



WORLD HEALTH ORGANIZATION
INTERNATIONAL AGENCY FOR RESEARCH ON CANCER

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans

Volume 39

Some Chemicals Used in Plastics and Elastomers

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ETHYL ACRYLATE

VOL.: 39 (1986) (p. 81)

CAS No.: 140-88-5

Chem. Abstr. Name: 2-Propenoic acid, ethyl ester

5. Summary of Data Reported and Evaluation

5.1 Exposure data

Ethyl acrylate has been produced commercially since the early 1930s. Occupational exposure occurs in the manufacture of ethyl acrylate and in the manufacture and use of its emulsion polymers. It is also used as a synthetic flavouring substance and fragrance adjuvant in consumer products.

5.2 Experimental data

Ethyl acrylate was tested for carcinogenicity by gavage in mice and rats. Dose-related increases in the incidence of squamous-cell papillomas and carcinomas of the forestomach were observed in both species. Ethyl acrylate was tested by inhalation in the same strains of mice and rats; no treatment-related neoplastic lesion was observed. No treatment-related tumour was observed following skin application of ethyl acrylate for lifespan to male mice.

In one experiment in rats, oral administration of ethyl acrylate produced signs of embryotoxicity and foetotoxicity at mildly maternally toxic doses but did not increase foetal malformation. It was not embryotoxic, foetotoxic or teratogenic to rats at an airborne concentration that produced slight maternal toxicity.

Ethyl acrylate was not mutagenic to *Salmonella typhimurium* in the presence or absence of an exogenous metabolic system, nor was it mutagenic to *Drosophila melanogaster*. It induced chromosomal aberrations in Chinese hamster lung cells *in vitro* and micronuclei in the bone marrow of mice treated *in vivo*.

5.3 Human data

No data were available to evaluate the reproductive effects or prenatal toxicity of ethyl acrylate to humans.

No case report or epidemiological study was available to evaluate the carcinogenicity of ethyl acrylate to humans.

5.4 Evaluation

There is *sufficient evidence* for the carcinogenicity of ethyl acrylate in experimental animals.

No data on humans were available.

For definition of the italicized terms, see [Preamble Evaluation](#).

Previous evaluation: [Vol. 19 \(1979\)](#)

Subsequent evaluation: [Vol. 71 \(1999\)](#)

Synonyms

- Acrylic acid, ethyl ester
- Carboset 511
- CE 245
- Ethoxycarbonylethylene
- Ethyl propenoate
- Ethyl 2-propenoate
- Latol 28-tall oil fatty acid

Last updated: 13 April 1999

METHYL ACRYLATE

VOL.: 39 (1986) (p. 99)

CAS No.: 96-33-3

Chem. Abstr. Name: 2-Propenoic acid, methyl ester

5. Summary of Data Reported and Evaluation

5.1 Exposure data

Methyl acrylate has been available commercially since 1944. Occupational exposure may occur during its use, primarily as a comonomer with acrylonitrile in the preparation of acrylic and modacrylic fibres. No data on occupational exposure to this compound were available to the Working Group.

5.2 Experimental data

In one study reported as an abstract, in which rats were exposed to methyl acrylate by inhalation for two years, no neoplastic effect was reported.

No data were available to evaluate the reproductive effects or prenatal toxicity of methyl acrylate to experimental animals.

Methyl acrylate was not mutagenic to bacteria, in the presence or absence of an exogenous metabolic system. It induced chromosomal aberrations in Chinese hamster lung cells *in vitro* and micronuclei in the bone marrow of mice treated *in vivo*.

5.3 Human data

No data were available to evaluate the reproductive effects or prenatal toxicity of methyl acrylate to humans.

No case report or epidemiological study was available to evaluate the carcinogenicity of methyl acrylate to humans.

5.4 Evaluation

There is *inadequate evidence* for the carcinogenicity of methyl acrylate to experimental animals.

No data on humans were available.

In the absence of epidemiological data, no evaluation of the carcinogenicity of methyl acrylate to humans could be made.

For definition of the italicized terms, see [Preamble Evaluation](#).

