

QUARTERLY REPORT; July 1- September 30, 1977

AIR DILUTION AND FILTRATION (Project 1246)

I. Basic Studies of Air Dilution and Filtration (Norman, Reynolds, Smith, Wheeler)

A. BB Taste Effect

The extensive BB taste effect study was completed on time. Smoke comparison studies, routine smoke analyses, analysis of semivolatile bases, pressure drop data, filtration efficiencies, air dilution analysis, and expert taste panel tests were all performed. The data were summarized in a specially prepared pamphlet. Several discussions among research and development personnel resulted in a consensus evaluation of the data which was reported to the marketing department in a presentation on September 16, 1977. The conclusions reached were 1) there is apparently a BB taste effect, 2) it is manifested in a perceived strength in excess of what a smoker expects from a low-tar cigarette, 3) it is most likely due to a combination of the effects of air dilution and filtration on the generation and delivery of the smoke from the BB cigarette, 4) it cannot be attributed to one compound or even a group of compounds, but results from the totality of compounds in the smoke, 5) the design of the BB filter appears to be anticipated in the prior art.

B. Low-CO Cigarette

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Tobacco rods and filter rods were ordered from TPD in order to prepare the low-CO prototype cigarettes described in the previous quarterly report. The filter rods have been received. The tobacco rods have not been made at this time because of difficulty in obtaining the necessary high porosity wrappers.

C. Improvements to Air Dilution and Filtration Technology

1) Lab-sized filter maker

The laboratory-sized filter maker has been installed in

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distribution

Building 27-1. Problems still exist in the ~~distribution~~ of plasticizer onto the tow. Efforts are continuing to improve the performance of the maker.

## 2) Diffusion of CO from ~~the cigarette wrapper~~ Cigarette Wrapper

Diffusion of CO through the wrapper is thought to be a mechanism whereby the ~~EE~~ mainstream CO of air-~~mix~~ diluted cigarettes is reduced. A method for the determination of this CO has been developed. ~~EE cigarette~~ The cigarette is enclosed in a glass envelope ~~which~~ except ~~for~~ for the ~~xxxxxx~~ coal and about 3 - 5 mm of rod ~~which~~ which extends into the atmosphere. Argon gas sweeps through the envelope and is collected in a Saran plastic bag. The contents of the bag are analyzed for CO after smoking is completed. Limited ~~data~~ data are available now. Regular, 85 mm WINSTON cigarettes allowed  $4.1 \pm 0.5$  mg CO per ~~gx~~ cigarette to escape in this way, while regular, 100 mm WINSTON LONG ~~lights~~ LIGHTS yielded  $4.0 \pm 0.4$  mg per cigarette. Regular, 85 mm WINSTON LIGHTS yielded ~~xx~~ 4 mg per cigarette, ~~W~~ while 85 mm, 1 mg FTC 'tar', regular NOW cigarettes yielded  $1.7 \pm 0.1$  mg per cigarette. Regular, 85 mm, 2 mg FTC 'tar' NOW cigarettes ~~xx~~ yielded 2.2 mg CO per cigarette. Ongoing work ~~xx~~ at present includes examination of a series of experimental cigarettes, and an attempt to separately determine only the CO escaping from the air dilution vents in air-diluted brands.

## 3) Spectrophotofluorometric determination of WTPM and filtration efficiency.

A method for the determination of WTPM and filtration efficiency similar to that described by McConnell, et al., TOBACCO SCIENCE <sup>IV</sup> ~~IV~~, 56-61 <sup>1760</sup> (1959), and presently used at the Tennessee Eastman Research laboratories for filter research has been implemented. It is intended to ~~xx~~ use the method for filter research problems ~~which~~ involve ~~determination~~ determination of WTPM deposition, and filtration efficiency of portions or sections of filters. In the method, filters are ~~extracted~~ quantitatively extracted with methanol, and the resulting ~~solutions~~ solutions are analyzed by observing the ~~fi~~ intensity of fluorescence at 410 nm on irradiation at 365 nm. Calibration of the instrument by ~~kx~~ with known amounts of WTPM ~~is~~ is required. As an example of the method, we report the determination

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50283 3993

of the filtration efficiency of the regular 85 mm WINSTON. ~~the~~ The gravimetric method (which is the so-far commonly used method here) ~~yielded~~ yielded a WTPM of 22.3 mg per cigarette and a filtration efficiency of  $48.2 \pm 1.8 \%$ . The spectrophotofluorimetric method yielded 22.5 mg WTPM per cigarette and an efficiency of  $48.4 \pm 1.9 \%$ .

