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CIGARETTE ELEMENT FOR TOBACCO SMOKE

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This invention relates to purification of tobacco smoke, and more particularly relates to a filter tip cigarette having a filter element consisting, at least in part, of absorbent collagen material.

The smoke produced by combustion of the ordinary cigarette paper is acid in reaction although the smoke or tobacco may be alkaline due to nitrogenous substances therein. A tobacco smoke filter, therefore, should remove harmful ingredients from the smoke whether acidic or alkaline in character.

Tobacco smoke is made up of a mixture of harmful and irritating gaseous compounds and finely divided solids. The tobacco smoke comprises tar, phenol, methanol, acetic acid, acrolein, carbon dioxide and water vapor.

An object of this invention is to provide a filter element for smoke resulting from the combustion of tobacco which will remove a greater proportion of the harmful and irritating impurities than material heretofore known and particularly a greater proportion of the so-called "tars."

Yet another object is to provide a filter material which is amphoteric in nature having the capacity to bind both acids and bases.

Still another object is to provide a filter element which removes all or a major portion of the distasteful and injurious ingredients in tobacco smoke without adversely affecting the characteristic flavor of the smoke.

A further object is to provide a filter material which is non-toxic and harmless if taken into the mouth.

It has now been found that substantially pure collagen may be employed effectively in the treatment of tobacco smoke, and that filter elements of collagen exhibit a great affinity for tobacco, oils, and tars which are believed by many investigators to be detrimental to the health and well being of the smoker.

Collagen is a naturally occurring protein that is widely distributed in connective tissue and may be recovered therefrom in a substantially pure form by mechanical and chemical means. It is known, for example, that collagen will swell in dilute aqueous acid solutions and treatment with dilute acids has been used to separate collagen from associated proteins such as reticulin and elastin that do not swell.

The substantially pure swollen collagen fibers may then be precipitated from the acid dispersion with a dehydrating agent such as acetone. Collagen fibers obtained in this manner have a low density and a large surface area. The loose random structure of such fibers make them well adapted for use in tobacco filters. Such fibers have an isoelectric point near pH 7. The acid binding capacity is about 0.85 to 0.90 milligram equivalents of acid (HCl) per gram of collagen. The maximum base binding capacity is about 0.4 to 0.5 milligram equivalents per gram of collagen.

Alternatively, the dispersions of collagen fibers described above may be forcibly extruded into an acetone dehydrating bath forming strands of controlled diameter and surface area. Such strands may be crimped and

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chopped into rovings of about ½ inch to 2 inches. While the crimping step is not necessary, the crimped strands result in a more open filter structure having good "draw" and less tendency to channel. The collagen, whether in the form of loose fibers or extruded strands may be mixed in various proportions with other known tobacco smoke filter agents such as rayon staple fiber, cotton fiber and paper.

For a fuller understanding of the invention, reference should be made to the following examples which are given as specific illustrations. It should be understood, however, that the invention is not limited to the specific details set forth in the illustrations.

EXAMPLE I

Preparation of collagen fibers

Tendon from cattle is trimmed to remove muscle, skin and sheath. The cleaned tendon is washed and then frozen to facilitate slicing. The tendon is sliced to a thickness of about 25 mils and is swollen in 20 volumes of 2.5% acetic acid. The slices may be dispersed in the acid solution with a Lightning mixer and dispersion may be facilitated by forcing the mixture through a perforated plate.

The dispersion is diluted with 10 volumes of distilled water and filtered through a Buchner funnel with suction. No filter paper is used in the Buchner funnel during this step. The filtered dispersion is next centrifuged at 25,000 r.p.m. and the supernatant is filtered through cotton gauze filters of increasing fineness. Collagen fibers are precipitated from this filtrate by adjusting the pH to 7.0 with ammonium hydroxide.

The precipitate of collagen fibers so obtained are washed with distilled water and then redispersed in 0.6% malonic acid to form a dispersion containing about 1.6% collagen. This collagen dispersion may be forced through a spinnerette into a dehydrating bath to form collagen strands, or alternatively, long white collagen fibers may be precipitated from the dispersion by adjusting the pH to 7.0 with ammonium hydroxide.

EXAMPLE II

Preparation of the filter

Loose dried collagen fibers prepared according to Example I above are rolled into plugs 2¾ inches in length using a "Model" cigarette rolling kit. The rolled plugs are then sliced into individual filters—five from a plug—each filter element having a length of about ½ inch.

