



WORLD HEALTH ORGANIZATION
INTERNATIONAL AGENCY FOR RESEARCH ON CANCER

IARC Monographs on the Evaluation of Carcinogenic Risks to Humans

Volume 19

Some Monomers, Plastics and Synthetic Elastomers, and Acrolein

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Last updated: 13 April 1999

ACRYLIC ACID AND ACRYLATES

VOL.: 19 (1979) (p. 47)

Acrylic acid

CAS No.: 79-10-7

Chem. Abstr. Name: 2-Propenoic acid

Methyl acrylate

CAS No.: 96-33-3

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

Ethyl acrylate

CAS No.: 140-88-5

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

Polyacrylic acid

CAS No.: 9003-01-4

Chem. Abstr. Name: 2-Propenoic acid homopolymer

5. Summary of Data Reported and Evaluation

5.1 Experimental data

No carcinogenicity or mutagenicity data on acrylic acid, methyl acrylate or polyacrylic acid were available to the Working Group.

Ethyl acrylate was tested in rats by oral administration; the reporting of the experiment was considered inadequate by the Working Group. No mutagenicity data on ethyl acrylate were available to the Working Group.

Acrylic acid is embryotoxic and teratogenic.

5.2 Human data

No case reports or epidemiological studies relating to the carcinogenicity of acrylic acid, methyl acrylate, ethyl acrylate or polyacrylic acid were available to the Working Group.

Acrylic acid is used primarily for the production of acrylates and polymers, and human exposure may be expected to occur. The use of methyl acrylate, ethyl acrylate and polyacrylic acid in a variety of textile, surface coating and other applications suggests other occupational exposures. Because methyl and ethyl acrylate as well as polyacrylic acid components are permitted in some countries for use in contact with foods, the general population may be exposed; in addition, polyacrylic acid sodium salt has been used as a food additive in one country.

5.3 Evaluation

The data available to the Working Group do not permit an evaluation of the carcinogenicity to humans of acrylic acid, methyl acrylate, ethyl acrylate or polyacrylic acid.

The Working Group noted the absence of data on carcinogenicity and mutagenicity for this group of

substances and considered that suitable experiments should be undertaken. Even in the absence of such data in animals, because of the substantial production of these compounds and products containing them as well as the diversity of end-applications, research should be undertaken to identify exposed groups, to measure exposure levels and to conduct the appropriate epidemiological studies.

Subsequent evaluations: [Vol 39 \(1986\) \(Methyl acrylate, ethyl acrylate\)](#); [Suppl. 7 \(1987\) \(Ethyl acrylate, p. 63: **Group 2B**\) \(Methyl acrylate, p. 66: **Group 3**\) \(Polyacrylic acid, p. 70: **Group 3**\)](#); [Vol 71 \(1999\) \(Acrylic acid\)](#); [\(Ethyl acrylate\)](#); [\(Methyl acrylate\)](#)

For definition of Groups, see [Preamble Evaluation](#).

Synonyms for Acrylic acid

- Acroleic acid
- Ethylenecarboxylic acid
- Vinylformic acid

Synonyms for Methyl acrylate

- Acrylic acid methyl ester
- Methoxycarbonylethylene
- Methyl propenoate
- Methy1-2-propenoate

Synonyms for Ethyl acrylate

- Acrylic acid ethyl ester
- Ethoxycarbonylethylene
- Ethyl propenoate
- Ethyl 2-propenoate

Synonyms for Polyacrylic acid

- Acrylic acid polymer
- Acrylic acid resin
- Acrylic polymer
- Acrylic resin
- Acrysol A 1
- Acrysol A 3
- Acrysol A 5
- Acrysol AC 5
- Acrysol ASE-75
- Acrysol WS-24
- Antiprex A
- Aron
- Aron A 10H
- Atactic poly(acrylic acid)
- Carbopol 940
- Carbopol 941
- Carbopol 960
- Dispex C40
- Good-rite K 37
- Good-rite K 702
- Good-rite WS 801

- Junlon 110
- Nalfloc 636
- OLD 01
- PA 11M
- PAA-25
- P 11H
- Polyacrylate
- Poly(acrylic acid)
- Primal ASE 60
- R968
- Revacryl A 191
- Rohagit SD 15
- Synthemul 90-588
- Versicol E 7
- Versicol E9
- Viscalex HV 30
- Viscon 103
- WS 24
- WS-801
- XPA

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ETHYLENE AND POLYETHYLENE

VOL.: 19 (1979) (p. 157)

Ethylene

CAS No.: 74-85-1

Chem. Abstr. Name: Ethene

Low-density and high-density polyethylenes

CAS No.: 9002-88-4

Chem. Abstr. Name: Ethene homopolymer

5. Summary of Data Reported and Evaluation

5.1 Experimental data

No data on the carcinogenicity or mutagenicity of ethylene were available to the Working Group.

