Aflatoxin B₁ and Tobacco Products

by

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SUMMARY

The potential for aflatoxin B₁ contamination of tobaccos and its subsequent transfer to smoke has been raised. This paper examines published work relevant to this issue and concludes that aflatoxin B₁ is not a contamination issue on tobaccos and, even if present, would decompose in the burning cigarette and would not transfer to smoke. [Beitr. Tabakforsch. Int. 19 (2000) 167–168]

ZUSAMMENFASSUNG

Es wurde die Frage nach einer möglichen Verunreinigung des Tabaks durch Aflatoxin B₁ und den nachfolgenden Übergang in den Tabakrauch aufgeworfen. Diese Arbeit untersucht die Literatur zu diesem Thema und kommt zu dem Schluß, dass Aflatoxin B₁ kein Verunreinigungsproblem für Tabak darstellt und, auch wenn es vorhanden wäre, in der brennenden Cigarette Zersetzungsprozesse stattfinden und Aflatoxin B₁ nicht in den Rauch übergehen würde. [Beitr. Tabakforsch. Int. 19 (2000) 167–168]

RESUME

La possibilité d'une contamination du tabac par l'aflatoxine B₁ et son transfert ultérieur vers la fumée est discuté. Cette étude examine la littérature relative à ce sujet et aboutit à la conclusion que l'aflatoxine B₁ n'est pas un sujet de contamination du tabac et, même si l'aflatoxine B₁ était présente, une dégradation aurait lieu dans la cigarette au cours de la combustion et l'aflatoxine B₁ ne serait pas transférée vers la fumée. [Beitr. Tabakforsch. Int. 19 (2000) 167–168]

INTRODUCTION

It has recently been suggested that the carcinogenic fungal metabolite of *Aspergillus flavus*, aflatoxin B₁, is present on

tobaccos and will transfer to mainstream and sidestream smoke and that smokers, or people in the presence of smoke, will inhale aflatoxin B₁ (1). This paper examines published work relevant to this assertion and concludes that aflatoxin B₁ is not a contamination issue on tobaccos and, even if present on tobaccos, would not transfer to smoke.

AVAILABLE INFORMATION AND CONCLUSIONS

Work concerning aflatoxin B₁ on tobacco has been carried out by TSO and SOROKIN of the US Department of Agriculture in a range of experiments (2). They assayed mouldy and sound tobaccos for their aflatoxin B₁ content and none was detected.

In addition, cigarettes were made from tobaccos spiked with either 500 ppb or 5000 ppb aflatoxin B₁. Using a method with a detection limit of 0.3 ppb, no aflatoxin B₁ was detected in the smoke condensate (2). These data and the issue of aflatoxin B₁ were subsequently discussed in the 1979 report of the US Surgeon General (3). The report states

Aflatoxins have been reported to occur in many commodities, but its presence in leaf tobacco has not been positively confirmed, although *A. flavus* was known to be present.

The report goes on to conclude

Pure aflatoxin B₁ added to cigarettes was not recovered in the smoke condensate, indicating that aflatoxin B₁, even if present, was changed or decomposed during the smoking process.

The Surgeon General has not seen it necessary to address the issue subsequently.

In a separate piece of work at the Northwest University Medical School in Chicago, cigarettes were spiked with either 100 or 300 µg of aflatoxin B₁ and smoked (4).

Methodology with a detection limit of 0.01 µg demonstrated there was no detectable aflatoxin B₁ in either the cigarette butts, the ash, the smoke condensate or smoke vapour phase trapped in solvent. This study also found that thermal degradation of aflatoxin B₁ occurs at 264 °C, only slightly above its melting point of 263 °C. Thus it is highly unlikely that the aflatoxin B₁ would transfer undecomposed to smoke and this, as outlined above, has been effectively confirmed by TSO and SOROKIN and KAMINSKI *et al.* in their spiking experiments (2, 4).

One positive report of aflatoxin B₁ on tobacco originates from Egypt (5). However, this group also injected cigarettes with 10, 20 and 50 µg aflatoxin B₁, and they confirm the previous reports of no detectable aflatoxin B₁ in the smoke. After smoking, aflatoxin B₁ was found in the cigarette filters. However, the spiking doses of aflatoxin B₁ were injected into the cigarettes in 1 mL of chloroform, which will contaminate the filter and would transfer aflatoxin B₁ to the filter by solvent transfer rather than via the smoke.

The paper speculating that aflatoxin B₁ is present in smoke, cited tobacco industry documents which indicate 100% transfer of aflatoxin B₁ to smoke during tobacco combustion (1). However, subsequent follow up documents from the cited company, report that there is no substance to this claim (6).

Support for the hypothesis of aflatoxin B₁ transfer to mainstream smoke and environmental tobacco smoke was provided by the assertion that the decomposition temperature of aflatoxin B₁, given as 269 °C, is above the combustion temperature of an idling cigarette (1). On the contrary, the degradation temperature of aflatoxin B₁ of 264 °C is well exceeded during the smoking and smouldering of a cigarette (4). The gas and solid phase temperature in a smouldering cigarette are almost 800 °C in the centre of the burning zone and over 500 °C at the edge of the burning zone (10). During a puff, temperatures of over 900 °C occur (7–10). The sidestream products (which go on to become the major contributor to environmental tobacco smoke) leave the burning zone predominantly during the smoulder period between puffs. The sidestream gases (carbon monoxide, carbon dioxide, hydrogen and water) are formed in the interior of the burning zone and diffuse out with an initial temperature in excess of 350 °C. The sidestream particulate phase components are formed in a pyrolysis/ distillation zone immediately behind the burning zone, here the temperatures are up to 600 °C. They diffuse outwards through the partially degraded cigarette paper and become visible as smoke as the sidestream smoke temperature falls below about 150 °C (10–12).

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