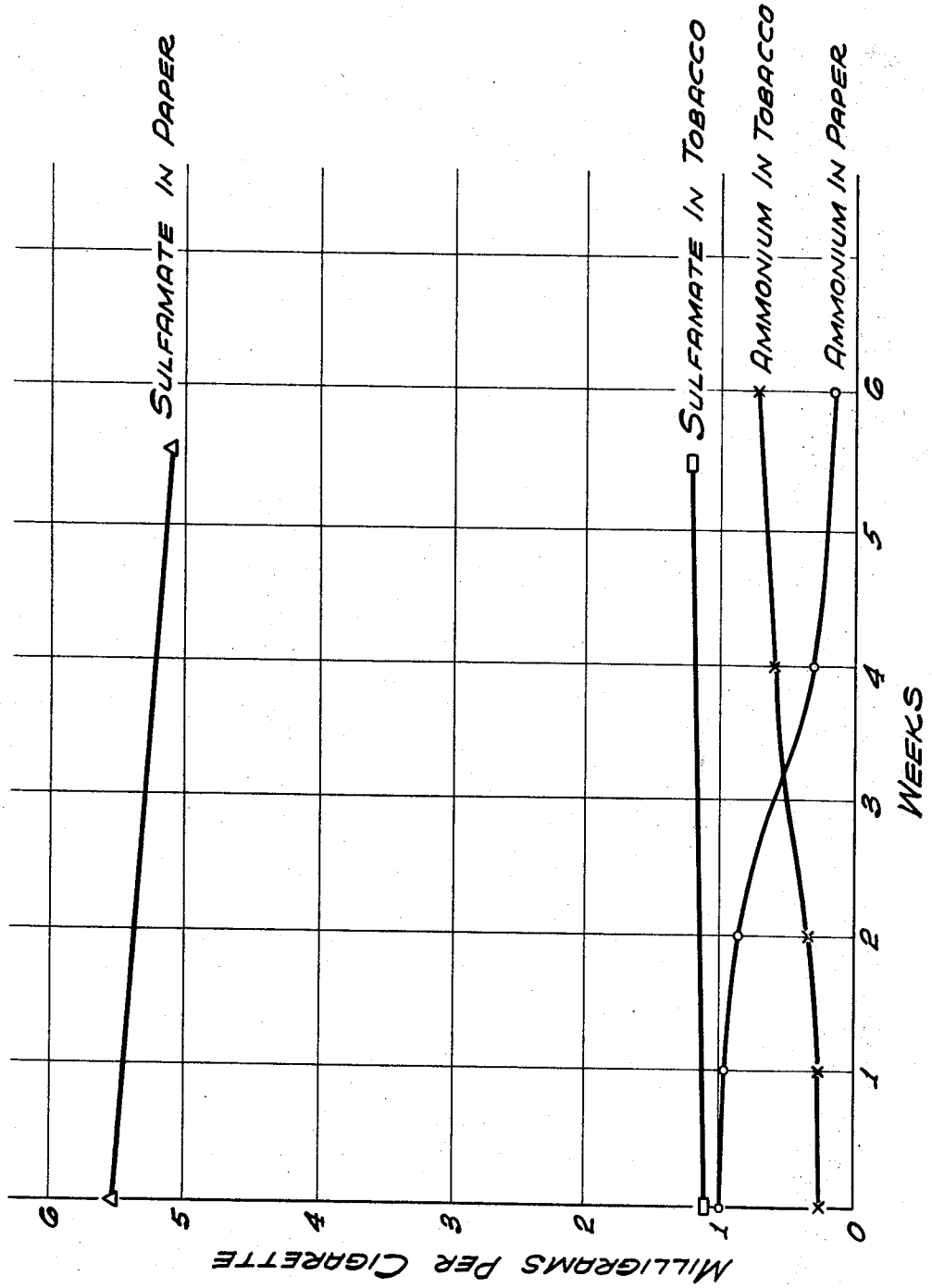
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METHOD OF TREATING A SMOKING COMPOSITION TO REDUCE UNDESIRABLE PRODUCTS THEREFROM

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INVENTOR.
IRVING MICHELSON
By Mikatta, Glenny, Poms & Smith
ATTORNEYS.