Previous evaluation: [Vol. 19 \(1979\)](#)

Subsequent evaluation: [Vol. 71 \(1999\)](#)

Synonyms

- Acrylic acid, methyl ester
- Methoxycarbonylethylene
- Methyl acrylate, monomer
- Methyl propenate
- Methyl propenoate
- Methyl prop-2-enoate
- Methyl-2-propenoate
- Propenoic acid, methyl ester

Last updated: 13 April 1999

VINYLIDENE FLUORIDE

VOL.: 39 (1986) (p. 227)

CAS No.: 75-38-7

Chem. Abstr. Name: Ethene, 1,1-difluoro-

5. Summary of Data Reported and Evaluation

5.1 Exposure data

Vinylidene fluoride has been produced commercially since the 1940s. It is used in the manufacture of polyvinylidene fluoride and elastomeric copolymers. Exposure is limited to the manufacture of the monomer and its use in the production of polyvinylidene fluoride and elastomeric copolymers.

5.2 Experimental data

In a limited study in one strain of rats by oral administration, a small number of liposarcomas was observed in treated animals.

No data were available to evaluate the reproductive effects or prenatal toxicity of vinylidene fluoride to experimental animals.

Vinylidene fluoride gave equivocal results for mutagenicity to *Salmonella typhimurium* when tested in the presence of an exogenous metabolic system.

5.3 Human data

No data were available to evaluate the reproductive effects or prenatal toxicity of vinylidene fluoride to humans.

No case report or epidemiological study was available to evaluate the carcinogenicity of vinylidene fluoride to humans.

5.4 Evaluation

There is *inadequate evidence* for the carcinogenicity of vinylidene fluoride in experimental animals.

No data on humans were available.

In the absence of epidemiological data, no evaluation of the carcinogenicity of vinylidene fluoride to humans could be made.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: [Vol. 71 \(1999\)](#)

Synonym

- VDF

- Vinylidene difluoride

Last updated: 13 April 1999

11-AMINOUNDECANOIC ACID

VOL.: 39 (1986) (p. 239)

CAS No.: 2432-99-7

Chem. Abstr. Name: Undecanoic acid, 11-amino-

5. Summary of Data Reported and Evaluation

5.1 Exposure data

11-Aminoundecanoic acid is synthesized by one company for the production of Nylon 11.

5.2 Experimental data

11-Aminoundecanoic acid was tested for carcinogenicity in mice and rats by administration in the diet. Increased incidences of transitional-cell carcinomas of the urinary bladder and neoplastic nodules of the liver were observed in male rats. Transitional-cell carcinomas of the kidney and epithelial hyperplasia of the urinary bladder and renal pelvis were observed in male and female rats. No clear evidence for an increased incidence of treatment-related tumours was seen in mice.

No data were available to evaluate the reproductive effects or prenatal toxicity of 11-aminoundecanoic acid to experimental animals.

11-Aminodecanoic acid was not mutagenic to *Drosophila melanogaster*.

5.3 Human data

No data were available to evaluate the reproductive effects or prenatal toxicity of 11-aminoundecanoic acid to humans.

No case report or epidemiological study was available to evaluate the carcinogenicity of 11-aminoundecanoic acid to humans.

5.4 Evaluation

There is *limited evidence* for the carcinogenicity of 11-aminoundecanoic acid in experimental animals.

No data on humans were available.

In the absence of epidemiological data, no evaluation of the carcinogenicity of 11-aminoundecanoic acid to humans could be made.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 57: **Group 3**)

Synonyms

- Aminoundecanoic acid

- l-Aminoundecanoic acid
- 11-Aminoundecylic acid

Last updated: 21 April 1998

3,3'-DIMETHOXYBENZIDINE-4,4'-DIISOCYANATE

VOL.: 39 (1986) (p. 279)

CAS No.: 91-93-0

Chem. Abstr. Name: 1,1'-Biphenyl, 4,4'-diisocyanato-3,3'-

5. Summary of Data Reported and Evaluation

5.1 Exposure data

3,3'-Dimethoxybenzidine-4,4'-diisocyanate has been used in isocyanate-based adhesives and as a components of polyurethane elastomers. There is no evidence of current exposure.