EXAMPLE III

Preparation of the cigarette

The filter plugs prepared in Example II above are rolled, along with a standard grade of tobacco, into a cigarette using the "Model" kit referred to in Example II above. Control cigarettes are prepared using the same tobacco but eliminating the filter element.

EXAMPLE IV

Testing

The effectiveness of the filters is investigated by the use of a modified smoking apparatus. This smoking apparatus consists of a suction flask fitted with a Buchner funnel upon which is placed an open bottomed, enclosed glass chamber. A glass T tube is fitted to the top of the chamber which acts as a smoke delivery tube from the cigarette inserted in the end of the tube. Vacuum is applied to the apparatus and the smoke from the cigarette is drawn into the glass chamber and then through a weighed disk of No. 3 filter paper placed in the Buchner funnel. Vacuum is maintained constant for both the experimental and control tests to assure approximately

the same passage of smoke through each cigarette filter and the apparatus. After each cigarette is completely smoked, the No. 3 filter disks are reweighed to determine the percentage of tar retention. From this value, the approximate percent effectiveness of the cigarette filter may be determined. By use of the same smoking apparatus, these tests may be compared with a control cigarette of the same tobacco but having no filter and with a commercial brand of filter cigarette (Brand A). The results appear in the following table:

TABLE I

Filter	Wt. #3 Filter Disk and Tar, gms.	Tare Wt. #3 Disk, gms.	Net Wt. Tar, gms.
1. Collagen.....	1.5106	1.4539	0.0567
2. Collagen.....	1.5282	1.4776	0.0506
3. Collagen.....	1.5782	1.5418	0.0364
4. Collagen.....	1.7454	1.7110	0.0344
5. Collagen.....	1.6064	1.5558	0.0506
6. Collagen.....	1.6198	1.5512	0.0686
7. Collagen.....	1.6187	1.5496	0.0691
8. Collagen.....	1.5231	1.4752	0.0479
9. Collagen.....	1.5483	1.4959	0.0524
10. Collagen.....	1.5626	1.5264	0.0362
			0.5029
			Ave.=0.0503
11. Brand A.....	1.6439	1.5798	0.0641
12. Brand A.....	1.6268	1.5695	0.0573
13. Brand A.....	1.5798	1.5176	0.0622
14. Brand A.....	1.8086	1.7415	0.0671
15. Brand A.....	1.8226	1.7593	0.0633
			0.3140
			Ave.=0.0628
16. Control.....	1.8621	1.7838	0.0783
17. Control.....	1.8153	1.7432	0.0721
18. Control.....	1.8479	1.7406	0.1073
19. Control.....	1.7744	1.7119	0.0625
20. Control.....	1.7862	1.7279	0.0583
			0.3785
			Ave.=0.0757

EXAMPLE V

The collagen dispersion described in Example I is extruded through a stationary spinnerette into a flowing acetone bath containing about 150 milligrams of ammonium per liter. The extruded strand is dried, cut into sections about 2 inches long, and given a slight crimp by rolling between the hands. A comparative test using

the smoke apparatus described in Example IV above gives the following results:

TABLE II

Unfiltered control	108.0 mgs. tar retained by
Filtered control	filter paper.
brand A	62.2 mgs. tar retained by
	filter paper.
Collagen filter	34.4 mgs. tar retained by
	filter paper.

Although this invention is particularly applicable to the use of collagen fibers in cigarette filters, it is not limited thereto for it is also applicable to the treatment of tobacco smoke resulting from the combustion of tobacco in pipes and other devices.

What is claimed is:

1. The improved method of treating tobacco smoke resulting from the combustion of tobacco during the act of smoking, comprising bringing the tobacco smoke between the burning tobacco and the mouth of the smoker, into contact with collagen whereby noxious substances of the tobacco smoke are selectively absorbed.

2. The improved method of treating tobacco smoke resulting from the combustion of tobacco during the act of smoking, comprising bringing the tobacco smoke between the burning tobacco and the mouth of the smoker, into contact with collagen fibers whereby noxious substances of the tobacco smoke are selectively absorbed.

3. A filter cigarette having a filter positioned therein to require substantially all smoke that may be drawn from a lighted tip thereof to the opposite tip thereof to pass therethrough, said filter containing substantially pure collagen.

4. A filter tip cigarette having a filter element consisting at least in part of substantially pure collagen.

5. A filter tip cigarette having a filter element consisting at least in part of substantially pure collagen fibers.

6. In a cigarette having a filter, the improvement in the filter which comprises the presence therein of an effective amount of collagen.

7. In a cigarette having a filter, the improvement in the filter which comprises the presence therein of an effective amount of collagen fibers.

No references cited.