Polyethylene was tested by subcutaneous implantation in rats and mice, by intraperitoneal implantation in rats, using discs, films, rods, fragments and powder, and by intrauterine insertion in rats of polyethylene devices. Subcutaneous implantation of all forms except the powder resulted in local sarcomas, the incidences of which varied with the size and form of the implants. The results obtained following intrauterine implantation of polyethylene devices could not be used to evaluate the carcinogenicity of polyethylene.

5.2 Human data

The massive production of ethylene and polyethylene and the general use of the polymer over the past several decades indicate that exposure of workers and the general population is common. In addition, medical use (e.g., for intrauterine contraceptive devices) has been extensive. No epidemiological studies relating to the carcinogenicity of these compounds were available to the Working Group.

5.3 Evaluation

No information was available to the Working Group for evaluating the possible carcinogenic effects of ethylene in humans; and the available data on polyethylene do not permit an evaluation of its potential carcinogenicity. Experimental carcinogenicity studies on the monomer are recommended.

The results of animal implantation experiments using polyethylene and the limitations of the data from humans indicate the need for further epidemiological studies of persons receiving implants or insertions of devices made from the polymer.

Subsequent evaluations: Suppl. 7 (1987) (Ethylene, p. 63: **Group 3**) (Polyethylene, p. 70: **Group 3**); [Vol. 60 \(1994\) \(Ethylene\)](#) For definition of Groups, see [Preamble Evaluation](#).

Synonyms for Ethylene

- Acetene
- Bicarburetted hydrogen
- Olefiant gas

Synonyms for Polyethylene

- AC 8
- AC 8 (polymer)
- AC 394
- AC GA: ACP 6
- A 60-20R
- Acroart
- Agilene
- Alathon 14
- Alcowax 6
- Aldyl A
- Alithon 7050
- Alkathene
- Allied PE 617
- Alphex FIT 221
- Ambythene
- Amoco 610A4
- Bakelite DFD 3300
- Bareco Polywax 2000
- Bicolene C
- BPE-I
- Bralen KB 2-11
- Bulen A
- Bulen A 30
- Carlona 58-030
- Chemplex 3006
- CIPE
- Coathylene HA 1671
- Courlene-X3
- CPE
- Cryopolythene
- Cry-O-Vac L
- Daisolac
- Daplen
- Daplen 1810 H
- DFD 0173
- DFDJ 5505
- DGNB 3825
- Diothene
- Dixopak
- DMDJ 4309
- DQDA 1868
- DQWA 0355
- DXM 100
- Dylan
- Dylan super
- Dylan WPD 205
- DYNH
- DYNK 2
- Eltex
- Epolene C
- Ethene polymer
- Etherin
- Etherol 23F203
- Ethylene homopolymer
- Ethylene polymer
- Fabritone PE
- FB 217
- Fertene

- Flamolin MF 15711
- Flothene
- FM 510
- Fortiflex 6015
- FP 42100 GP
- Grex
- Grisolen
- HFDB 4201
- Hi-fax
- Hizex
- Hi-Zex 7000F
- Hoechst PA 190
- Hoechst Wax PA 520
- Hostalen
- Hostalen GUR
- Irax
- Irrathene R
- Lacqten 1020
- LD 400
- LDPE 4
- Lupolen
- Lupolen 4261A
- Manolene 6050
- Marlex 9
- Microthene
- Microthene 510
- Mirason 9
- Mirathen
- Mirathen 1313
- Moplen RO-QG 6015
- Neopolen
- Neozex 45150
- Neozex 4010B
- Nopol (polymer)
- Novatec JUO 80
- NVC 9025
- Okiten G23
- Orizon
- 6020P
- PA 130
- PAD 522
- P 2010B
- PE 512
- PE 617
- PEN 100
- PEP 211
- PES 100
- PES 200
- Petrothene
- P 4007EU
- P 4070L
- Planium
- Plaskon PP 60-002
- Plastazote X 1016
- Plastronga
- Plastylene MA 2003
- Politen
- Politen I 020
- Poly-Em 12

