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TOBACCO SMOKE FILTERING

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Several propositions have been made to remove nicotine and other harmful substances from the smoke of tobacco so that this alkaloid and similar substances, and tarry substances, would not harm the smoker. Paper, or cellulose in spongy form has been proposed; furthermore, substances with highly developed internal surface, like silica gel, aluminum gel, and activated carbon. Tobacco itself has found wide use as an adsorptive for these products which are formed by dry distillation and combustion of tobacco. It has been proposed to use regenerated cellulose in form of filaments and of spun cellulose acetate and cellulose formate. The spun cellulose acetate is acetone soluble, incompletely substituted cellulose acetate with a certain amount of free hydroxyl groups which make this material rather strongly hydrophil. Cellulose formate never has been produced until now as a highly substituted cellulose ester which has enough stability.

An object of this invention is providing a new tobacco filter material absorbing a larger quantity of nicotine and harmful tobacco smoke ingredients than the filters known to the present art.

A further object is providing a filter that will preserve its adsorptive quality even after repeated use.

Still another object is a filtering material that does not absorb moisture from tobacco smoke, thereby preserving the quality of the smoke and avoiding irritation of the throat. Those fibrous, nearly or wholly substituted cellulose esters and cellulose ethers absorb nicotine and other dangerous substances very easily.

Another object is providing a filtering material softening the taste of harsh tobacco, thereby allowing the use of inexpensive tobacco grades in a high quality smoke.

Other objects of this invention will readily appear from the specification.

The present invention discloses the use as a tobacco filter of fibrous cellulose esters preferably with completely esterified hydroxyl groups, for instance fibrous cellulose triacetates, or mixed fibrous esters like cellulose acetopropionate; furthermore, ethers like methyl and ethyl cellulose. These substances are used to bind in an excellent way the harmful substances like nicotine. The harmful substances are entrained with the smoke, not in form of vapors, but in form of fine droplets. The boiling point of nicotine is rather high with 247° C. (477° F.). The vaporized nicotine, together with the gaseous

tar constituents which also possess high boiling points, condenses quickly in the zone following the combustion zone of tobacco. An extremely fine dispersion of condensed droplets of nicotine, liquid tarry material, and condensed water droplets result, which enter with gases containing carbon dioxide, carbon monoxide, air constituents, etc. the body of the smoker.

Cellulose esters and ethers absorb nicotine and other dangerous substances very easily.

Molecular compounds or absorption compounds are formed. Due to their hydrophobic nature those fibrous triesters of cellulose prevent the further transport of the dangerous products of distillation and decomposition of tobacco with the smoke and, therefore, protect the smoker.

These hydrophobe cellulose esters and ethers do not absorb any water, or very little. Therefore, they do not dry the smoke and the throat of the smoker.

The nearly or completely substituted cellulose esters and ethers, due to their hydrophobic nature, absorb very little of the water. They show different behavior than with the incomplete substituted esters, for instance acetone soluble cellulose acetate. A completely substituted cellulose triacetate in contact with an atmosphere completely saturated with water vapors absorbs .5% of water. Spun acetone soluble acetate under the same conditions absorbs 8 to 10% of water. This difference in the behavior between acetone insoluble fibrous cellulose triacetate and spun acetone soluble cellulose acetate is responsible for the very important fact that the fibrous triacetate does not dry the smoke and the throat of the smoker, and that acetone soluble spun cellulose acetate, as well as regenerated cellulose in form of spun viscous threads, takes up a large amount of water from the smoke. Therefore, the smoke is dry and affects the throat of the smoker in a very unfavorable way.

The cellulose smoke filters known to the prior art are unsatisfactory because the presence of OH groups makes them hydrophil and causes them to dry out the smoke. In the material disclosed in the present invention, the OH groups are nearly or completely replaced by ester and ether groups; consequently, the material is hydrophobe, while, at the same time, possessing a high affinity for nicotine and tarry substances.

These nearly or completely substituted cellulose esters and ethers are used in fibrous form from which all different other geometric forms, for instance woven filaments, or pressed foils can be made. Those fibrous, practically completely

substituted cellulose esters may be combined with cellulose ethers.

These fibrous, nearly or completely substituted cellulose esters and cellulose ethers can be used so that at the end of each cigar or cigarette they may be used alone or in combination with the aforementioned substances. The cellulose esters and ethers can be filled in a tube so that the same filling can be used for a greater number of cigars, cigarettes, and pipe fillings.