#### 4) Tennessee Eastman "standard dilution device"

A device proposed by workers at the Tennessee Eastman research laboratories as a standard ~~method~~ by which to evaluate ~~methods~~ methods of determining air dilution was recently examined. ~~XXXXXXXXXXXXXXX~~ The device consists of two Eastman multiple capillary pressure drop standards joined by a perforated metal tube. Depending on which end is ~~is~~ considered the "mouth end", one of two values of air dilution can ~~be~~ be obtained. The Tennessee Eastman researchers had calculated the expected percent dilution for both orientations ~~XXXXXXXXXXXXXXX~~ on theoretical grounds. Their actual measurements (made with a soap bubble flowmeter) did not bear out their calculations. Therefore we were asked to ~~make~~ make measurements of the air dilution by our method. The ~~orientation~~ orientation calculated to yield a dilution of 79 % was found to yield a value of  $67.9 \pm 1.4 \%$  by our argon entrainment method, and a value of  $69.5 \pm 0.2 \%$  by our soap bubble flowmeter method. The orientation calculated to ~~yield~~ yield 74 % dilution actually yielded  $60.0 \pm 3.2 \%$  by argon entrainment and  $61.1 \pm 0.2 \%$  by soap bubble flowmeter. *The differences between the argon and flowmeter methods are not significant at these levels of dilution. <sup>the values obtained by</sup>*

#### II. Competitive Brand Awareness (Norman, Wheeler, Smith)

The percent dilution occurring in Kool Super Lights is 27.9 %.

#### III. Support to Tobacco Development (Norman, Reynolds, Wheeler)

##### A. REAL Cigarette Evaluation

~~Two~~ Two samples of REAL cigarettes were evaluated for FTC 'tar', nicotine and percent dilution in three weight ranges each. The results were reported to TPD.

##### B. TPD RSM Study

Percent dilution for 14 samples of air-diluted cigarettes was determined.

50283 3994

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Twenty-two additional samples are expected.

C. DORAL Cigarette Evaluation

Percent dilution of several cigarette samples having DORAL, True, or plain ventilated cellulose acetate filters was determined.

D. WINSTON Tow Evaluation

Examination of filter tow from Tennessee Eastman and Celanese revealed characteristics that enabled the distinguishing of ~~xxxx~~ materials from these suppliers. by optical microscopy  
When the technique was applied to ~~xxxxxfilter~~ filter samples from ~~WINSTON~~ WINSTON cigarettes, it was found that the majority of ~~WINSTON~~ WINSTON samples about which consumer complaints had recently been registered had <sup>filters of</sup> Celanese ~~filter~~ tow.

~~XXXXXXXXXXXXXXXXXXXX~~

When the filter samples were examined at 1250 X using a newly-acquired Leitz microscope, excellent resolution of the fibers was achieved. The examination showed that Eastman tow had more striated fibers, while Celanese tow had many bubble-like inclusions in the tow not seen in Eastman tow. ~~XXXXXX~~ It is felt that ~~XXXX~~ ~~the~~ had we been limited to the sole use of our ~~XXXXXX~~ older Unitron instrument ~~XXXXXXXXXXXXXXXXXXXX~~ ~~these~~ ~~XXXX~~ results would have been ~~XXXXXXXXXXXX~~ unobtainable.

IV. Flavored Filters (Rix)

A. Menthol Delivery as a Function of TPM ~~XXXXXXXXXX~~ Throughput.

Unmentholated SALEM blend tobacco rods were attached to 2.9 dpf/41000 td filters, 21 mm in length, each containing  $1.98 \pm 0.05$  mg menthol in about 7.5 mg of Atmos 300 (a glyceryl ester of long-chain fatty acids). The cigarettes were smoked various numbers of puffs to vary the ~~XXXXXXXXXXXX~~ ~~XXXX~~ TPM put through the filters. Analysis of the TPM for menthol revealed a linear dependency of menthol delivery on TPM throughput.

B. Aging Studies on Menthol Flavored Filters.

Studies of the menthol retention and delivery by filters containing triacetin, propylene glycol, <sup>and</sup> Atmos 300 revealed that while some supports were able to retard the equilibration of filter menthol with an unmentholated tobacco rod much better than ~~xxx~~ triacetin, none was able to transfer menthol to smoke as well as triacetin.

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V. Miscellaneous Activity ~~(XXXXXX)~~ (Norman, Reynolds, Wheeler, White)

A. Effect of Plastic Mouthpiece on Taste of Air-Diluted Cigarettes

~~XXXXXXXXXXXX~~ Unfiltered CAMEL tobacco rods were perforated through the wrapper 13 mm from the mouth end. Samples of these cigarettes and of ~~identical~~ cigarettes identical except ~~for~~ for the addition ~~of~~ of an unperforated plastic mouthpiece were submitted to the Research Department Taste Panel. Results of a monadic panel test revealed no difference between these two cigarettes.

B. Visit to Tennessee Eastman Research Laboratories.

~~XXXXXXXXXXXX~~ Three members of the Physical Sciences Section (Norman, ~~Reynolds~~ Reynolds and Wheeler) visited the Research and Development Laboratories of the Tennessee Eastman Corp. on August 23, 1977. The agenda included a morning-long informal presentation of some aspects of the work of their Research Department and tours of their Research and Development areas in the afternoon. A brief presentation of work being done on a computer-controlled filter plug maker was included in the afternoon program.

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