5.2 Experimental data

3,3'-Dimethoxybenzidine-4,4'-diisocyanate was tested for carcinogenicity in one study in mice by administration in the diet and in one study in rats by gavage followed by dietary administration. No treatment-related tumour was observed in mice. A statistically significant increase in the combined incidence of leukaemia and malignant lymphomas was observed in both male and female rats, together with a treatment-related increase in the incidence of tumours of the skin and Zymbal gland. Increases in the incidence of endometrial stromal polyps were observed in female rats.

No data were available to evaluate the reproductive effects or prenatal toxicity of 3,3'-dimethoxybenzidine-4,4'-diisocyanate to experimental animals.

3,3'-Dimethoxybenzidine-4,4'-diisocyanate was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system.

5.3 Human data

No data were available to evaluate the reproductive effects or prenatal toxicity of 3,3'-dimethoxybenzidine-4,4'-diisocyanate to humans.

No case report or epidemiological study was available to evaluate the carcinogenicity of 3,3'-dimethoxybenzidine-4,4'-diisocyanate to humans.

5.4 Evaluation

There is *limited evidence* for the carcinogenicity of 3,3'-dimethoxybenzidine-4,4'-diisocyanate to experimental animals.

No data on humans were available.

In the absence of epidemiological data, no evaluation of the carcinogenicity of 3,3'-dimethoxybenzidine-4,4'-diisocyanate to humans could be made.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 62: **Group 3**)

Synonyms

- DADI
- Dianisidine diisocyanate
- 3,3'-Dimethoxy-4,4'-biphenyl diisocyanate
- 3,3'-Dimethoxy-4,4'-biphenylene diisocyanate
- 3,3'-Dimethoxy-4,4'-biphenylene isocyanate
- 3,3'-Dimethoxy-4,4'-biphenylene isocyanic acid ester
- 3,3'-Dimethoxy-4,4'-diphenyl isocyanate
- Isocyanic acid, 3,3'-dimethoxy-4,4'-biphenylene ester
- NCI-CO2175

Last updated: 21 April 1998

2,6-DICHLORO-*para*-PHENYLENEDIAMINE

VOL.: 39 (1986) (p. 325)

CAS No.: 609-20-1

Chem. Abstr. Name: 1,4-Benzenediamine, 2,6-dichloro-

5. Summary of Data Reported and Evaluation

5.1 Exposure data

2,6-Dichloro-*para*-phenylenediamine has been used to a limited extent as an intermediate in dye and resin manufacture. The main potential for exposure derives from its formation as a metabolite of the pesticide 2,6-dichloro-4-nitroaniline.

4.2 Experimental data

2,6-Dichloro-*para*-phenylenediamine was tested in mice and rats by oral administration in the diet. Increased numbers of liver-cell tumours were observed in mice; no treatment-related tumour was found in rats.

No data were available to evaluate the reproductive effects or prenatal toxicity of 2,6-dichloro-*para*-phenylenediamine to experimental animals.

2,6-Dichloro-*para*-phenylenediamine was mutagenic to *Salmonella typhimurium* in the presence and absence of an exogenous metabolic system.

4.3 Human data

No data were available to evaluate the reproductive effects or prenatal toxicity of 2,6-dichloro-*para*-phenylenediamine to humans.

No case report or epidemiological study was available to evaluate the carcinogenicity of 2,6-dichloro-*para*-phenylenediamine to humans.

4.4 Evaluation

There is *limited evidence* for the carcinogenicity of 2,6-dichloro-*para*-phenylenediamine to experimental animals.

No data on humans were available.