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METHOD OF TREATING A SMOKING COMPOSITION TO REDUCE UNDESIRABLE PRODUCTS THEREFROM

Irving Michelson, New Rochelle, N.Y., assignor to American Safety Equipment Corporation, New York, N.Y., a corporation of New York

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ABSTRACT OF THE DISCLOSURE

A method of treating a smoking composition composed of cured tobacco wrapped in paper is disclosed, said composition containing from 0.1% to 1.0%, by weight, of ammonium sulfamate, at least 50% of the ammonium ion of the ammonium sulfamate being in the tobacco and at least 70% of the sulfamate ion of the ammnoium sulfamate being in the paper, whereby the smoke produced from said tobacco composition has a significantly reduced amount of components which cause tumors on the skin of mice and other biological damage, and the toxicity of tars capable of being condensed from said smoke is significantly reduced while, at the same time, the taste of said smoke, the burning of said tobacco composition, and the appearance of the ash resulting from the burning of said composition is not adversely affected. The method for producing such a composition includes adding ammonium sulfamate to the paper and allowing the ammonium sulfamate to remain on the paper until a significant amount of the ammonium ion has migrated to the tobacco. Preferably, the ammonium sulfamate is added to the paper in the form of a solution (e.g. an aqueous solution).

RELATED APPLICATIONS

This application is a continuation-in-part of my copending application Ser. No. 678,184, filed Oct. 26, 1967.

BACKGROUND OF THE INVENTION

In recent years, the concern for the health of tobacco smokers, particularly cigarette smokers, has increased. The reason for this concern is because of the evidence gathered by scientists around the world that smoking definitely endangers the health of the smoker to a greater or lesser extent, depending upon the amount of the smoke, the extent to which it is inhaled, and the person's susceptibility to being injured by tobacco smoke. For example, it is definitely established that cigarette smokers are more apt to develop lung cancer, bronchitis, emphysema, and suffer other biological damage than non-smokers. Figures from Smoking and Health, report of the Advisory Committee to the Surgeon General, indicate that heavy smokers are fifteen to twenty-five times more susceptible to the risk of lung cancer than that of non-smokers and that light smokers' chances of developing lung cancer is five to ten times that of non-smokers. In addition, the mortality of smokers because of bronchitis and emphysema is five to eight times that of non-smokers.

Because of the foregoing and other evidence that smoking is detrimental to the health and well-being of people of all ages, the federal government of the United States has required all cigarette manufacturers to place on cigarette packages the warning that "Cigarette Smoking May Be Hazardous to Your Health." In spite of this warning, the consumption of cigarettes and other tobacco has actually increased from the prior years. It is thus very apparent that people who are addicted to cigarette smoking are very unlikely to quit merely because they run the risk of having their health seriously impaired.

It is thus a desideratum in the art to produce a tobacco composition, the smoke of which has a reduced amount of components which are apt to cause biological damage to the smoker. It is therefore not surprising that in the past decade the prior art has endeavored to produce a safe tobacco, particularly safe cigarettes. For the most part, the prior art attempts have centered around the idea of filtering out or screening the tars produced during the smoking of the tobacco. However, this has not been entirely satisfactory because inter alia it appears that the materials produced in the smoking of the cigarette which cause biological damage cannot be filtered out selectively and therefore the filtered smoke still contains substantially the same proportions of deleterious material as the unfiltered smoke.

There have also been attempts to produce safer tobacco for smoking by adding various components which reduce the amount of certain compounds contained in tobacco smoke which are believed to be carcinogens. For example, see Alvord et al., the British Journal of Cancer, 1956, vol. X, pages 498 through 503, and Bentley et al., Analyst, October 1960, vol. 85, pages 727 through 730. In addition, attempts have been made to improve the safety of cigarettes by adding a material to the cigarette paper which is said to reduce the amount of 3,4-benzopyrene contained in the smoke produced by the cigarette paper. See U.S. Pat. 2,859,753.