- Polyethylene AS
- Polymist A12
- Polymul CS 81
- Polysion N 22
- Polywax 1000
- Polythene
- Porolen
- P 2070P
- PPE 2
- Procene UF 1.5
- Profax A 60-008
- P 2020T
- PTs 2
- PVP 8T
- Py 100
- RCH 1000
- Repoc
- Rigidex
- Ropol
- Ropothene OB.03-110
- Sanwax 161P
- Sclair 59
- SDP 640
- Sholex 5003
- Socarex
- SRM 1475
- SRM 1476
- Staflen E 650
- Stamyln 900
- Stamyln 1000
- Sumikathene
- Sunwax 151
- Super dylan
- Suprathen
- Takathene
- Telcotene
- Telecothene
- Tenaplas
- Tenite 800
- Trovidur PE
- Tyrin
- Tyvek
- Unifos Dyob S
- Unifos EFD 0118
- Valeron
- Valspex 155-53
- Velustral KPA
- Vestolen
- Wax LE
- WJG 11
- WNF 15
- WVG 23
- XL 335-1
- XL 1246
- XNM 68
- XO 440
- Yukalon EH 30
- ZF 36

Last updated: 30 March 1998

METHYL METHACRYLATE AND POLYMETHYL METHACRYLATE

VOL.: 19 (1979) (p. 187)

Methyl methacrylate

CAS No.: 80-62-6

Chem. Abstr. Name: 2-Methyl-2-propenoic acid methyl ester

Polymethyl methacrylate

CAS No.: 9011-14-7

Chem. Abstr. Name: 2-Methyl-2-propenoic acid methyl ester homopolymer

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Methyl methacrylate was tested by oral administration and by skin application in rats. These studies were considered inadequate by the Working Group for an evaluation of the carcinogenicity of this compound. No data on the mutagenicity of methyl methacrylate alone were available to the Working Group.

Polymethyl methacrylate, when implanted intramuscularly, subcutaneously or intraperitoneally as discs, produced local sarcomas in rats. In mice, subcutaneous implantation of polymethyl methacrylate films also resulted in local sarcomas. Intramuscular implantation of polymethyl methacrylate in guinea-pigs and implantation into the cheek pouch in hamsters produced no implantation site tumours.

5.2 Human data

No case reports or epidemiological studies relating to the carcinogenicity of methyl methacrylate or polymethyl methacrylate were available to the Working Group. The wide use of both materials, including major industrial and specialized medical products, particularly in surface coatings, indicates human exposure. This has been documented in two studies that relate to the toxicity of these substances.

5.3 Evaluation

The data available to the Working Group do not permit an evaluation of the carcinogenicity to humans of methyl methacrylate or polymethyl methacrylate. However, the results of available animal experiments, together with evidence both of occupational exposure by inhalation and of exposure by implantation arising from medical applications, indicate the need for experimental and epidemiological studies.

Subsequent evaluation: Suppl. 7 (1987) (p. 70: Polymethyl methacrylate - **Group 3**); [Vol. 60 \(1994\) \(Methyl methacrylate\)](#)

For definition of Groups, see [Preamble Evaluation](#).

Synonyms for Methyl methacrylate

- Methacrylic acid methyl ester
- Methylmethacrylate
- Methyl 2- methylpropenoate
- Methyl 2-methyl-2-propenoate
- MME

