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SELECTIVE REDUCTION OF TUMORIGENICITY OF TOBACCO SMOKE. IV. APPROACHES TO THE REDUCTION OF NITROSAMINES AND AROMATIC AMINES

Stephen S. Hecht, T. C. Tso, and Dietrich Hoffmann

The presence of carcinogenic nitrosamines and aromatic amines in tobacco and tobacco smoke was discussed, with emphasis on recent studies. The simple dialkyl nitrosamines, nitrosopyrrolidine, and nitrosopiperidine have all been detected in tobacco smoke at levels up to 180 ppb; N'-nitrosonornicotine (NNN) is present in both smoke and in unburned tobacco, with concentrations in the latter being as high as 89,000 ppb. All of these compounds are animal carcinogens. Among the aromatic amines in tobacco smoke, β -naphthylamine, a known bladder carcinogen in man, was detected in quantities of 22 ng/cigarette. The factors contributing to the presence of nitrosamines in tobacco and tobacco smoke were discussed. The most important factors related to dimethylnitrosamine (DMN) concentration in smoke appeared to be the rate of nitrogen fertilization and the total nitrogen content of the tobacco leaf. NNN levels in tobacco could be influenced by curing practices and nitrate levels. Available evidence pointed to nicotine as the major precursor to NNN in tobacco. Suggestions were made for future studies on the reduction of nitrosamines in tobacco and tobacco smoke. These included examination of unburned tobacco for nitrosamines presently found in smoke, selective filtration of volatile nitrosamines, addition of ascorbic acid to tobacco to inhibit nitrosamine formation, and a detailed examination of the influence of agronomic and curing practices on nitrosamine levels in tobacco. Evidence concerning the reduction of aromatic amines in smoke is currently rather limited, and much more work would be necessary before reasonable approaches could be designed.

The carcinogenicity of a wide variety of N-nitrosamines in animal species, including primates, has been well established (1-4). There is, at present, no direct evidence such as exists for aromatic amines to indicate that these compounds are carcinogenic to man, but they certainly must be considered among the most potentially hazardous environmental carcinogens because of their high degree of activity at very low levels in animal systems, and because of their ease of formation in high yield from amines and nitrite under a variety of conditions (5, 6).

Nitrosamines may or may not contribute to the biological activity of tobacco and tobacco smoke, but they certainly must be considered as potential factors. Tobacco carcinogenesis in the lung and oral cavity is a contact phenomenon; the relationship of smoking to cancer in other organs such as urinary bladder and pancreas is much less clear. Nitrosamines are generally site specific carcinogens, when tested in experimental animals. However, the influence of other tobacco components on the site of activity is not known. Whether nitrosamines play a role

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