Both of the articles referred to above report that the addition of a certain amount of ammonium sulfamate to tobacco reduces the amount of 3,4-benzopyrene in the tar recovered from the smoke. The articles disagree as to the precise reduction in the content of 3,4-benzopyrene in the tar of the smoke. Whether reducing the amount of this compound does in fact render the cigarette smoke safer is open to question. Nevertheless, whether cigarettes are safer because of a reduced benzopyrene content or not, the fact remains that the addition of about 2% or more of ammonium sulfamate to tobacco adversely affects the various properties of the tobacco which make it desirable for smoking. For example, ammonium sulfamate is a well-known flameproofing agent for textiles and paper.

SUMMARY OF THE INVENTION

The present invention is based upon the surprising discovery that ammonium sulfamate added in a certain critical manner to smoking compositions composed of cured tobacco wrapped in paper significantly and materially reduces the amount of components in tobacco smoke which cause tumors on the skin of mice but does not alter or affect the taste of the tobacco smoke, the burning properties of the tobacco and paper or the appearance of the ash of said tobacco and paper. Moreover, the addition of ammonium sulfamate to smoking compositions in a manner which will be described hereinafter, reduces the amount of components in smoke produced from such compositions which have an adverse effect on the pulmonary functions in test animals (guinea pigs) and damage sebaceous glands in mice.

The above advantages obtained by the compositions produced by the method of this invention are the result of adding ammonium sulfamate to tobacco compositions in a certain critical manner. In order to achieve the foregoing results, the ammonium sulfamate is applied to a smoking composition composed of tobacco wrapped in paper by contacting the paper with said ammonium sulfamate. Surprisingly, immediately after the ammonium sulfamate is applied, the smoke produced from such a composition has about the same properties as smoke produced

from a smoking composition not containing ammonium sulfamate. However, within a period of one to two weeks, I have discovered that the ammonium ion of the ammonium sulfamate starts to migrate into the tobacco and after a period of about six weeks, about 80% of the ammonium ion has migrated into the tobacco while the majority of the sulfamate ion has remained on the paper. It is only after a significant amount of the ammonium ion has migrated into the tobacco that the smoke produced from such tobacco shows a reduction in components which cause tumors in mice and other biological damage.

I have also discovered, based on tests conducted heretofore, that when the ammonium sulfamate is added directly to tobacco that the reduction in the amount of components causing tumors in mice is not as great as when the ammonium sulfamate is added in accordance with the present invention.

It is thus an object of the present invention to disclose and provide a smoking composition composed of tobacco wrapped in paper, the smoke of which has a significantly reduced amount of components which cause tumors on the skin of mice and harm sebaceous glands on the skin of mice.

Another object of the present invention is to disclose and embody a treated cigarette which, when smoldered, produces a smoke which has substantially the same taste as the smoke produced by a corresponding untreated cigarette.

It is still a further object of the invention to produce a safer cigarette wherein the tobacco of said cigarette contains a significant amount of ammonium ion which is derived from ammonium sulfamate which has been applied to the paper of said cigarette.

Still another object of the invention is to disclose and provide a novel method for producing the said tobacco compositions and treated cigarettes, said method allowing for the production of a smoking composition and a cigarette wherein the tobacco contains over 50% of the ammonium ion derived from ammonium sulfamate which has been added to the paper, said smoking compositions and cigarettes producing less components which cause tumors on the skin of mice as well as reducing the toxicity of tars capable of being condensed from the smoke produced from such smoking compositions and cigarettes.

Still another and further object is to provide a novel method for producing novel tobacco compositions and cigarettes by applying a solution of ammonium sulfamate to the paper of such tobacco compositions and cigarettes by contacting the paper with a solution containing ammonium sulfamate and allowing the thus obtained paper to contact the tobacco for a sufficient length of time to allow at least 50% of the ammonium ion from such ammonium sulfamate to migrate to said tobacco.