In the absence of epidemiological data, no evaluation of the carcinogenicity of 2,6-dichloro-*para*-phenylenediamine to humans could be made.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 62: **Group 3**)

Synonyms

- C.I. 37020
- Daito Brown Salt RR
- 1,4-Diamino-2,6-dichlorobenzene
- 2,5-Diamino-1,3-dichlorobenzene
- 2,6-Dichloro-1,4-benzenediamine
- 2,6-Dichloro-1,4-phenylenediamine
- 3,5-Dichloro-1,4-phenylenediamine
- Fast Brown RR Salt

Last updated: 21 April 1998

MELAMINE

VOL.: 39 (1986) (p. 333)

CAS No.: 108-78-1

Chem. Abstr. Name: 1,3,5-Triazine-2,4,6-triamine

5. Summary of Data Reported and Evaluation

5.1 Exposure data

Melamine has been available commercially since the late 1930s. Occupational exposure to this compound may occur during its production and use in the manufacture of laminates, surface coatings, moulding compounds and textiles. No measurement of such exposure was available to the Working Group.

5.2 Experimental data

Melamine was tested for carcinogenicity by oral administration in the diet in one study in mice and in one study in rats, and for initiating activity by skin application in one study in mice. No neoplasm related to treatment was observed after oral administration to mice. Male rats fed diets containing melamine developed transitional-cell tumours of the urinary bladder; with one exception, all tumour-bearing animals had bladder stones probably consisting of melamine. This finding precluded a clear interpretation of the results. In a two-stage mouse-skin assay in which melamine was tested at one dose level, it did not show initiating activity.

The available data were inadequate to evaluate the reproductive effects or prenatal toxicity of melamine to experimental animals.

Melamine was not mutagenic to *Salmonella typhimurium* in the presence or absence of an exogenous metabolic system nor was it mutagenic to *Drosophila melanogaster*.

5.3 Human data

No data were available to evaluate the reproductive effects or prenatal toxicity of melamine to humans.

No case report or epidemiological study was available to evaluate the carcinogenicity of melamine to humans.

5.4 Evaluation

There is *inadequate evidence* for the carcinogenicity of melamine to experimental animals.

No data on humans were available.

In the absence of epidemiological data, no evaluation of the carcinogenicity of melamine to humans could be made.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: Suppl. 7 (1987) (p. 65); [Vol. 73 \(1999\)](#)

Synonyms

- Ammelide
- Cyanuramide
- Cyanuric triamide
- Cyanurotriamide
- Cyanurotriamine
- Cyanurtriamide
- Cymel
- Hicophor PR
- Isomelamine
- NCI-C50715
- Teoharn
- Theoharn
- Triaminotriazine
- 2,4,6-Triaminotriazine
- 2,4,6-Triamino-s-triazine
- 2,4,6-Triamino-1,3,5-triazine
- s-Triazinetriamine
- 1,3,5-Triazine 2,4,6(1*H*,3*H*,5*H*)-trimine
- Virset 656-4

Last updated: 30 September 1999

4,4'-METHYLENEDIANILINE AND ITS DIHYDROCHLORIDE

VOL.: 39 (1986) (p. 347)

4,4'-Methylenedianiline

CAS No.: 101-77-9

Chem. Abstr. Name: Benzenamine, 4,4'-methylenebis-

4,4'-Methylenedianiline dihydrochloride

CAS No.: 13552-44-8

Chem. Abstr. Name: Benzenamine, 4,4'-methylenebis-, dihydrochloride

5. Summary of Data Reported and Evaluation

5.1 Exposure data

4,4'-Methylenedianiline has been available commercially since the 1920s. It is used mainly as an intermediate in 4,4'-methylenediphenyl diisocyanate production and as a curing agent for epoxy resins. Exposure occurs during the production of 4,4'-methylenedianiline and the use of 4,4'-methylenediphenyl diisocyanate resins.

5.2 Experimental data

4,4'-Methylenedianiline and its dihydrochloride were tested for carcinogenicity by oral administration in mice, rats and dogs. Treatment-related increases in the incidences of thyroid follicular-cell adenomas and hepatocellular neoplasms were observed in both male and female mice. In rats, treatment-related increases in the incidences of thyroid follicular-cell carcinomas and hepatic nodules were observed in males and thyroid follicular-cell adenomas occurred in females. In a study in rats in which 4,4'-methylenedianiline was administered orally in conjunction with a known carcinogen, the incidence of thyroid tumours was greater than that produced by the carcinogen alone.