- Pegalan

Synonyms for Polymethyl methacrylate

- Acronal S 320 D
- Acrylite
- Acryloid A-15
- Acrypet
- Acrysol ASE
- Akuripetto VH
- Altulor M 70
- A 21LV
- AO 120
- CMW Bone Cement
- Crinothene
- Degalan LP 59/03
- Delpet 50M
- Diakon
- Disapol M
- DV 400
- Elvacite 2008
- K 120 N
- Kallocryl K
- Kallodent 222
- Kaneace PA 20
- Korad
- LPT
- LSO-M
- Lucite
- Lucite 30
- Metaplex NO:
- Methacrylic acid methyl ester polymers
- Methyl methacrylate homopolymer
- Methyl methacrylate polymer
- Methyl methacrylate resin
- MH 101-2
- 50N
- 50N (polymer)
- Organic glass E 2
- Osteobond
- Osteobond Surgical Bone Cement
- Palacos
- Paraglas
- Parapet 60N
- Paraplex P 543
- Perspex
- Plex 8572F
- Plex 8572-F
- Plexiglas
- Plexigum M 920
- PMMA
- Poly(methyl methacrylate)
- Pontalite
- Repairsin
- Resarit 4000
- Rhoplex B 85
- Riston
- Romacryl

- Shinkolite
- SO 95
- SOL
- ST 1
- ST 1 (polymer)
- Stellon pink
- Sumipex B-LG
- Superacryl AE
- Surgical Simplex
- Tensol 7
- Torex G
- Vedril

Last updated: 30 March 1998

PROPYLENE AND POLYPROPYLENE

VOL.: 19 (1979) (p. 213)

Propylene

CAS No.: 115-07-1

Chem. Abstr. Name: 1-Propene

Polypropylene

CAS No.: 9003-07-0

Chem. Abstr. Name: 1-Propene homopolymer

5. Summary of Data Reported and Evaluation

5.1 Experimental data

No data on the carcinogenicity or mutagenicity of propylene were available to the Working Group.

Polypropylene was tested in one experiment in rats by subcutaneous implantation of discs or powder; local sarcomas were induced at the site of implantation.

5.2 Human data

The massive production of both propylene and polypropylene and the general use of the polymer over the past several decades indicate that exposure of both workers and the general population is common. No epidemiological studies or case reports relating to the carcinogenicity of these compounds were available to the Working Group.

4.3 Evaluation

No information was available to the Working Group for evaluating the possible carcinogenic effects of propylene in humans; and the available data on polypropylene do not permit an evaluation of its carcinogenicity. The results of animal implantation experiments, however, indicate a need for experimental and epidemiological studies.

Subsequent evaluations: Suppl. 7 (1987) (Polypropylene, p. 70: **Group 3**); [Vol. 60 \(1994\) \(Propylene\)](#)

For definition of Groups, see [Preamble Evaluation](#).

Synonyms for Propylene

- Methylethene
- Methylethylene
- Propene
- I-Propylene

Synonyms for Polypropylene

- Admer PB 02
- Amco
- Amerfil

- Amoco 1010
- Ampol C 60
- AT 36; Avisun
- Atactic polypropylene
- Avisun 101
- Azdel
- Beamette
- Bicolene P
- Carlona K 571
- CD 419
- Celgard 2500
- Chisso 5078
- Clysar
- Coathylene PF 0548
- Courlene PY
- CPP 25S
- D 151
- Daplen AD
- Dexon E 117
- DLP
- DS 8620
- Eastobond L 8080-270A
- Elpon
- EI Rexene PP 115
- EM 490
- Enjay CD 392
- Epolene M 5H
- Escon 622
- F 080 PP
- Gerfil
- GPCD 398
- Hercoflat 135
- Hercotuf 110A
- Hercules 6523
- Herculon
- HF 20
- HO 50
- Hostalen N 1060
- Huls P 6500
- ICI 543
- Isotactic polypropylene
- J 400
- J 700
- JGD 1800
- JMD 4500
- K 300
- Lambeth
- Lanco Wax PP 1362D
- Lupareen
- LYM 42
- Marlex 9400
- Maurylene
- Meraklon
- MFR 4
- MH 4
- Mitsui Polypro B 220
- MM2A
- Moplen
- Mosten

- Noblen
- Novamont 2030
- Novolen
- Oletac 100
- P 6500
- Paisley 750
- Pellon 2505
- Pistac CC
- Polypro 1014
- Poprolin
- Polypropene
- Propene polymers
- Propylene polymer
- PP 1
- PR 144
- Profax
- Propathene
- Propolin
- Propophane
- PS 2011
- PXC 3391
- PXC 8639
- Rexall 413S
- 413S
- SD 5220
- Shell 5520
- Shoallomer
- Syndiotactic polypropylene
- TA 3
- Tatren 141
- Tenite 423
- Trespaphan
- Tuff-Lite
- Ulstron
- USI 11-4-0047
- Vestolen 5200
- Viscol 350P
- W 101
- WEX 1242

