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CIGARETTE PAPER PRODUCTS COMPRISING WATER INSOLUBLE DEXTRAN

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Fig. 1

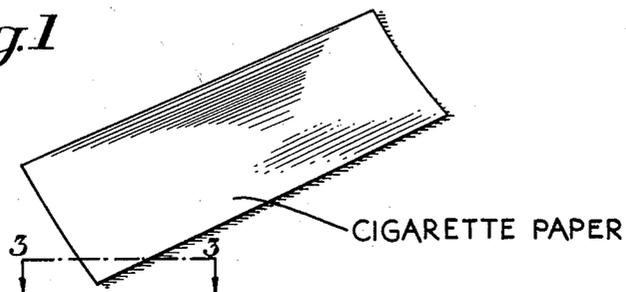


Fig. 2

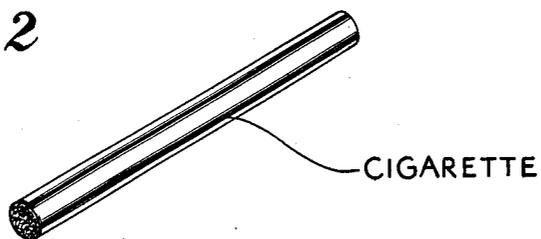


Fig. 3



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CIGARETTE PAPER PRODUCTS COMPRISING
WATER INSOLUBLE DEXTRAN

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This invention relates generally to nonwoven fibrous webs. More particularly, it relates to paper and paper products, especially cigarette paper.

The paper used as wrapper for machine made cigarettes is combustible, i.e., of a type that will burn easily when rolled in contact with the tobacco, to yield a finished cigarette which, once lighted, continues to burn until the cigarette is consumed, without requiring a forced draft or continuous puffing by the smoker.

In order to achieve this objective of continued burning the cigarette paper is filled or "loaded" with an alkaline filler, commonly calcium carbonate (chalk) which is incorporated in the paper sheet during manufacture thereof. Thus, the calcium carbonate is added to the paper pulp suspension comprising cellulose fibers and commonly cellulose fibers from flax, while the suspension is in the beater or in the machine chest or just prior to formation of the pulp into a continuous paper web or sheet on the paper machine. The chalk filler is normally used in an amount such that it constitutes about 20% to 30% of the total weight of the filled paper.

The chalk filler is used for other purposes in addition to insuring continued burning of the paper. It makes the paper more opaque which results in a cigarette of improved appearance, and also cuts down the time required to dry the paper.

The disadvantages of chalk as filler for the paper have not been fully evaluated. The exact bearing it may have on indications that the incidence of cancer is higher in cigarette smokers than in smokers of tobacco in other forms has not been established. However, calcium carbonate is an inorganic substance and that alone would seem to render it undesirable for use as the filler for cigarette paper if an organic filler imparting the same desirable properties to the paper were made available.

A known disadvantage of the calcium carbonate filler is that the paper containing it normally does not have the most desirable ashing characteristics and in order to avoid the formation of carbonized paper particles that commonly appear as black curling ashes which tend to flake off and fall from the cigarette onto the smoker's clothes, unless the paper is subjected to chemical treatment to produce a clinging ash which is cohesive and adheres to the tobacco ash. One or more of such materials as water-soluble borates, tungstates, sulfates and phosphates, such as guanlyurea phosphate have to be added to the filled paper before it leaves the machine, for this purpose. Obviously the more extraneous chemical substances required to be added to the cigarette paper to make it acceptable as wrapper for the tobacco, and the greater the variation in structure of the substances, the more risk incurred that, on smoking of the cigarette, physiologically harmful tars and volatile products will be produced.

Another known disadvantage of the chalk-filled paper is that it is relatively weak when wet. This appears when the cigarette is smoked and the saliva in the smoker's mouth wets the paper, the wet portion tending to pull away from the remaining dry portion and adhere to the smoker's lips. Sometimes the cigarette paper disintegrates in the smoker's mouth.

Further, while it has been proposed to use gum dextran-aldehydes to obtain viscosities which are comparable to gum tragacanth, such aldehyde-type gummy dextrans

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are not suitable for cigarette paper manufacture because they are sticky and give a disagreeable taste.

