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IDENTIFICATION AND SEMI-QUANTITATION OF MAINSTREAM VAPOR PHASE COMPONENTS FROM CAMEL LIGHTS 85 AND CAMEL LIGHTS 85 WITH A THREE COMPONENT EXPERIMENTAL FILTER

OBJECTIVE:

To identify, and quantify the components from the mainstream vapor phase (MSVP) of CAMEL Lights 85 and CAMEL Lights 85 equipped with an experimental filter.

SUMMARY:

The MSVP components from CAMEL Lights and CAMEL Lights containing a three component experimental filter were identified and quantified using dynamic headspace gas chromatography/mass spectrometry (GC/MS) analysis. The MSVP was trapped using three different trapping methods. The results from all three experiments show that the MSVP components are reduced by approximately 50% for CAMEL Lights equipped with the experimental filter.

KEYWORDS:

Mainstream vapor phase, purge and trap,dynamic headspace, gas chromatorgraphy, HV filter.

INTRODUCTION:

Main stream vapor phase components can be collected in a number of ways. A Tenax trap or an impinger containing chilled water placed after or before the Cambridge pad have been successfully used to trap low

molecular weight volatile components. Initial work on collecting the MSVP for this type of product was performed by William.M. Coleman and is found in ARD:WMC93005,1. These results showed that a charcoal filter significantly alters the composition of MSVP for CAMEL Lights cigarettes.

Three different trapping methods for MSVP were employed in this work. The collection of MSVP was accomplished by trapping in chilled water in the impinger placed after or before the Cambridge pad, and on Tenax traps placed after the Cambridge pad. The components trapped were analyzed by dynamic headspace GC/MS . The cigarettes analyzed were CAMEL Lights 85 and Camel Lights 85 tobacco rod equipped with a three component experimental filter. The three components are a 7-mm gathered web carbon filter, a 7-mm plastic filter with a flow restricting aperture placed in the center and a 13-mm low efficiency cellulose acetate filter (10/3500) forming the mouth piece. The cigarette is air diluted approximately 50% at 12mm from the mouth end. The control CAMEL Lights has the standard 3.3/3900 dpf cellulose acetate and is air-diluted to approximately 18% at 16 mm. Average deliveries from these cigarettes using FTC smoking conditions are as follows:

	Control	Experimental
% Dilution	18	50
Puff No.	8.0	8.0
WTPM Mg	12.3	11.1
Nic., Mg	0.77	0.77
Tar, Mg	10.3	9.5

METHODS AND MATERIALS:

Trapping Methods:

The cigarettes are smoked under FTC smoking conditions on a 6 port smoking machine. An impinger containing water and cooled by an ice bath is placed either before or after the Cambridge pad. An internal standard of cyclohexanol is placed in the water for quantitation The standard was made at a concentration that would give 212.00 ug of cyclohexanol in 10ml of water.

The Tenax trap is placed after the cambridge pad and 1.54 µg of d6-Benzene gas used as a standard is purged onto the Tenax trap before smoking. The smoking procedure was one cigarette smoked per impinger or Tenax trap and each sample was smoked six times.

Dynamic Headspace:
A Tekmar LCS 2000 Dynamic Head Space multiport system was used to analyze MSVP trapped in water. One ml of the water from the impinger is transferred to U-shaped spurge tubes and heated to 70°C while being purged with Helium for 20 minutes. This sample is trapped onto a Tenax trap which is then purged for 5 minutes onto a GC column.
Tenax Traps: A Perkin Elmer (ATD 400) Automatic Thermal Desorption System was used to analyze MSVP trapped on to Tenax traps. This is a micrprocessor controlled two stage thermal desorption system. Before sample tubes are used the tubes are preconditioned at 300°C while being purged with Helium for 10 minutes. An internal standard of d6-benzene from Scott Specialty Gases is purged onto the tubes at 1.54µg. The tubes are placed in a 50 port autosampler where they a checked for leaks and then are purged of air with a carrirer gas flowing, heated to 275°C for 20 minutes to an electrically cooled cold trap at -30°C and then heated to 275°C to inject the volatiles on the GC column.

