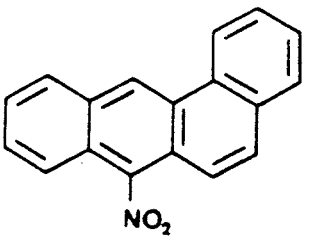
7-NITROBENZ[*a*]ANTHRACENE

1. Chemical and Physical Data

1.1 Synonyms

Chem. Abstr. Services Reg. No.: 20268-51-3
Chem. Abstr. Name: Benz[*a*]anthracene, 7-nitro-
IUPAC Systematic Name: 7-Nitrobenz[*a*]anthracene

1.2 Structural and molecular formulae and molecular weight



$C_{18}H_{11}NO_2$ Mol. wt: 273.3

1.3 Chemical and physical properties of the pure substance

(*a*) *Description*: Yellow crystals (Newman & Lilje, 1979; Chemsyn Science Laboratories, 1988)

(*b*) *Melting-point*: 159–161°C (Newman & Lilje, 1979); 160–163°C (Buckingham, 1987)

(*c*) *Spectroscopy data*: Infra-red, nuclear magnetic resonance (Iversen *et al.*, 1985) and mass (Schuetzle & Jensen, 1985) spectral data have been reported.

(*d*) *Solubility*: Limited solubility in toluene and benzene (Chemsyn Science Laboratories, 1988)

1.4 Technical products and impurities

7-Nitrobenz[*a*]anthracene is available for research purposes in ≥99% purity (Chemsyn Science Laboratories, 1988).

2. Production, Use, Occurrence and Analysis

2.1 Production and use

(*a*) *Production*

7-Nitrobenz[*a*]anthracene is the main product of the nitration of benz[*a*]anthracene (Buckingham, 1987). No evidence was found that this compound has been produced in commercial quantities.

(*b*) *Use*

No evidence was found that 7-nitrobenz[*a*]anthracene has been used for commercial applications.

2.2 Occurrence

7-Nitrobenz[*a*]anthracene was not detected in an extract of the exhaust of a light-duty diesel vehicle (detection limit, ~0.3 mg/kg; Paputa-Peck *et al.*, 1983).

Toners for use in photocopy machines have been produced in quantity since the late 1950s and have seen widespread use. 'Long-flow' furnace black was first used in photocopy toners in 1967; its manufacture involved an oxidation whereby some nitration also occurred. Subsequent changes in the production technique reduced the total extractable nitropyrene content from an uncontrolled level of 5–100 mg/kg to below 0.3 mg/kg (Rosenkranz *et al.*, 1980; Sanders, 1981; Butler *et al.*, 1983), and toners produced from this carbon black since 1980 have not been found to contain detectable levels of mutagenicity or, hence, nitropyrenes (Rosenkranz *et al.*, 1980; Butler *et al.*, 1983).

2.3 Analysis

See the monograph on 1-nitropyrene.

3. Biological Data Relevant to the Evaluation of Carcinogenic Risk to Humans

3.1 Carcinogenicity studies in animals

Intraperitoneal administration

Mouse: Groups of 90 or 100 male and female newborn CD-1 mice received three intraperitoneal injections of 7-nitrobenz[*a*]anthracene (total dose, 2800 nmol [0.8 mg]; purity, >99%) in 10, 20 and 40 μl dimethyl sulfoxide (DMSO) on days 1, 8 and 15 after birth; a total dose of 560 nmol [0.14 mg] benzo[*a*]pyrene (purity, >99%) as three injections; or