In order to improve the wet strength of the chalk-filled paper, water-resistant materials, such as urea-formaldehyde resin precondensates, have been incorporated in the partially dry paper together with an acid to catalyze insolubilization of the resin during drying or on subsequent heat-treatment of the paper.

This need to resort to resins also affords the opportunity for the production of harmful or at any rate undesirable combustion products during smoking of the cigarette.

The object of this invention is to provide improved cigarette paper having the desired ashing characteristics, opacity and wet strength and comprising a wholly organic filler.

Another object is to provide cigarette paper that does not require inclusion or after-treatment with chemicals other than the organic filler for imparting the desired ashing characteristics, resistance to wetting, and opacity.

These and other objects are accomplished by providing a cigarette paper the filler of which consists of water-insoluble dextran.

The dextrans are high molecular weight polysaccharides made up of anhydroglucopyranosidic units and characterized in that the units are joined by molecular structural repeating linkages of which at least 50%, and usually a higher proportion, are 1,6 linkages, and obtained by the action of microorganisms such as those of the *Leuconostoc mesenteroides* and *L. dextranicum* types on sucrose. The ratio of 1,6 to non-1,6 linkages, which influences the physical properties of the dextran, depends on the particular microorganism (or enzyme thereof) used to effect the biosynthesis. Microorganisms which convert sucrose to a dextran that is water-insoluble include those bearing the following NRRL (Northern Regional Research Laboratory) designations: *Leuconostoc mesenteroides* B-523, B-1118, B-1120, B-1139, and B-1144.

The procedure is to inoculate a suitable aqueous sucrose-bearing nutrient medium with a culture of the microorganism, or the enzyme filtered from the culture, incubate the mass until the dextran is produced in maximum yield, and then separate the dextran from the fermentate, and purify it, to eliminate impurities which are undesirable for the reason aforementioned.

Preferably the bacteria-free dextran used has a molecular weight between 1×10^6 and 5×10^6 . This high molecular weight dextran is substantially insoluble in water, and is distinguished from the lower molecular weight dextrans which are water-soluble. To decrease the bacteria count the dextran may be irradiated under 2900 A. ultra-violet rays for 30 minutes.

These water-insoluble dextrans are soluble in aqueous alkaline solution such as 4% to 6% aqueous sodium hydroxide and may thus be readily incorporated into the paper pulp in the form of such solutions.

In addition to the pulp suspension, the alkaline solution of the dextran is diluted to the extent that the dextran is thrown out of solution and tends to precipitate or be absorbed on the fibers to serve, when the suspension is laid down, as both binder for the fibers and filling or loading material for the paper. The dextran may be used in an amount such that it constitutes about 10 to 30% based upon the total weight of the finished paper. The water in which the cellulose fibers and dextran are suspended may be acidified, for example it may be a 1% to 3% hydrochloric acid solution to assist in precipitating the dextran onto the surfaces of the cellulose fibers.

In producing the dextran-filled paper, an aqueous alkaline solution of the water-insoluble dextran is added to

the pulp suspension in the paper machine chest or beater, or it may be introduced in the stock line between the beater and the headbox. The furnish, in which the aqueous alkaline dextran solution is added is neutral or slightly alkaline (any acid present initially being neutralized by the alkali), as is the paper formed from the furnish.

On running the pulp-dextran furnish over the paper machine in the conventional manner, a paper is obtained which is opaque, and more resistant to wetting than when other fillers, as aforementioned, are used, and which has acceptable ashing characteristics. The fillers must not contain any extraneous chemical substance other than the organic dextran binder with or without additional inerts to prevent the possibility of a large number of complex undesirable or physiologically harmful combustion products being formed during burning of the tobacco mixture of the cigarette.

The cellulose fibers from which the pulp suspension is prepared may be obtained from any source but in general flax pulp is used, following the conventional practice.

The following example is illustrative of a specific embodiment of the invention, it being understood that the example is not limitative.

