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REVIEW TITLE : Biological Effects of Tobacco Smoke and Tobacco Extracts in Short Term Tests

REVIEW TEXT : 1. Mutagenicity of Commercial Cigarettes:
Interest in this study has been maintained on account of the possibility that governments in Canada and elsewhere might demand Ames tables, ranking mutagenic activities of commercial cigarettes, as is being done for tar, nicotine and CO. A recent examination of a group of Canadian and U.S. brands included Capri, a slim (circumference = 17 mm), 100 mm brand recently introduced by B & W into the U.S. market. In this study, Capri was found to be significantly lower in mutagenicity than Winston Light, a regular circumference, U.S. blended cigarette, but much higher than Avanti and du Maurier Special Mild, the two Canadian brands examined. Avanti, a lower circumference (23 mm), 100 mm length cigarette showed lower mutagenicity than du Maurier Light, a regular circumference, 100 mm cigarette, but the difference between them did not reach statistical significance (p < 0.05). However, it should be pointed out that while the Canadian brands were closely matched with respect to tobacco and physical parameters, such a matching between the American cigarettes was not possible at the time of the study.

An interesting observation made during this study was that within both the Canadian (37 flue-cured brands) and U.S. (9 blended brands) groups of cigarettes the 100 mm brands were the highest in mutagenicity in their respective groups. Work is in progress to determine if other 100 mm brands also show high mutagenicity, and whether this high activity is related to their length.

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2. Effect of Filters on Ames Mutagenicity of Cigarettes

Studies in Hamburg, Montreal and Southampton have suggested that filter tip cigarettes gave condensates that were higher in Ames activity than condensates from plain-end cigarettes, but the results were equivocal. The differences obtained rarely showed statistical significance, not to mention the fact that besides filter ventilation, the cigarettes employed were different, with respect to other parameters such as tobacco blend and paper porosity. In the study reported herein, two different types of filters were attached to the same plain-end cigarette, viz., Player's Check 28. Filter A was a 39,000 tow filter with a pressure drop of 176 mm, while Filter B was a 55,000 tow filter with a pressure drop of 722 mm. Included also was Player's King Filter, which was smoked with and without the filter tip. The results of this study showed that the filters increased mutagenicity when expressed as activity per unit weight of condensate. However the differences were eliminated when activity was expressed on a dry tar weight basis. Clearly, selective removal of water by the filter caused an apparent increase in mutagenicity of the whole smoke condensate. However, it should be pointed out that in an earlier B.A.T. study the tobacco blend appeared to determine whether or not the filter affected the mutagenicity of the condensate, - a significant increase in mutagenicity in the case of a U.S. blended cigarette and none in the case of the flue-cured cigarette. Consequently, work will be undertaken to see if this B.A.T. result can be confirmed or not.

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3. Mutagenicity of Tobacco Extracts:

Mould-contaminated foods and tobacco are likely to contain a variety of mutagens and carcinogens. While many studies have shown mutagenic activity in contaminated foods, the few studies undertaken with tobacco have failed to detect mutagenic activity. Mutagenic activity of tobacco extracts thus far was detectable only if the extracts were treated with nitrite under acidic conditions. In contrast, in the last IITL semi-annual report we reported that an acetone extract of tobacco snuff (Copenhagen) contained frameshift mutagens. This observation has now been confirmed in an experiment in which an acetone extract from Copenhagen snuff was more mutagenic than an extract from another brand, Happy Days. This is an interesting observation as it would confirm, a role for the microorganisms present in the sample in generating mutagenic compounds. In earlier microbiological studies we had found Copenhagen to contain a much higher load of microorganisms than Happy Days.

4. Effect of Antioxidants and Other Chemicals on the Mutagenicity of CSC

Considerable interest exists on the inhibitory or enhancing effects of antioxidants and other compounds on the carcinogenicity and mutagenicity of chemicals. At IITL we have been systematically screening such compounds and have found that while 2-aminoanthracene enhances the mutagenicity of CSC, others such as selenite and ellagic acid have the opposite effect. Other chemicals such as ascorbic acid, cysteine, glutathione and nicotine do not appear to influence the mutagenic activity of CSC. Further studies have shown that the enzyme catalase did not influence the mutagenicity of CSC, while α -tocopherol reduced its activity. However, considerable amounts of α -tocopherol have to be employed (at least a 2:1 ratio of α -tocopherol to CSC) before a reduction in mutagenicity is obtained. An experiment employing CaCl_2 has shown considerable toxicity and will have to be modified before any conclusion can be drawn.

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The results with glutathione were a surprise since this chemical is a major protective chemical in mammalian systems. Further, a recent report suggested that it reduced the mutagenicity of CSC at much lower concentrations but longer pre-incubation times than we had been employing. Consequently, it was considered important that we modify our testing procedure and increase the pre-incubation period from 10 to 30 minutes to determine if glutathione could indeed reduce the mutagenicity of CSC. Such a modification, too, did not result in our obtaining a reduced mutagenicity of CSC. The only other difference between our study and the other study in which a positive effect was obtained was that the latter employed condensate from an American blended cigarette while we employed a Virginia cigarette. Further studies will take this difference into consideration.

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