method of treating tobacco. More particularly, this invention is concerned with a method for increasing the volume of tobacco.

2. Description of the Prior Art

Tobacco which has been treated so as to substantially increase its volume is generally referred to as puffed tobacco. Various methods have been suggested in the prior art to manufacture puffed tobacco. These methods have, however for the most part, proven to be completely unsatisfactory. Certain of the suggested methods cause a substantial portion of the cell walls of the tobacco to rupture which significantly decreased the physical strength of the tobacco. Other methods also had a rather severe adverse affect of the taste of the tobacco. The methods heretofore suggested were also economically unfeasible for commercial production.

Attempts have also been made to reduce the nicotine and tar content of tobacco in an economical manner without adversely effecting the desirable properties of the tobacco, especially taste, without success.

It is accordingly an object of this invention to provide a commercially feasible process for manufacturing puffed tobacco which does not adversely effect the desirable properties of the tobacco, especially the taste.

Other objects and advantages of this invention will become further apparent hereinafter in the specification and the subjoined claims.

SUMMARY OF THE INVENTION

The objects of this invention have been achieved by providing a process wherein the tobacco to be puffed is initially treated with catalase and thereafter treated with an aqueous solution of hydrogen peroxide.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Various species of tobaccos may be treated in accordance with the present invention. The tobaccos, when treated, are preferably in the cured state as opposed to the green state. The tobacco may be in various physical forms. Advantageously, tobacco is treated in the leaf form. However, tobacco may also be satisfactorily treated in the shredded form, customarily used for the manufacture of cigarettes or in any other form.

The effective compound which is employed to cause the decomposition of the aqueous hydrogen peroxide solution is catalase. Catalase is a red crystalline enzyme which is a protein complex with hematin.

Catalase may be applied to the tobacco in the purified form in order to decompose the hydrogen peroxide. Catalase is, however, a natural enzyme which is produced by certain plants and in particular yeast. Since yeast in inexpensive to purchase and, if desired, can be cultivated with little or no difficulty, yeast is accordingly the preferred source for the catalase.

The yeast which may be employed in this invention must be an active live yeast if the yeast plants are to be cultivated to produce the catalase. The particular strain of yeast which is employed is not critical. Excellent results have been obtained with the common baker type yeast, as well as with the brewer'S-type yeast. Other types of yeast are also suitable for employment in this invention. The principal criterion of the yeasts which are used in this invention is that the yeast contain or produce sufficient amounts of catalase to cause the decomposition of the hydrogen peroxide solutions so as to produce large volumes of gases. The yeast that is selected should not impart adverse properties to the treated tobacco, especially with regard to taste.

The aqueous hydrogen peroxide solutions which are employed in the process of this invention are commercially

available. The hydrogen peroxide solutions which are used, for example, may be the commonly available 3 percent hydrogen peroxide solutions. Superoxol (30 percent hydrogen peroxide) can also be used as a stock material and diluted as required with water to obtain the desired strength hydrogen peroxide solution. There is no exact lower limit with regard to the strength of the hydrogen peroxide solutions which may be employed in the present invention. However, for practical purposes the strength of the aqueous hydrogen peroxide solution should be between 10 and 50 volumes with the most preferred results being obtained when a 20 to 40 volume peroxide solution is employed.

The initial step in the process of the present invention is to apply the catalase to the tobacco. The most convenient method of applying the catalase to the tobacco is in the form of an aqueous dispersion of a suitable yeast. The tobacco can advantageously be treated by immersing the tobacco into the aqueous yeast solution. However, in the case of certain forms of tobacco, for example, shredded tobacco, it is considerably simpler to spray the aqueous dispersion of the yeast onto the tobacco. The yeast can also be applied to the tobacco in the dried state. In this method, the yeast is sprinkled or spread in a relatively uniform manner over the tobacco to be treated. The yeast can be applied as a dry powder or, if desired, it can also be applied along with a water soluble binder which insures that the yeast, once distributed uniformly through the tobacco mass, will remain in a uniform distribution.