EXAMPLES

It has been found that these fibrous, nearly or completely substituted cellulose esters and cellulose ethers give a remarkable effect concerning the removal of the poisonous alkaloids. The following table shows the results of comparative experiments. For these experiments fibrous cellulose triacetate with 62.2% bound acetic acid (completely substituted cellulose triacetate shows 62.5% bound acetic acid) has been used.

1. Very quick smoking without filter	mg--	61.6
2. Rapid smoking without filter	mg--	30
3. Rapid smoking with one cigarette 7 cm. long as filter (1 g. tobacco for 6 cigarettes)	mg--	16
4. Rapid smoking with fibrous cellulose triacetate filter 7 cm. long, 1 g. cellulose acetate for 6 cigarettes	mg--	4.8-2
5. Rapid smoking with individual filter of fibrous cellulose triacetate 1.5 cm. long, 100 mg. cellulose acetate per cigarette	mg--	6.5
6. Slow, normal smoking with one cigarette 7 cm. long as filter for 6 cigarettes	mg--	7.8
7. Slow smoking with 1½ cm. (100 mg.) fibrous cellulose triacetate chips per one cigarette	mg--	3.4
Total amount of bases calculated as nicotine adsorbed by the filter layer		
		Percent
Experiment 3 with tobacco		53.3
Experiment 4 with fibrous cellulose triacetate		82.7-92.6
Experiment 5 with fibrous cellulose triacetate		76.4
Experiment 6 with tobacco		70.9
Experiment 7 with fibrous cellulose triacetate		87.0

The comparison of Experiments 6 and 7 shows that a small layer of 1.5 cm. of fibrous cellulose triacetate absorbs the alkaloid bases much better (87%) than a 7 cm. long cigarette which absorbs 70.9% of the bases, calculated as nicotine.

Comparative experiments were carried out, furthermore, using on one hand 100 mg. of fibrous completely substituted cellulose triacetate, and, on the other hand, the same weight of spun acetone soluble cellulose acetate with 53% bound acetic acid. Within 5 seconds 75 cu. cm. of air were sent through the burning cigarettes. After 55

seconds the same amount of air in the same time was sent through the system. Two cigarettes were burned in each experiment. Then the cellulose acetates were removed from the glass tube, extracted carefully with diluted sulfuric acid to eliminate all bases. Then those bases were distilled over (after having alkalized the acid liquid) and titrated with 1/10 normal sulfuric acid. It was found that the cellulose triacetate filter contained, as is described above, most of the tarry substances and the bases calculated as nicotine. The spun acetone soluble cellulose acetate with parallelly orientated filaments absorbed only very little of the bases and of the tarry substances. On the other hand, the amount of condensed water from tobacco smoke was smaller with the spun acetone soluble acetate than with the fibrous, non-spun and non-parallel, orientated cellulose triacetate.

Modifications of the foregoing disclosure within the scope of this invention will be readily apparent to those skilled in the art. The scope of this invention, therefore, is to be limited by the claims only.

I claim:

1. As a new article of manufacture, a tobacco smoke filtering material comprising a cellulose derivative of the group comprising fibrous, nearly or wholly esterified cellulose ester and cellulose ether.
2. As a new article of manufacture, a tobacco smoke filtering material comprising a fibrous, nearly or wholly esterified cellulose ester.
3. As a new article of manufacture, a tobacco smoke filtering material comprising a cellulose ether.
4. As a new article of manufacture, a tobacco smoke filtering material comprising a fibrous, nearly or wholly esterified mixed cellulose ester.
5. As a new article of manufacture, a tobacco smoke filtering material comprising fibrous cellulose triacetate.
6. As a new article of manufacture, a tobacco smoke filtering material comprising fibrous methyl cellulose.
7. As a new article of manufacture, a tobacco smoke filtering material comprising a mixture of a fibrous cellulose ester and a cellulose ether.
8. The method of purifying tobacco smoke comprising passing said smoke through a cellulose derivative of the group comprising fibrous, nearly or wholly substituted cellulose ester and cellulose ether.
9. The method of purifying tobacco smoke comprising passing said smoke through a fibrous, nearly or wholly substituted cellulose ester.
10. The method of purifying tobacco smoke comprising passing said smoke through a cellulose ether.
11. The method of purifying tobacco smoke comprising passing said smoke through a fibrous, nearly or wholly substituted mixed cellulose ester.

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