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**Urbanic**

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[54] **TOBACCO SMOKE FILTER**

[75] Inventor: **John Emery Urbanic**, Pittsburgh,  
Pa.

[73] Assignee: **Calgon Corporation**, Pittsburgh, Pa.

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[58] Field of Search ..... **131/10-10.9,**  
**131/261-269, 17**

[56] **References Cited**

**UNITED STATES PATENTS**

3,046,994 7/1962 Schur ..... 131/10.9

3,426,763 2/1969 Sloan et al. .... 131/266  
3,460,543 8/1969 Keith et al. .... 131/266 X  
3,724,469 4/1973 Reynolds et al. .... 131/266

*Primary Examiner*—Melvin D. Rein  
*Attorney, Agent, or Firm*—H. E. Westlake, Jr.; Frank  
Mahon; Raymond F. Speer

[57]

**ABSTRACT**

An improved tobacco smoke filter material for removing HCN from tobacco smoke is provided which comprises activated carbon impregnated with an effective quantity of cuprous chloride.

**5 Claims, No Drawings**

## TOBACCO SMOKE FILTER

This invention relates to a new tobacco smoke filter material useful for the removal of noxious and irritative material from tobacco smoke. More particularly, the instant invention is concerned with an improved tobacco smoke filter material comprising activated carbon impregnated with cuprous chloride; with methods for the preparation of such filter material; and with the use of such filter material for the removal of HCN from tobacco smoke.

As is well-known, constituents present in tobacco smoke formed during the act of smoking cigarettes, cigars, pipes and the like comprise combustion products derived from the tobacco and consist generally of a gaseous phase in which is carried suspended liquid droplets and/or solid particles. Many of the chemical components of the gaseous phase and of the liquid droplets and solid particles are believed to be harmful to the health of the smoker and there have been proposed a variety of filtering elements to be used to clarify tobacco smoke and to remove from it components believed to be harmful.

Among the many materials proposed as cigarette filter materials are various cellulosic materials including cellulose, cellulose acetate, cotton, paper, starch, viscose rayon and the like. These materials have been fabricated into a variety of smoke-filtering elements designed for use with cigarettes, cigars and pipes either alone or in combination with a variety of adsorbants such as silica-gel, ion exchange resins, alumina, activated carbon and natural and synthetic clays. None of the commercially available filter materials, however, have proved entirely satisfactory.

Filter elements formed into cylindrical rings from cellulosic fibers have been found to be effective in removing from tobacco smoke a significant proportion of the liquid droplets and solid particles normally contained therein. Such filters, however, are relatively ineffective in removing gaseous components, and notably HCN, from tobacco smoke. Attempts to improve the gas adsorbing properties of such filters by incorporation therein of adsorbing materials such as those mentioned above, while showing some improvement, have been only partially effective in removing gaseous phase contaminants such as HCN due to a variety of factors including partial saturation or deactivation of adsorbant during manufacture of the filter element and in subsequent handling during the cigarette manufacturing process.

More recently, tobacco smoke filtering materials have been proposed which comprise gas adsorbant materials of high surface area such as activated charcoal, alumina, natural and synthetic clays and silica-gel which have been impregnated with a mixture of the oxides of iron and zinc. These tobacco smoke filtering materials have been found to be effective in the removal of gaseous contaminants including HCN from tobacco smoke (see Keith et al., U.S. Pat. No. 3,251,365). The instant invention is concerned with applicant's discovery that tobacco smoke filtering materials which are highly effective in removing HCN from tobacco smoke may be prepared by impregnating granular activated carbon with an effective quantity of cuprous chloride.

In its composition aspect, therefore, the instant invention may be described as residing in the concept of a tobacco smoke filtering material comprising granular

activated carbon impregnated with cuprous chloride. It is contemplated that such tobacco smoke filtering material will be incorporated into cigarette filters or into cigarette and/or cigar holders or into pipe stem filter elements for the removal of HCN from tobacco smoke.

The instant invention is based upon applicant's discovery that activated carbon containing from 0.5 to 15 per cent by weight is highly effective in removing HCN from tobacco smoke. This result has been confirmed by actual test employing standard laboratory techniques. A typical experiment is described below.

Activated carbon containing 2.0 per cent by weight cuprous chloride was prepared by the method herein-after described and was loaded into 85 mm standard cigarettes with 20 mm filter cavities between two cellulose acetate filter plugs. Approximately 100mg. of impregnated activated carbon was loaded into each cigarette to provide a filter length of about 4 mm. of carbon.

This carbon filter cigarette type was smoked and the smoke was analyzed for HCN content. A control cigarette without an activated carbon filter and a cigarette containing the same activated carbon filter but without the cuprous chloride impregnant also was smoked and the smoke from these cigarettes was analyzed for HCN content using the same techniques.

Samples of the three test cigarettes were smoked on an automatic smoking apparatus. The smoke was drawn by syringe from the cigarette through a glass fiber filter disc and through 75 ml. of 2 percent aqueous sodium hydroxide solution in a 100 ml. graduated cylinder. The cylinder was fitted with a constricted tip, dip tube to provide good gas liquid contact. A two second 40 mm. puff was taken at 58 second intervals. After the cigarette was smoked to a 35 mm. butt length, which usually required seven to nine puffs, smoking was stopped and the adsorbing solution was removed, diluted to 100 ml. with additional 2 percent sodium hydroxide, and an approximate aliquot taken for HCN analysis.