The amount of yeast that is applied to the tobacco can be relatively small. Yeast being a living plant will rapidly multiply under the proper conditions. Most yeasts, even if applied to the tobacco in the dry inactive state, will start to rapidly reproduce in a moist aerobic environment at ambient to slightly elevated temperature, for example, about 25°–30° in about 3–4 hours. As the yeast plants multiply additional amounts of catalase are produced.

Accordingly, by applying a relatively small amount of yeast to the tobacco and ageing the tobacco under the proper conditions, a given amount of yeast can be readily grown on the tobacco which will result in a given amount of catalase being produced on the tobacco.

In order to have a rapid growth of yeast on the tobacco, it is essential that nutrients be provided for the yeast. Carbohydrate, for example, sugars such as sucrose, lactose or the like and starches are most effective as nutrients for the yeast. The selection of nutrient is dependent on the properties desired in the final product. If a degree of sweetness is desired in the final tobacco, sugars can be used. However, if sweetness is not desired, the starches are a better choice of nutrient.

A relatively simple and inexpensive method of producing catalase for the process is to maintain a stock mixture of tobacco, preferably in shredded form, nutrients and a suitable yeast in an aerobic moist condition at an optimum temperature of 30° C. The stock mixture of tobacco will rapidly be covered with the yeast growth. A portion of the yeast covered stock tobacco mixture can be removed and blended with the tobacco to be puffed to provide the initial source of yeast. By maintaining the tobacco to be puffed under the proper condition and especially by adding a nutrient, the yeast will rapidly multiply over the untreated tobacco.

While it is preferable to apply a small amount of yeast to the tobacco and allow the yeast to multiply on the tobacco, it is of course possible to also initially apply a heavy concentration of yeast which contains a sufficient amount of catalase for the purposes of this invention.

After this tobacco has been treated with the catalase, as noted above, the tobacco is then contacted with an aqueous solution of hydrogen peroxide. THe hydrogen peroxide can be applied to the tobacco in substantially the same manner as that employed for the aqueous dispersion of the yeast, that is, the hydrogen peroxide may be applied by immersing the catalase-treated tobacco into a hydrogen peroxide solution or by spraying the hydrogen peroxide onto the catalase-treated tobacco.

Almost as soon as the catalase and the hydrogen peroxide solutions are brought into contact, there is a considerable evolution of gases. If yeast is used as the source of catalase, CO_2 gas is produced along with the oxygen formed when the hydrogen peroxide decomposes into water and oxygen. The rapid, almost violent decomposition of the hydrogen peroxide, is caused by the enzyme catalase. It is the evolution of the bases from the reaction of the catalase-treated tobacco and the hydrogen peroxide which causes the tobacco to expand to a larger volume and consequently a lower density to provide the puffed tobacco product of this invention.

The amount that the volume of the tobacco is increased by the process of this invention is directly related to the strength of the hydrogen peroxide solution employed. The higher the strength of the peroxide used, the greater will be the increase in the volume of the tobacco. However, there is a maximum limit to the strength of the hydrogen peroxide which can be employed, since excessively strong solutions will cause excess oxidation of the tobacco itself which is highly undesirable. For example, it should be noted that superoxol which is one hundred volume peroxide, could cause excessive oxidation of the tobacco if applied in the undiluted form. The optimum concentrations of hydrogen peroxide for employment in this invention are those which contain from 10–50 and more preferably 20–40 volumes of hydrogen peroxide.

The amount of catalase which is applied or produced on the tobacco in the initial step of the process is directly related to the amount of hydrogen peroxide which is employed. The amount of yeast that is on the tobacco should be sufficient to produce an amount of catalase which is sufficient to decompose all of the hydrogen peroxide which is employed.

The relative amount of the yeast which must be employed in order to insure that sufficient catalase will be present to completely decompose the hydrogen peroxide will vary considerably depending upon the particular strain which is employed and the reaction conditions under which the process of the present invention is conducted. The exact amount of a given strain which is required in order to decompose a given amount of hydrogen peroxide can readily be determined by well-known standard laboratory tests for detecting and measuring hydrogen peroxide content. The most commonly used reagent for the detection of hydrogen peroxide is titanium sulfate. A solution of this compound gives a yellow to red color with an acidified solution of hydrogen peroxide. Accordingly, by varying the relative amounts of the yeast and thereby the catalase content and the hydrogen peroxide, the desired increase in volume can be obtained with the complete decomposition of the hydrogen peroxide.

