

FROM RESEARCH LABORATORY

TO RESEARCH AND DEVELOPMENT.

November 18, 1959.

VANGUARD CIGARETTES

References: File Memorandum from Research and Development to Mr. R.S. Wade dated August 6, 1959.

File Memorandum from Research laboratory to Research and Development dated August 19, 1959.

File Memorandum, Research and Development Dept. dated August 24, 1959.

Report to Research and Development dated Jan. 9, 1959 on Cigarette Smoke temperatures.

The laboratory was requested to determine the presence of alkaloids, (Memorandum of August 6, 1959) in the constituents of Vanguard (tobacco-less) cigarettes as well as the combustion and smoke temperatures and whole tar and 3,4-benzpyrene contents of the cigarette smoke (Memorandum of August 24, 1959.)

The search for tropane alkaloids such as atropine, hyoscyamine and scopolamine proved fruitless and their absence in Vanguard cigarettes has been confirmed by Dr. R.S. Griffith of the Brown and Williamson Corporation. The main constituents of Vanguard cigarettes according to Dr. Griffith, appear to be:

Sugar Cane Bagasse, Sugar Beet Fibres (i.e. The residue after pressing out sugar), Cornsilk, with possibly Trilisa leaves (Deer's tongue...used for perfuming smoking, chewing and snuff tobacco) and probably also spearmint flavouring.

Characteristics of the cigarettes:

Length: 70 mm.
Circumference: 26 mm.
Length of Tip: 11 mm.
Tip material: Cellulose acetate
Total weight of cigarette: 875 mg.
Weight of non-filter portion: 700 mg.

Combustion and Smoke temperatures:

The cigarettes were smoked and the burning and smoke temperatures were measured as described in the January 9, 1959 report on Cigarette smoke temperatures. The pertinent paragraphs and definitions of terms are given in the appendix.

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TABLE I

Cigarette	Temperature of burning zone °C	Smoke Temperatures		
		T ₂₅ °F	LBT mm	LTR mm
Vanguard	826	118	28.4	27.8
Brand A (plain end)	860	93	23.7	24.6
Brand B (filter tip)	868	88	23.5	26.1

The values for a plain end (Brand A) and a filter tipped (Brand B) cigarette have been included for comparison purposes.

The lower temperature of the burning zone appears to be significant.

It is obvious that the Vanguard cigarettes produce a hotter smoke for a given butt length than either of the other brands. But the Vanguard cigarette is remarkable in that although it is a light weight cigarette (700 mg/59mm. compared to 896 mg/59 mm. for the filter tip (Brand B) cigarette or 920 mg/59 mm for the plain end (Brand A) cigarette) its smoke temperatures compare well with that of the other cigarettes while we have found that light weight cigarettes always yield much higher smoke temperatures for a given butt length. The obvious reason is that we are dealing with a completely different kind of material with a different heat capacity from that of tobacco.

Whole Tar and 3,4-benzpyrene smoke content

For tar and 3,4-benzpyrene determinations 515 cigarettes were smoked to a 23 mm. butt length by means of a constant volume machine under standard conditions of a 35 cc. puff of 2 seconds duration taken once a minute. The smoke was collected in spiral traps, surrounded by dry ice, from which it was dissolved in methylene chloride-methanol solution, dried over sodium sulphate and concentrated to dryness in vacuo to constant weight. The 3,4-benzpyrene content was determined spectrophotometrically after separation from the tars by column and paper chromatography.

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TABLE II#

Cigarettes	Butt length mm.	Length smoked mm.	Weight of length smoked in mg (wet basis)	Whole tar mg/cigt	% tar	3,4-benzpyrene $\mu\text{gm}/100$ cigt	ppm of whole tar
Vanguard	23	47	568	22.7	4.0	3.73	1.64
Brand A (Plain)	23	49	764	27.5	3.6	2.63	0.96
Brand B (filter)	23	51	775	16.5	2.1	1.58	0.96

*Results are averages of two determinations.

Again for comparison purposes the results for a plain end and a filter tip cigarette have been included.

The 3,4-benzpyrene figures for the filter cigarettes (B) were calculated from the Brand A results assuming non-selective filtration of the tip and 40% filtration efficiency. This is reasonable since the whole tar figure for Brand B is 40% of that for Brand A.

The Vanguard cigarettes yield more tar (38%) and more 3,4-benzpyrene (136%) than a regular filter tip cigarette inspite of the smoking of a smaller weight of material over a shorter length. Even when compared to a plain end cigarette the Vanguard cigarettes yield a greater amount of smoke solids compared to the weight of material burned and a greater 3,4-benzpyrene product (42%).

Summary

- 1) Vanguard cigarettes do not contain any tropane alkaloids.
- 2) The burning zone temperature is lower than that of plain end and filter tip tobacco cigarettes.
- 3) The smoke temperatures for a given butt length are higher than that for plain end and filter tip tobacco cigarettes but markedly lower than that of a plain end tobacco cigarette with a similar light weight.
- 4) The absolute whole tar content of the smoke is 38% higher than the filter tip cigarette but 17% lower than the plain end cigarette. The whole tar produced per weight of material smoked is, however, higher than that of either plain end or filter tip cigarettes.

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- 5) The 3,4-benzopyrene content is 42% greater than that of the plain end cigarette and 136% greater than that of the filter tip cigarette.

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APPENDIX

Measurement of cigarette smoke temperatures

The smoking was carried out on a smoking machine employing a Cambridge type filter. The machine was set to give a puff of 2 second duration, 35 cc. in volume once every minute. Estimates of butt length were made by marking the cigarette off in 5 mm. intervals and estimating to the nearest mm. between marks. This was actually a limiting factor in the precision of the observations as each length recorded was probably within only plus or minus 2 mm. of the actual. The between puff interval under these conditions was about 5 mm., 3 mm. of puff and 2 mm. free burn. Temperatures in the smoke were measured by means of a platinum--87% platinum, 13% rhodium thermocouple (0.002" diameter) the junction of which was positioned axially in a filter adapter at a distance of about 1 mm. behind the cigarette. The resulting e.m.f. was measured on a Leeds and Northrup Speedomax recording potentiometer.

Definition of symbols:

- a) T_{25} : 25 mm. butt length (butt length in all instances is the length prior to the puff which generates the indicated temperature). This length was arbitrarily chosen as that point where a cigarette might be discarded by a smoker.
- b) L_{TR} : Butt length at temperature rise. This figure is obtained by extending the base line and extending the rise line to intercept.
- c) L_{BT} : Butt length at body temperature 98.6°F.

It is felt that due to the slow recorder response to high signals little confidence should be placed in the absolute temperature values at 25 mm. butt length, but that the other two values give a truer indication of cigarette behavior.

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