three injections of DMSO only (Wislocki *et al.*, 1986). Treatment of a second vehicle control group was begun ten weeks after that of the other groups. At 25–27 days, when the mice were weaned, 25 males and 33 females in the treated group, 37 males and 27 females in the positive control group and 28 and 31 males and 45 and 34 females in the two vehicle control groups were still alive. All remaining mice were killed after one year. Liver tumours occurred in 7/25 7-nitrobenz[*a*]anthracene-treated males (six adenomas and one carcinoma; $p < 0.05$ compared with DMSO controls), 0/33 7-nitrobenz[*a*]anthracene-treated females, 18/37 benzo[*a*]pyrene-treated males, 0/27 benzo[*a*]pyrene-treated females, 2/28 and 5/45 DMSO-treated males, and 0/31 and 0/34 DMSO-treated females. Lung adenomas occurred in significantly more benzo[*a*]pyrene-treated males (13/37) and females (13/27) than in controls ($p < 0.005$), but no significant increase occurred among 7-nitrobenz-[*a*]anthracene-treated males (2/25) or females (3/33). The incidences of lung tumours in the DMSO groups were 1/28 and 4/45 in males and 0/31 and 2/34 in females. [The Working Group noted the short duration of the experiment.]

3.2 Other relevant data

(*a*) *Experimental systems*

Absorption, distribution, excretion and metabolism

Liver microsomes from male Sprague-Dawley rats pretreated with 3-methylcholanthrene catalysed the conversion of 7-nitrobenz[*a*]anthracene to 7-nitrobenz[*a*]-anthracene *trans*-3,4-dihydrodiol and 7-nitrobenz[*a*]anthracene *trans*-8,9-dihydrodiol (Fu & Yang, 1989).

Rat liver microsomes and xanthine oxidase, a mammalian nitroreductase, catalysed the binding of 7-nitrobenz[*a*]anthracene to exogenous DNA (Colvert & Fu, 1986; Colvert *et al.*, 1989).

Toxic effects

No data were available to the Working Group.

Genetic and related effects

The genetic and related effects of nitroarenes and of their metabolites have been reviewed (Rosenkranz & Mermelstein, 1983; Beland *et al.*, 1985; Rosenkranz & Mermelstein, 1985; Tokiwa & Ohnishi, 1986).

7-Nitrobenz[*a*]anthracene did not induce mutation in *Salmonella typhimurium* TA98 or TA100 in the presence or absence of an exogenous metabolic system from Aroclor 1254-induced rat liver (Greibrokk *et al.*, 1984; Fu *et al.*, 1985; White *et al.*, 1985 (10 μg/plate)).

(*b*) *Humans*

No data were available to the Working Group.

3.3 Epidemiological studies and case reports of carcinogenicity in humans

No data were available to the Working Group.

4. Summary of Data Reported and Evaluation

4.1 Exposure data

No data were available to the Working Group.

4.2 Experimental data

7-Nitrobenz[*a*]anthracene was tested for carcinogenicity in one experiment by intraperitoneal injection into newborn mice, resulting in an increased incidence of liver-cell tumours in males.

4.3 Human data

No data were available to the Working Group.

4.4 Other relevant data

Metabolism of 7-nitrobenz[*a*]anthracene led to binding to exogenous DNA. It was not mutagenic to bacteria.

4.5 Evaluation[1]

There is *limited evidence* for the carcinogenicity in experimental animals of 7-nitrobenz[*a*]-anthracene.

No data were available from studies in humans on the carcinogenicity of 7-nitrobenz[*a*]-anthracene.

Overall evaluation

7-Nitrobenz[*a*]anthracene *is not classifiable as to its carcinogenicity to humans (Group 3).*

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[1]For definitions of the italicized terms, see Preamble, pp. 25–28.

Summary table of genetic and related effects of 7-nitrobenz[*a*]anthracene

Nonmammalian systems												Mammalian systems																									
Prokaryotes		Lower eukaryotes				Plants			Insects				*In vitro*													*In vivo*											
													Animal cells							Human cells							Animals						Humans				
D	G	D	R	G	A	D	G	C	R	G	C	A	D	G	S	M	C	A	T	I	D	G	S	M	C	A	T	I	D	G	S	M	C	DL	A	D	S	M	C	A
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A, aneuploidy; C, chromosomal aberrations; D, DNA damage; DL, dominant lethal mutation; G, gene mutation; I, inhibition of intercellular communication; M, micronuclei; R, mitotic recombination and gene conversion; S, sister chromatid exchange; T, cell transformation

–, considered to be negative for the specific end point and level of biological complexity

5. References

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