Additional benefits are obtained with the process of the present invention. In addition to increasing the volume of the tobacco, the tobacco is bleached and certain undesirable components in the tobacco are reduced. In particular, it should be noted that the nicotine in the tobacco is oxidized by the oxygen which is liberated on decomposition in the hydrogen peroxide reaction into the relatively harmless products including nicotinic acid and certain other relatively harmless organic products. The reduction in nicotine is especially noticeable if a catalytic amount of nitric acid is added. It has also been found that to some degree, the relative amount of tar in the tobacco is also reduced by the process of the present invention. The exact mechanism by which the tar is reduced is not known but it is believed to a combination of both the action of the enzymes on the tar and oxidation of the tar by the oxygen produced by the decomposition of the hydrogen peroxide.

The method of the present invention is advantageously conducted at room temperatures to slightly elevated temperatures. The yeast and the hydrogen peroxide will readily react in this temperature range to produce the desired evolution of gases. The method of course can also be conducted at a somewhat elevated temperature to accelerate the reactions. There is an upper temperature limit at which the reaction can be conducted if a growth of yeast is employed to produce the required amount of catalase. The temperature must be maintained at a temperature below that at which the yeast will be killed during the growth step. This upper temperature is determined by the particular strain of the yeast which is employed. However, for most purposes, quite satisfactory results are obtained by conducting the method of the present invention at ambient temperatures to 30° C. The degree of treatment to the tobacco, using the method of the present invention, can be readily controlled by several expedients. As noted above, the increase in the volume of the tobacco can be controlled by increasing or decreasing the concentration of the hydrogen peroxide. A further method which has proven to be quite satisfactory is to kill the yeast with heat when the tobacco reaches the desired increase in volume, in that the catalase production is likewise stopped. This also prevents any latent yeast on the tobacco from growing and producing enzymes which might possibly further affect the tobacco during storage. The puffed product of the present invention is dried to the desired degree of moisture content in the conventional manner. The cost of treating tobacco in accordance with the invention is relatively low. With the exception of the cost of hydrogen peroxide which is readily commercially available at a reasonable price, There are no other substantial material costs involved in that the yeast which produces the catalase can be readily cultivated in sufficient quantities at minimal costs in the manner noted above.

The following examples are provided in order to further illustrate the process of the present invention. It should be appreciated, however, that the subjoined claims are not intended to be limited to the scope of the examples.

EXAMPLE 1

A solution was prepared by dispersing one part by weight of common baker yeast in 20 parts by weight of water. This solution was sprayed on shredded tobacco in an amount such that the tobacco was uniformly wet out. Immediately thereafter, the tobacco was sprayed with a forty volume hydrogen peroxide. Almost as soon as the hydrogen peroxide contacted the yeast treated tobacco, there was a noticeable bubbling action as gases were evolved. The evolved gases were found to be comprised mainly of a mixture of carbon dioxide and oxygen. The evolution of the gases was substantially completed in a very short time. As the gases were evolved, the tobacco simultaneously increased in volume. The tobacco was dried in a drum dryer and cooled by forcing cool air through the mixture. After the tobacco was dried, there was no significant decrease in the volume of the puffed tobacco. The product also was considerably lighter in color. The mechanical properties of the treated tobacco were compared with the mechanical properties of the tobacco prior to treatment by manually crushing the tobacco samples. Surprisingly, the treated tobacco properties were at least equivalent to those of the untreated product with regard to resiliency. Cigarettes were made from treated and untreated tobacco and smoked. No adverse effects were observed with regard to taste of the treated product.

EXAMPLE 2

Example 1 was repeated with the exception that 20 volume hydrogen peroxide was employed in place of the 40 volume. The process proceeded in the same manner except that the increase in volume and the degree of bleaching was significantly less.

EXAMPLE 3

Example 1 was repeated with the exception that the yeast was dispersed in a saturated sucrose solution. The result obtained was equivalent to that of example 1 with the exception that the tobacco had a sweet taste.