BRIEF DESCRIPTION OF THE DRAWING

The drawing is a graph showing the migration of ammonium ion from the paper to the tobacco.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The smoking compositions produced by the method of this invention are produced by adding a certain critical amount of ammonium sulfamate to said compositions in a certain critical manner. The amount of ammonium sulfamate necessary to produce the desirable properties possessed by my tobacco composition is between about 0.1% and 1.0% based on the total amount of tobacco and cigarette paper which comprise my tobacco compositions. Based upon present tests, the presently preferred range of ammonium sulfamate is 0.2% to 0.8% by weight and most preferably, from about 0.2% to 0.5% by weight.

The manner in which the ammonium sulfamate is added to the tobacco compositions produced by the method of this invention is, as noted supra, critical. The ammonium sulfamate is added to the paper and the ammonium sulfamate is allowed to remain on the paper in contact with the tobacco until at least about 50% of the ammonium ion of the ammonium sulfamate is allowed to migrate to the tobacco. This takes place in a period of from two to three weeks, but it is preferred to wait a longer period of time, e.g. six weeks, at which time from 70% to 80% of the ammonium ion is present in the tobacco and only 30% to 20% is present in the paper. At the same time that this is occurring, the majority of the sulfamate ion of the ammonium sulfamate remains on the paper. Precisely why this phenomenon occurs is not, at present, completely understood; however, it is clear from biological tests that this migration must occur in order to produce safer smoking compositions. Moreover, the smoking compositions produced by such a method, i.e. migration of the ammonium ion into the tobacco, produces smoke which is less toxic than smoke in which the ammonium sulfamate is added directly to the tobacco. Here again, precisely why this occurs is, at present, not completely understood.

I have determined that a very convenient way in which to add the ammonium sulfamate to the paper is via an aqueous solution. The precise amount of ammonium sulfamate in the solution is not critical provided that from 0.1% to 1.0% of ammonium sulfamate, based on the total weight of tobacco and paper, is added to the paper. Certain practical considerations however enter into the picture, e.g. the amount of water added to the paper should not be so great as to require special removal steps. Based on experiments, I have determined that a 5% to 50% solution of ammonium sulfamate is convenient and, most preferably, a 5% to 15% solution. When a solution of this concentration is utilized, the amount of ammonium sulfamate present in the cigarette paper and tobacco is within the ranges referred to above.

The ammonium sulfamate solution can be added in any convenient manner, e.g. spraying the solution on the cigarette paper. Because of certain practical considerations in producing a limited amount of cigarettes for testing (about 2 million) in the exemplary embodiment the ammonium sulfamate is added by passing a cigarette through a cylinder of suitable size and diameter which is filled with a sorbent material such as a sponge, the cylinder having an aperture or bore which forms a passage completely through the cylinder as well as the sponge-like material through which the tobacco composition may be inserted without rupturing or tearing the paper. As the tobacco composition is passed through the cylinder, the paper thereon absorbs the ammonium sulfamate solution contained in the sponge-like material. If conventional cigarettes are utilized, a passageway or bore in the cylinder and absorbent material will have a diameter on the order of $11/32$ of an inch. The speed at which the cigarette is passed through the bore or aperture depends upon the particular concentration which is desired on the cigarette paper and also the concentration of the solution in the sorbent material. The cigarette can either be pushed manually through the device or in the alternative, can be pushed mechanically through the device at a predetermined speed as shown, e.g. U.S. Pat. 239,780. No matter how the ammonium sulfamate is applied to the cigarette paper, the paper should not be adversely affected.

Inasmuch as water does not color the paper or otherwise adversely affect the paper and also because water is inexpensive, an aqueous solution of ammonium sulfamate is preferred. However, any other liquid in which ammonium sulfamate can be dispersed or dissolved, and which does not adversely affect the smoking properties of the cigarette, can be utilized.

