



Health
Canada

Santé
Canada

Your health and
safety... our priority.

Votre santé et votre
sécurité... notre priorité.

Aromatic Amines: Contribution to the Mutagenic Activity of Tobacco Smoke



Key Messages

- Aromatic amines (AA) are cancer-causing chemicals found in tobacco smoke.
- Harman, MeAαC, o-toluidine and 1-aminonaphtalene are the AA that contribute the most to the total mutagenic activity of mainstream tobacco smoke.

Background

Mutagens are cancer-causing chemicals capable of triggering the conversion of normal cells into cancer cells. Aromatic amines (AA) are cancer-causing chemicals present in tobacco smoke and are commonly associated with its mutagenic activity.

Health Canada has studied AA in order to determine which of these chemicals contribute the most to the total mutagenic activity of mainstream tobacco smoke. The formula to

estimate the contribution of a certain chemical to the total mutagenic activity of mainstream tobacco smoke is shown below. The concentration of the chemical in mainstream tobacco smoke (measured in nanograms per cigarette) is multiplied by its respective capacity to induce mutations. The mutagenic activity is determined through the bacterial reverse mutation assay using *Salmonella typhimurium* mutant strains TA98, TA1537 and TA100.

Concentration of chemical in mainstream tobacco smoke

(ng/cigarette)

x

Capacity of this chemical to induce mutations

(number of mutations/ng)

=

**Contribution of this chemical to the total mutagenic activity
of mainstream tobacco smoke**

(number of mutations/cigarette)

Results

The Health Canada study analyzed the AA present in mainstream tobacco smoke. The study found that norharman and harman are present in the highest concentration in mainstream tobacco smoke. On the other hand, 4-aminobiphenyl, 3-aminobiphenyl and o-anisidine were found to have the highest

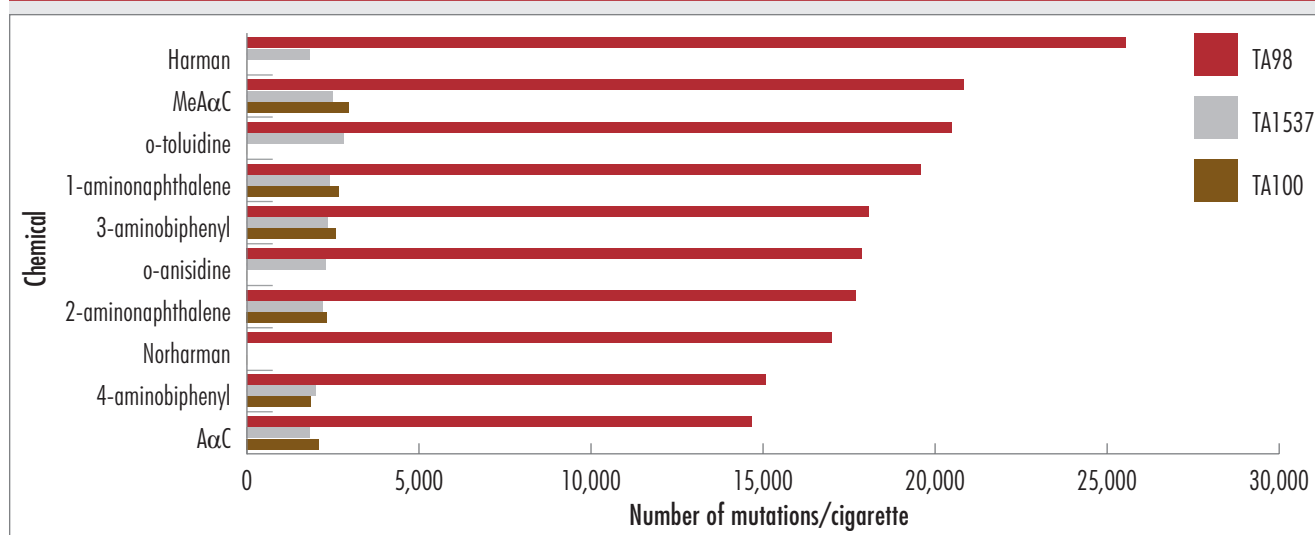
capacity to induce mutations (**Table 1**). Of the chemicals studied, harman, MeAαC, o-toluidine and 1-aminonaphtalene contribute the most to the total mutagenic activity of mainstream tobacco smoke (**Figure 1**).

Aromatic Amines: Contribution to the Mutagenic Activity of Tobacco Smoke

Table 1: Substance concentration in mainstream tobacco smoke and capacity to induce mutations

Chemical	Substance concentration (ng/cig)	Capacity to induce mutations TA98 (mutations/ng)	Capacity to induce mutations TA1537 (mutations/ng)	Capacity to induce mutations TA100 (mutations/ng)	Contribution to mutagenic activity TA98 (mutations/cig)	Contribution to mutagenic activity TA1537 (mutations/cig)	Contribution to mutagenic activity TA100 (mutations/cig)
Norharman	5,659	3	–	–	16,977	–	–
Harman	1,823	14	1	–	25,522	1,823	–
A α C	131	112	14	16	14,672	1,834	2,096
o-toluidine	104	197	27	–	20,488	2,808	–
1-aminonaphthalene	19	1,030	126	140	19,570	2,394	2,660
MeA α C	14	1,488	177	210	20,832	2,478	2,940
2-aminonaphthalene	12	1,475	183	194	17,700	2,196	2,328
o-anisidine	4	4,469	568	–	17,876	2,272	–
3-aminobiphenyl	3	6,021	778	861	18,063	2,334	2,583
4-aminobiphenyl	2	7,531	996	923	15,062	1,992	1,846

Figure 1: Contribution to the total mutagenic activity of mainstream tobacco smoke



Conclusion

Health Canada considers that aromatic amines present in mainstream tobacco smoke can potentially lead to mutations causing cancer.

References

1. Malaisson, E., Levasseur, G., Fillion, J. and Kaiserman, M. *The Identification of Tobacco Smoke Emissions Related to Toxicity/Mutagenicity*. Health Canada, 61th Tobacco Science Research Conference, 2007, Charlotte, United States, paper #12.
2. Health Canada, *Regulations Amending the Tobacco Reporting Regulations*, SOR/2005-179, P.C. 2005-1126, Ottawa, June 2005.
3. Health Canada, *Tobacco Reporting Regulations*, SOR/2000-273, P.C. 2000-1040, Ottawa, June 2000.