STYRENE, POLYSTYRENE AND STYRENE-BUTADIENE COPOLYMERS

VOL.: 19 (1979) (p. 231)

Styrene

CAS No.: 100-42-5

Chem. Abstr. Name: Ethenylbenzene

Polystyrene

CAS No.: 9003-53-6

Chem. Abstr. Name: Ethenylbenzene homopolymer

Styrene-butadiene copolymers

CAS No.: 9003-55-8

Chem. Abstr. Name: Ethenylbenzene polymer with 1,3-butadiene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Styrene was tested by oral administration to mothers and offspring of two strains of mice and of one strain of rats. In one strain of mice, high doses of styrene increased the incidence of lung tumours in offspring. In the other strain, a lower dose of styrene slightly increased the incidence of liver-cell tumours in male offspring. In rats, the total incidence of tumours was not statistically different in styrene-treated and control animals.

Styrene is mutagenic.

Subcutaneous implantation of polystyrene discs, rods, spheres or powder in rats induced local sarcomas, the incidences of which varied with the size and form of the implant.

No data on the carcinogenicity of styrene-butadiene copolymers were available to the Working Group.

5.2 Human data

The extensive production of styrene and polystyrene and the widespread use of the polymer and the copolymers derived from styrene for consumer products and medical applications suggest that occupationally and medically exposed groups may be identified for epidemiological investigation. Extensive data on toxicity in workers and hygienic measurements indicate that exposures do occur. Skin absorption of styrene has been reported. The widespread occurrence of styrene in the environment and the fact that in some countries styrene and some of its polymers are approved as food additives and for use in contact with food (e.g. disposable dinnerware and drinking glasses) indicate that the general population is also exposed.

The only report that relates to possible human carcinogenicity of styrene has methodological deficiencies: the population at risk was not clearly defined and may have been exposed to a variety of chemicals, such as benzene. No conclusion could be made concerning the carcinogenicity of styrene.

No case reports or epidemiological studies with regard to the carcinogenicity of polystyrene were available to the Working Group.

The case reports and epidemiological studies that concern the carcinogenic effects of styrene-butadiene copolymers also have limitations: the usual ones apply to the case reports; the epidemiological studies involved small numbers of workers. However, the collective nature of the findings, together with the similarity

of tumour types observed, clearly indicate the need for further studies.

5.3 Evaluation

Although no information is available on carcinogenicity in humans attributable to styrene, its wide use and the facility with which it can be absorbed by inhalation indicate that it may be possible to carry out studies measuring both dose and cancer incidence in exposed workers. The finding of chromosomal aberrations in workers exposed to styrene further supports the need for epidemiological investigations.

Results from polystyrene implant studies in animals point to the need for further investigations with regard to the polymer. Recent epidemiological information on styrene-butadiene copolymer workers, which indicates lymphato-haematopoeietic malignancies, clearly requires elucidation by further studies.

Subsequent evaluations: Suppl. 7 (1987) (Polystyrene, p. 70: **Group 3**) (Styrene-butadiene copolymers, p. 72: **Group 3**); [Vol. 60 \(1994\) \(Styrene\)](#)

For definition of Groups, see [Preamble Evaluation](#).

Synonyms for Styrene

- Cinnamene
- Phenethylene
- Phenylethene
- Phenylethylene
- Styrol
- Styrole
- Styrolene
- Vinylbenzene
- Vinylbenzol

Synonyms for Polystyrene

- Afcolene
- Atactic polystyrene
- Bactolatex
- Bakelite SMD 3500
- BASF III
- BDH 29-790
- Bextrene XL 750
- Bicolastic A 75
- Bicolene H
- Bio-Beads S-X 2
- BP-KLP
- BSB-S 40
- Bustren
- Cadco 0115
- Carinex GP
- Copal Z
- Cosden 550
- Denka QP3
- Diarex 43G
- Dorvon
- Dow 360
- Dylark 250
- Dylene