In the exemplary embodiment the ammonium sulfamate is added to the cigarette paper while it is wrapped around the tobacco. In commercial production the ammonium sulfamate is added to the paper prior to being wrapped around the tobacco. This can be done in the same way, and at the same time, indeed in the same

aqueous medium, as other soluble components are added to cigarette paper for controlling burning characteristics and color of the ash of cigarette paper.

To produce a cigarette containing between 0.3 and 0.5%, by weight, of ammonium sulfamate, a water solution containing between 5% and 15% of ammonium sulfamate is prepared by dissolving the ammonium sulfamate in the requisite amount of water. The aqueous solution thus prepared is then added to a sorbent pad contained in the cylinder described supra and the cigarette is passed therethrough. Depending upon the speed of the cigarette, between 0.3% and 0.5% of ammonium sulfamate is added to the cigarette.

A number of the cigarettes thus prepared were tested to determine the amount of sulfamate ion and the amount of ammonium ion in both the tobacco and the paper. As shown in the drawing, the amount of sulfamate ion in the paper is relatively constant whereas the ammonium ion in the paper starts to migrate to the tobacco after about two weeks and, after about six weeks, there is between 70% to 80% of the ammonium ion in the tobacco.

As noted hereinabove, the smoke of a cigarette treated with ammonium sulfamate in which the ammonium ion has not had time to migrate to the tobacco, does not have a reduction in components which cause biological damage to mice and other test animals. This is demonstrated by comprising the effect of smoke from untreated cigarettes, cigarettes which had ammonium sulfamate applied to them and were smoked after only ten minutes, and cigarettes which had ammonium sulfamate applied to them and were smoked a month after treatment. All three types of cigarettes were made from the same batch of a standard American blend of cigarette tobacco, and the same batch of cigarette paper, and were made on the same machine. The only difference between the three types of cigarettes was the ammonium sulfamate treatment. The untreated cigarettes provide a control against which to compare the treated cigarettes.

A 15% ammonium sulfamate solution was applied to to the paper of two groups of cigarettes. Both types of cigarettes contain approximately 4 to 6 mg. of the ammonium sulfamate per cigarette. One batch of cigarettes was smoked ten minutes after the ammonium sulfamate was applied and the other batch of cigarettes was allowed to remain at 60–65° F. and approximately 60% relative humidity for thirty days. The cigarettes were smoked in a manifold-type smoking machine, one two-second puff per minute, with the suction pressure equal to that which delivers a 17.5 ml./sec. in sample cigarettes of the respective groups. The smoke was condened in two-liter collection flasks and immersed in a dry ice-methanol mixlection flasks and immersed in a Dry Ice-methanol mixture. The condensate is removed from the flask with acetone. The acetone suspension is concentrated in a flash evaporator until all the acetone is driven off. The remaining "crude tar" is treated with an equal volume of acetone and then eight volumes of heptane are added slowly with vigorous shaking to provide a two phase system. The upper phase is concentrated in a flash evaporator until all the heptane is apparently driven off. It has been shown that this fraction of the tars contained all of the carcinogenic activity that is found in crude cigarette tar.

Female ICR Swiss mice at 60–70 days of age were used in the test for sebaceous gland suppression activity. The mice were divided into three groups, each group having three to five mice. The mice is each group were shaded and "painted" with the cigarette tars two times daily for three consecutive days. The animals were killed six days after the first application of test solution and the skins processed to stain the sebaceous glands in whole section and examined microscopically to determine the extent of damage or complete destruction of the sebaceous gland. The criterion used was that any distant remnant of a gland whe scored as a gland present. The results of such tests are shown in the following Table I.

TABLE I

Group	Equiv. crude tar. conc. (gm./cc.)	Av. percent glands remaining	No. of mice tested
A	.2	43	14
B	.2	30	9
C	.3	65	10

The group labeled A were the untreated cigarettes, the group labeled B were the cigarettes which were smoked ten minutes after application of ammonium sulfamate, and the group labeled C were the cigarettes in which the ammonium sulfamate was allowed to remain on the cigarette paper for a period of about a month, in which time the ammonium ion had migrated to the tobacco.

