

The smoke is collected and condensed in helical traps surrounded by dry ice after which it is dissolved in a methylene chloride-methanol (8.5 : 1.5) solution. All basic and acidic compounds are removed by extraction with aqueous acid and base solutions respectively, leaving the neutral fraction (which contains all paraffins and polycyclic hydrocarbons) in the solvent.

After evaporation of the solvent from an aliquot containing the equivalent of 0.1 gm. of whole tar and solution of the residue in cyclohexane the neutral tars are fractionated by column chromatography on a 4.3 cm. x 8 mm. alumina column by elution with a cyclohexane-benzene solution. The fraction which should contain 3,4-benzpyrene is spotted and developed on a paper chromatogram for final identification of the compound according to a modified Tarbell's (10) procedure. In this last step, a pure 3,4-benzpyrene solution is also spotted on the paper and run simultaneously as a check.

Application of the procedure has permitted the detection of 2 ppm. and possibly less, of 3,4-benzpyrene which was added initially to the tar. Two preliminary tests on whole tar alone, without addition of the hydrocarbon, have failed to establish the presence of 3,4-benzpyrene.

Because the results are negative, there is always doubt as to whether it was somehow missed and therefore further checks will be made before a definite statement be issued. This work will also be extended to an examination of American and Canadian blended cigarettes as well as to tars from cigarette paper, with and without additives, which have been burnt by both Howard Smith's and Rand's method.

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(Sgd.) J. E. de Souza.

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I.T.Co (Canada) Ltd

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MEMORANDUM

Re: IDENTIFICATION OF 3,4-BENZOPYRENE IN THE SMOKE FROM A
REGULAR CANADIAN FLUE-CURED CIGARETTE BRAND.

In the past few years, research has been intensified in the search of an agent in cigarette smoke that purportedly gave rise to a high incidence of lung cancer amongst smokers, and more so since medical researchers have claimed that they were able to produce carcinomas on mice by application of cigarette tars.

During 1955, reports were received from various independently working entities claiming the identification of 3,4-benzopyrene, a highly carcinogenic substance, in cigarette and paper smoke. Among these were Lefemine (1), Rand Development Corp. (2), and Tennessee Eastman Co. (3) in the U.S.A.; Lindsay & Cooper (4) in England; Carl Seelkopf (5) in Germany; and Wright (6) in Canada.

Although much of the work is open to criticism from the standpoint of smoking conditions and in spite of some denials of the presence of 3,4-benzopyrene such as that of Kosak (7), the consensus of opinion seems to be that the compound is present in cigarette smoke to the extent of 1 - 10 ppm of whole tar. The results from the burning of cigarette paper appear to depend primarily on the method of burning and the presence of additives and vary from total absence of 3,4-benzopyrene to several ppm. In the first category can be cited the Howard Smith Paper Mills' burning method and in the second Rand's method.

The amounts of 3,4-benzopyrene detected are too small to be effective in the development of carcinoma (8). Nevertheless it was deemed advisable to check our own cigarettes for the presence of this compound in the smoke.

In August, 1955, Dr. Wright was sent three samples of condensed smoke from a regular Imperial Tobacco Co. flue-cured cigarette brand which was wrapped in the following types of paper:

- a) Wetproof with monoammonium phosphate
- b) Non-wetproof with monoammonium phosphate
- c) Non-wetproof without monoammonium phosphate

Dr. Wright was unable to detect 3,4-benzopyrene in any of the three samples. This posed the question of whether Canadian flue-cured cigarettes were free of this compound while American blends were not. Following up this idea, samples of smoke from a Canadian blended cigarette and American Pall Mall were submitted to Dr. Wright in November, 1955, but unfortunately, due to lack of personnel, he has been unable to carry out the required test.

In the meantime, the writer had been developing a procedure and technique along similar lines as those of Dr. Wright's for the detection of 3,4-benzopyrene in smoke.

The broad outline of the procedure established follows:

I.T.Co. flue-cured cigarettes are smoked by 5-unit smoking machines made by the Engineering Department according to the standard prototype of Bradford, Harlan & Hanmer (9). Each cigarette is submitted to a 35 cc. puff for two seconds once a minute. The 72 mm. long cigarettes are smoked to a 23 mm. butt.

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