The available data were inadequate to evaluate the reproductive effects or prenatal toxicity of 4,4'-methylenedianiline to experimental animals.

4,4'-Methylenedianiline was mutagenic to *Salmonella typhimurium* in the presence of an exogenous metabolic system. It induced DNA damage in Chinese hamster V79 cells in the presence of an exogenous metabolic system, and induced DNA damage in the liver of rats and sister chromatid exchange in the bone marrow of mice treated *in vivo*.

5.3 Human data

4,4'-Methylenedianiline is hepatotoxic. No data were available to evaluate the reproductive effects or prenatal toxicity of 4,4'-methylenedianiline to humans.

No case report or epidemiological study was available to evaluate the carcinogenicity of 4,4'-methylenedianiline to humans.

5.4 Evaluation

There is *sufficient evidence* for the carcinogenicity of 4,4'-methylenedianiline and its dihydrochloride to experimental animals.

No data on humans were available.

For definition of the italicized terms, see [Preamble Evaluation](#).

Previous evaluation: [Vol. 4 \(1974\)](#)

Subsequent evaluation: Suppl. 7 (1987) (p. 66: **Group 2B**)

Synonyms

- 4-(4-Aminobenzyl)aniline
- Ancamine TL
- Araldite Hardener 972
- Bis(aminophenyl)methane
- Bis(4-aminophenyl)methane
- Bis(*para*-aminophenyl)methane
- Dadpm
- DAPM
- DDM
- Diaminodiphenylmethane
- 4,4'-Diaminodiphenylmethane
- *para,para'*-Diaminodiphenylmethane
- Di(4-aminophenyl)methane
- Dianilinemethane
- Dianilinomethane
- 4,4'-Diphenylmethanediamine
- Epicure DDM
- Epikure DDM
- HT972
- Jeffamine AP-20
- MDA
- Methylenebis(aniline)
- 4,4'-Methylenebis(aniline)
- 4,4'-Methylenebisbenzenamine
- 4,4'-Methylenebis(benzeneamine)
- Methylenedianiline
- Methylenedianiline (VAN)
- *para,para*-Methylenedianiline
- *para,para'*-Methylenedianiline
- 4,4'-Methylenedibenzenamine
- Sumicure M
- Tonox

Synonym

- *para,para'*-Methylenedianiline dihydrochloride

DICHLOROACETYLENE

VOL.: 39 (1986) (p. 369)

CAS No.: 7572-29-4

Chem. Abstr. Name: Ethyne, dichloro-

5. Summary of Data Reported and Evaluation

5.1 Exposure data

Dichloroacetylene is not available commercially. It can be formed from the decomposition of trichloroethylene.

5.2 Experimental data

Dichloroacetylene was tested for carcinogenicity in mice and rats by inhalation. Treatment-related increases were observed in the incidence of adenocarcinomas of the kidney in male mice. In rats, the occurrence of benign tumours of the liver and kidney and an increased incidence of lymphomas were reported.

No data were available to evaluate the reproductive effects or prenatal toxicity of dichloroacetylene to experimental animals.

Dichloroacetylene and one of its decomposition products, trichloroacryloyl chloride, were mutagenic to *Salmonella typhimurium* in the presence or absence of an exogenous metabolic system. Under the same conditions a mixture of dichloroacetylene and acetylene was not mutagenic.

5.3 Human data

Dichloroacetylene is a neurotoxin, with a special affinity for the cranial nerves. No data were available to evaluate the reproductive effects or prenatal toxicity of dichloroacetylene to humans.

No case report or epidemiological study was available to evaluate the carcinogenicity of dichloroacetylene to humans.

5.4 Evaluation

There is *limited evidence* for the carcinogenicity of dichloroacetylene to experimental animals.

No data on humans were available.

In the absence of epidemiological data, no evaluation of the carcinogenicity of dichloroacetylene to humans could be made.

For definition of the italicized terms, see [Preamble Evaluation](#).

Subsequent evaluation: [Vol. 71 \(1999\)](#)

Synonym

- Ethyne, dichloro-

Last updated: 13 April 1999