EXAMPLE 4

Example 3 was repeated with the exception that the sucrose yeast solution was applied by immersing the tobacco in the solution. Equivalent results were obtained as in example 3.

EXAMPLE 5

Example 3 was repeated with the exception that the tobacco was immersed in a **10%** solution of the sucrose-yeast dispersion prepared in example 3 and stored for 12 hours in a chamber held at about 90 percent relative humidity and 30° C with air being circulated through the tobacco. Examination of the tobacco after this treatment, showed that the yeast plants had reproduced about 10 fold. THe tobacco was further treated in accordance with the procedure of example 1. The product which was obtained was almost identical to that of example 1.

EXAMPLE 6

A yeast treated stock tobacco mixture was prepared by treating tobacco cuttings in accordance with the yeast growing procedure described in example 5. One part of this stock tobacco was blended with 10 parts of untreated tobacco. The blend was sprayed with a saturated sucrose solution and held for 10 hours at 30° C. in a moist aenobic environment. After this period, the blend of tobacco was examined and it was found the yeast had reproduced and spread to the previously untreated tobacco. The mixture was treated with 20 volume peroxide and when the evolution of gases ceased, the product was dried. The product was found to have increased about 20 percent in volume and was noticeably lighter in color. The tobacco had excellent resistance to crushing when compared to the untreated tobacco before treatment.

What is claimed is:

1. The method of treating tobacco comprising the steps of providing on said tobacco, a given amount of catalase and thereafter contacting said tobacco with an aqueous solution containing a given amount of hydrogen peroxide, said given amount of catalase being effective to cause decomposition of said given amount of hydrogen peroxide and said given amount of hydrogen peroxide upon decomposition being effective to increase the volume of said tobacco.

2. The method of treating tobacco according to claim **1** wherein said catalase is provided on said tobacco by providing a growth of yeast containing said given amount of catalase.

3. The process according to claim **1** wherein said given amounts are amounts less than that which will cause substantial rupture of the cell walls of said tobacco.

4. The process according to claim **2** wherein said yeast is applied to said tobacco in the form of an aqueous dispersion of said yeast.

5. The process according to claim **4** wherein said aqueous dispersion is sprayed on said tobacco.

6. The process according to claim **4** wherein said aqueous dispersion is applied by immersing said tobacco in the aqueous dispersion.

7. The process according to claim **4** wherein said aqueous dispersion contains in addition to said yeasts, a nutrient for said yeast.

8. The process according to claim **2** wherein the yeast is applied to said tobacco as a dry powder.

9. The process according to claim **2** wherein said growth of yeast is provided on said tobacco by initially treating the tobacco with a growth initiating amount of said yeast, and a nutrient and thereafter maintaining said tobacco in a moist aerobic environment at ambient to slightly elevated temperature until said yeast reproduced to provide said given amount of catalase.

10. The process according to claim **2** wherein a first amount of tobacco is treated with a growth initiating amount of yeast and a nutrient, and said first amount of tobacco is maintained in a moist aerobic environment at a temperature sufficient for reproduction of said yeast until said yeast has reproduced to provide a substantial increase in the amount of said yeast and thereafter blending said first amount of tobacco with a second amount of tobacco to provide a blend of said first and second amounts of tobaccos.

11. The process according to claim **10** wherein the blend of tobacco is maintained under moist, aerobic conditions at a temperature sufficient to cause said yeast on said first amount of tobacco to reproduce and grow on said second amounts of tobacco.

12. The process according to claim **1** wherein said solution of hydrogen peroxide is an aqueous solution containing 3–30 percent by weight of hydrogen peroxide.

13. The process according to claim **1** wherein said solution of hydrogen peroxide is 10–50 volume hydrogen peroxide.

14. The process according to claim **1** wherein said hydrogen peroxide solution is 20–40 volume hydrogen peroxide.

15. The process according to claim **1** wherein the amount of the said hydrogen peroxide solution is sufficient to produce a volume of oxygen sufficient to oxidize a substantial portion of the nicotine in said tobacco.