Gas Chromatography/Mass Spectrometry:
A 30 meter x 0.25 micron DB1701 with a 1 µm film thickness was used for analyzing the MSVP. An outlet splitter is used at the end of the capillary column to transfer 10% to the FID and 90% to the MSD. The interface to the mass spectrometry is a direct interface into a HP-5970B Mass selective dector for mass spectral identification. GC conditions starts after the purge and trap is finished. The initial oven temperature is 5°C hold for 8 minutes then 2.00°C / minute to 47°C, followed by 10°C/ minute to 250°C hold 60 minutes. The mass spectrometry acquisitions parameters are a mass range of 40 to 200 amu and collection 0f 8 scans per seconds. The interface temperature 250°C and source temperature 250°C. The mass spectrometry is tune and calibrated with perflorotributylamine.
Tenax trap system: A 60 meter x 0.25 micron DBWAX with a 0.5µm film thickness was used for analyzing the Tenax sample. Initial oven temperature is 40°C for 4 minutes followed by a programming of 5°C/minute to 230°C hold 20 minutes.

Experimental Filter Design:

See Diagram #1.

RESULTS and DISCUSSION:

The MSVP for CAMEL Lights and the experimental cigarette was collected by three different methods. MSVP was trapped in water placed after the Cambridge pad, trapped in water placed before the Cambridge pad and trapped on Tenax traps placed after the pad. To distinguish the three different collections of MSVP, the following nomenclature will be used; MSVP will be used for trapping of mainstream vapor phase after the Cambridge pad, 'whole smoke' will be used for trapping of MSVP before the Cambridge pad and Tenax for the trapping of MSVP onto Tenax.

The GC /FID chromatograms obtained for MSVP of CAMEL Lights control and CAMEL Lights with the experimental filter are shown in Figures 1 and 2, respectively. The concentration in µg/cigt. are found in Table 1 and 2, respectively. Figures 3 shows bar graphs representing the concentration vs. retention time (which correlates to individual components see Table 1 and 2) comparing both cigarettes. Figure 4 represents the total MSVP that was identified for both cigarettes showing how the two cigarettes relate to each other. It is apparent from the graphical presentation of the data that the cigarettes are different. The MSVP collected from the experimental cigarette is approximately 50% reduced. This reduction is found for most components. This was a first attempt at using an internal standard in the trapping system. Because of the system set up and purging parameters the numbers are in the mg/cigt. range which seems high. However comparison of the two samples under the same sampling conditions is still valid and the reduction trend is still meaningful for product guidance. Collection of 'whole smoke' involved modification of the impinger. Figure 5 shows these necessary

modification. The GC/FID profiles of 'whole smoke' collected for the two cigarettes are found in Figures 6 and 7, respectively. The GC profiles for 'whole smoke' is exactly the same as that found for MSVP. This indicates that no additional components were trapped. However, the concentration of components between MSVP and whole smoke are different. The concentrations for the major components and replicate smoking are found in Tables 3 and 4. A bar graph of the major components shows a 50% reduction of most components for the experimental cigarette (see Figures 8&9).

The major components that were collected on Tenax traps for CAMEL Lights and CAMEL Lights with an experimental filter are tabulated in Tables 5 and 6, respectively . The components trapped are different then those trapped in water. This is expected due to the different trapping capability of water versus Tenax. Figures 9 and 10 show the total ion chromatograms for CAMEL Lights and the test cigarette, respectively. Figure 11 is the bar graph representating the relation between the cigarettes which again shows a 50 % reduction for most of the major components for the test cigarette.

CONCLUSION:

All three of the experiments used to trap MSVP have shown that the CAMEL Lights containing the experimental filter reduces the average MSVP concentration by at least 50% when compared to CAMEL Lights.