Example I

To a paper machine chest containing refined and beaten flax pulp at a consistency of about 2.5% there is added an amount of a solution of *L.m.* B-523 (1,6 to non-1,6 linkage ratio 3.2:1.0) dextran in 6% sodium hydroxide solution to provide about 10% by weight dextran as binder and filler in the finished paper. The dextran used is high purity water-insoluble dextran having an average molecular weight of 5×10^6 . The pulp-dextran furnish is run over the paper machine in conventional manner, in the course of which it is dried, to obtain an opaque dextran-filled sheet that is very suitable for use as cigarette paper, without additional chemical treatment, or the incorporation in the stock or application to the paper of inorganic fillers or modifiers.

Example II

In this instance cigarette paper is made as described in Example I using irradiated water-insoluble dextran having an average molecular weight of 2×10^6 and low bacteria count. A cigarette paper of improved taste and slow burning characteristics is provided.

In the drawing forming a part of this application and illustrating the utilization of the invention:

FIGURE 1 illustrates a cigarette paper in perspective;

FIGURE 2 shows a cigarette having a wrapper formed of the paper made in accordance with this invention;

FIGURE 3 is an enlarged view of a fragmentary section taken from the corner of the cigarette paper as shown in FIGURE 1 and illustrating the dextran particles dispersed throughout the cellulose fibers and forming a binder and filler.

Cigarettes rolled in the paper prepared as described in the examples burn to leave fine discontinuous flakes of paper ash which closely adhere to the tobacco ash, and present relatively little if any health hazard from the standpoint of toxic or irritant substances formed as a result of combustion or heat-breakdown of the dextran binder and filler during smoking of the cigarette.

Instead of using the *L.m.* B-523 dextran shown in the example, other water-insoluble or substantially water-insoluble dextrans may be used. The dextrans of low 1,6 to non-1,6 linkages ratio (1.9: to 10:1) and which exhibit the most pronounced water-insolubility may be preferred for use as filler and binder for the paper.

Since the dextran binder and filler is water-insoluble or

substantially so, the paper filled or loaded therewith exhibits less tendency to disintegrate on wetting than does paper filled with chalk. This resistance to disintegration on wetting also results from the fact that while the dextran filler is not readily soluble in water it is hydrophilic and capable of slowly absorbing moisture and holding the absorbed moisture without excessive swelling or dissolution.

Paper produced in accordance with the invention and which comprises paper-making cellulose fibers and dextran as filler and binding agent may be used for other purposes than as wrapper for cigarettes and may be used for any purpose for which an opaque, substantially neutral paper capable of absorbing moisture without disintegration because of the presence of the water-insoluble but generally hydrophilic dextran associated therewith is required or desirable.

The pulp-dextran filler furnish may be formed into paper products other than sheets, such as tubes and molded articles generally, as will be understood.

Fibers from various sources may be used in preparing the beaten and refined pulp. Also, the cellulose fibers may be mixed with 5% to 90% of fibers of other types such as artificial or synthetic fibers having smooth surfaces and which do not normally fibrillate on beating. The dextran is particularly valuable as binder for the non-fibrillating fibers. For some purposes, fibers of the paper may all be of the artificial or synthetic non-fibrillating type and may have the usual paper-making length or be shorter or longer than normal paper-making fibers.

Since in practicing the invention, some changes and variations may be made in the details specifically exemplified, without departing from the spirit and scope thereof, it is to be understood that the invention is not intended to be limited except as defined in the appended claims.

What is claimed is:

1. A method of making a fibrous combustible cigarette paper which consists in preparing an aqueous pulp suspension of cellulose fibers, adding thereto an aqueous alkaline solution of water-insoluble dextran which has been irradiated with 2900 Angstrom ultraviolet rays for approximately 30 minutes, the solution containing 4%-6% alkali, the dilution of the dextran solution by the water of the pulp suspension causing the dextran to precipitate onto the surfaces of the cellulose fibers so as to be adsorbed thereto, said dextran having a molecular weight between 1×10^6 and 5×10^6 , shaping the resultant suspension with removal of water to obtain a sheet of fibers bonded by the dextran, and drying the shaped sheet to provide a cigarette paper containing 10% to 30% by weight of dextran.

2. A combustible cigarette paper consisting of cellulose fibers bonded together by a water-insoluble dextran of molecular weight between 1×10^6 and 5×10^6 , the dextran having been irradiated with 2900 Angstrom ultraviolet rays for approximately 30 minutes, and constituting 10% to 30% by weight of the paper.

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