As is apparent from the foregoing table, the smoke of cigarettes in which the ammonium sulfamate has been allowed to remain on the paper for only ten minutes has little or no effect in preventing destruction of sebaceous glands in mice.

Similarly, the addition of ammonium sulfamate directly to the tobacco does not have as great an effect in preventing tumors in mice as does the smoke from cigarettes wherein the ammonium sulfamate is added to the paper and allowed to remain on the cigarette for a period of about thirty days. This is shown in the following tests wherein three types of cigarettes were utilized.

All three types of cigarettes were made from the same batch of standard American blend of cigarette tobacco and the same batch of cigarette paper and were made on the same machine. The only difference between the three types was the ammonium sulfamate treatment. Sample A consisted of untreated cigarettes. The cigarettes of sample B were prepared by spraying a 30% ammonium sulfamate solution on shredded, cured tobacco which is being rolled and tumbled. The amount of ammonium sulfamate sprayed on the tobacco was formed into cigarettes by wrapping the tobacco in cigarette paper. The cigarettes of sample C were prepared by drawing them through a sponge soaked with a 15% aqueous solution of ammonium sulfamate. The amount of ammonium sulfamate on the cigarette paper amounted to between 6 to 8 mg. per cigarette, which would be about .5%–.75%. The cigarettes were allowed to stand at a temperature of 60°–65° F. at 60% relative humidity for from thirty to forty days. The cigarettes were then smoked as set out above and the tars condensed from such smoke as set out above. The tars were then applied to female ICR Swiss mice which were sixty to seventy days old. The mice were divided into three groups, 100 in each group, and the mice in each group were shaved and painted two times daily, five days a week, for forty-one weeks with a solution of tar. About once a month the tar was replaced by a fresh batch which was obtained in exactly the same manner as the original tar. After a period of forty-one weeks, the mice which the tars produced from the group A cigarettes, had twenty-five tumors, the mice which were treated with the tars produced from the group B cigarettes had seventeen tumors, while the mice which were treated with the tars produced from the group C cigarettes had only nine tumors. Thus, the group B mice had 32% fewer tumors than the group A mice while the group C mice had 64% fewer tumors. From the results of this test, the group C cigarettes are twice as safe as the group B cigarettes.

In addition, tests indicate that smoke from cigarettes treated in accordance with this invention did not affect respiratory rate, minute volume and total pulmonary resistance in guinea pigs, whereas smoke from untreated cigarettes do adversely affect the respiratory rate, minute volume and total pulmonary resistance of guinea pigs.

It will be understood that the foregoing description is only illustrative of the present invention and it is not intended that the invention be limited thereto. Many other specific embodiments of the present invention will be ap-

parent to one skilled in the art from the foregoing disclosure. All substitutions, alterations and modifications of the present invention which come within the scope of the following claims or to which the present invention is readily susceptible without departing from the spirit and scope of this disclosure, are considered a part of the present invention.

I claim:

1. A method for significantly reducing the amount of components in smoke produced from tobacco wrapped in paper which cause tumors on the skin of mice and other biological damage, and significantly reducing the toxicity of tar capable of being condensed from said smoke, as measured by experiments on test animals, without significantly altering burning properties of the tobacco and paper producing the smoke, or without altering the appearance of the ash of said tobacco and paper, which comprises adding from about 0.1% to 1.0% by weight, based on the combined weight of the paper and tobacco, of ammonium sulfamate to said paper and allowing said ammonium sulfamate to remain on said paper until over 50% of the ammonium ion from said ammonium sulfaate has migrated to said tobacco.

2. A method according to claim 1 wherein the amount of ammonium sulfamate added to the paper is from 0.2% to 0.8% based on the combined weight of the paper and tobacco.

3. A method according to claim 2 wherein the solution containing ammonium sulfamate is an aqueous solution.

4. A method according to claim 3 wherein the amount of ammonium sulfamate in said aqueous solution is between about 5% and 15%.

5. A method according to claim 1 wherein the ammonium sulfamate is added to said paper prior to being wrapped around the tobacco.

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