The cyanide content of the sodium hydroxide solutions obtained above was measured by a modification of the pyridine/pyrazolone procedure of Epstein (Analytical Chemistry, Vol. 19, No. 4, 272-4, 1947). The method is a colorimetric procedure in which the cyanide is converted to cyanogen chloride with chloramine-T reagent (sodium p-toluene sulfonchloramide). The cyanogen chloride reacts with pyridine to form glutamic aldehyde which combines with 1-phenyl-3-methyl-5-pyrazolone to form a blue colored complex. The test procedure is described below.

The pH of the aliquot was adjusted to 7 with dilute acetic acid and transferred quantitatively to a 50 ml. volumetric flask. A 0.2 ml. volume of 1 percent aqueous chloramine-T. was added. The solution was allowed to stand for 2 minutes and 5 ml. of pyridine-pyrazolone solution was added. The contents of the flask were diluted to 50 ml. with distilled water and allowed to stand for 20 minutes for color development. Absorbance was measured using a Beckman DK-2 Spectrophotometer equipped with a lead sulfide detector. Distilled water was used as a reference. A graph of absorbance vs. hydrogen cyanide concentration was prepared using solutions of 2 percent aqueous sodium hydroxide containing known concentrations of potassium cyanide.

The results obtained are shown below:

TABLE I

|                                              | No<br>Carbon | Unimpreg-<br>nated Carbon | CuCl Im-<br>pregnated Carbon |
|----------------------------------------------|--------------|---------------------------|------------------------------|
| Micrograms HCN<br>Delivered per<br>Cigarette | 240          | 61                        | 10                           |

As confirmed above, the cuprous chloride impregnated activated carbon filter was far superior to the filter containing no carbon and to the unimpregnated carbon filter delivering by far the lowest amount of HCN per cigarette to the smoke passed through the filter.

The activated carbon useful in preparing the tobacco smoke filter materials of this invention desirably are granular activated carbons having mesh sizes between 4 and 40 mesh (U.S. Sieve Series). Particularly desirable are activated carbons of 12 to 40 mesh. Such activated carbons can have widely varying surface areas. It has been found that activated carbon base materials can have surface areas between 250 m.<sup>2</sup>/g. to 1200 m.<sup>2</sup>/g. with no significant change in effectiveness. As noted above, the cuprous chloride impregnant is effective for HCN removal from tobacco smoke in the range of 0.5 to 15 percent by weight of the activated carbon. Increases in the impregnant level does not proportionally increase the removal of HCN. Filter lengths between about 2 mm. and 6 mm. are effective with 4 to 6 mm. being preferred.

The tobacco smoke filter materials of this invention conveniently are prepared by soaking the activated carbon, either before or after screening to the desired mesh size, in an aqueous solution of cuprous chloride and ammonium hydroxide. The activated carbon is allowed to remain in contact with the impregnating solution, either with or without stirring, until it has become thoroughly saturated. Usually about 1 to about 4 hours is satisfactory. The wetted activated carbon is then separated from the impregnating solution and dried at about 100° to 150°C to drive off excess water and ammonia and to deposit the cuprous chloride impregnant in the activated carbon. Such drying operation usually requires about 3 to 12 hours. The amount of cuprous

chloride in the impregnating solution is selected so as to afford the proportion of cuprous chloride which it is desired to deposit upon the activated carbon.

In a typical preparation, 100 g. of 18 × 20 mesh activated carbon is deposited in a glass beaker. A solution of 2 g. of cuprous chloride in 50 ml. of ammonium hydroxide is prepared and diluted to 100 ml. with distilled water. The weighed activated carbon is then stirred into the cuprous chloride solution and stirred occasionally for 3 hours. The wetted carbon is then separated from the impregnating solution and dried over night at 100°C. The cuprous chloride impregnated carbon so produced then may be employed as the tobacco smoke filtering material in accordance with the instant invention.

The subject matter which applicant regards as his invention is particularly pointed out and distinctly claimed as follow:

1. The method of removing HCN from tobacco smoke which comprises contacting said tobacco smoke with a tobacco smoke filtering material comprising at least about 50 milligrams of granular activated carbon impregnated with 0.5 to 15 percent by weight of cuprous chloride.

2. The method of claim 1 wherein said granular activated carbon has a mesh size between 4 and 40 mesh and is impregnated with 0.5 to 15 percent by weight of cuprous chloride.

3. A smoking article having a burnable tobacco charge, a mouth end and a filter element interposed between said burnable tobacco charge and said mouth end, said filter element containing a tobacco smoke filtering material capable of removing HCN from tobacco smoke comprising at least about 50 milligrams of granular activated carbon impregnated with 0.5 - 15 percent by weight of cuprous chloride.

4. The smoking article of claim 3 wherein said smoking article is a cigarette.

5. The smoking article of claim 4 wherein said granular activated carbon has a mesh size between 4 and 40 mesh and is impregnated with 0.5 to 15 percent by weight of cuprous chloride.

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