- Dylite F 40
- 686E
- Edistir RB
- Esbrite
- Escorez 7404
- Estyrene 4-62
- FC-MY 5450
- FG 834
- Foster Grant 834
- Gedex
- 454H
- HF 10
- HH 102
- HHI 11
- Hi-Styrol
- Hostyren N
- HT 88
- HT 91-1
- IT 40
- K 525
- KB (polymer)
- KM
- KM (polymer)
- Koplen 2
- KR 2537
- Krasten 1.4
- Lacqren 506
- LS 061A
- Lustrex
- Lustrex H 77
- MX 4500
- 168N15
- NaPSt
- NBS 706
- N 4000V
- Oligostyrene
- Owispol GF
- Pelasan 333
- Piccolastic
- Polyco 220NS
- Polyflex
- Polystrol D
- Polystyrene BW
- Polystyrene latex
- Polystyrol
- Printel's
- PRX 1195
- PS 1
- PSB-C
- PSB-S-E
- PS 454H:
- PSV-L
- PY 2763
- R 3
- Rexolite 1422
- Rhodolne
- S 173
- SB 475K
- SD 188

- Shell 300
- SMD 3500
- SPS 600
- SRM 705
- ST 90
- Sternite 30
- ST 30UL
- Styrafoil
- Styragel
- Styrene polymers
- Styrex C
- Styrocell PM
- Styrofan 2D
- Styroflex
- Styrofoam
- Styrolux
- Styron
- Styropian
- Styropor
- TC 3-30
- TGD 5161
- TMDE 6500
- Toporex 500
- Trolitul
- Trycite 1000
- Ubatol U 2001
- UCC 6863
- UP 1
- UPM
- Vestolen P 5232G
- Vestyron
- Vinamul N 710
- Vinylbenzene polymer
- Vinyl Products R 3612

Synonyms for Styrene-butadiene copolymers

- Afcovac B 101
- BASF 661
- 1,3-Butadiene-styrene copolymer
- Butadiene-styrene polymer
- 1,3-Butadiene-styrene polymer
- Butadiene-styrene resin
- Butakon 85-71
- Diarek 600
- Dienol S
- Dow 209
- Dow Latex 612
- Downtex TL 612
- DST 50
- DST 75
- Duranit
- Duranit 40
- Edistir RB 268
- Goodrite 1800X73
- Histryrene S 6F
- Hycar LX 407
- K 55E

- KRO 1
- KRO 2
- Litex CA
- Lytron 5202
- Marbon 8000A
- Nipol 407
- Pharos 100.1
- Pliolite 151
- Polybutadienepolystyrene copolymer
- Polyco 2410
- Polyco 2415
- PS-SU2
- SBS
- SBS (block polymer)
- SBS copolymer
- SD 345 (polymer)
- S6F Histyrene resin
- SKS 85
- Soil stabilizer 661
- Solprene 300
- Styrene-1,3-butadiene copolymer
- Styrene-butadiene polymer
- Styrene polymer with 1,3-butadiene
- Synpol 1500
- Thermoplastic 125
- TR 201
- UP 1E
- Vestyron HI

VINYL ACETATE, POLYVINYL ACETATE AND POLYVINYL ALCOHOL

VOL.: 19 (1979) (p. 341)

Vinyl acetate

CAS No.: 108-05-4

Chem. Abstr. Name: Acetic acid ethenyl ester

Polyvinyl acetate

CAS No.: 9003-20-7

Chem. Abstr. Name: Acetic acid ethenyl ester homopolymer

Polyvinyl alcohol

CAS No.: 9002-89-5

Chem. Abstr. Name: Ethenol homopolymer

5. Summary of Data Reported and Evaluation

5.1 Experimental data

In the only study available, vinyl acetate was tested in rats by inhalation exposure; it produced no evidence of carcinogenicity.

Vinyl acetate was non-mutagenic in the only test system used.

Subcutaneous or intraperitoneal implantation of polyvinyl acetate powder in mice and rats did not result in local sarcomas. Subcutaneous implantation of polyvinyl alcohol sponges in rats produced local sarcomas, whereas negative results were obtained with polyvinyl alcohol powder.

5.2 Human data

No case reports or epidemiological studies relating to the carcinogenicity of either vinyl acetate or polyvinyl acetate were available to the Working Group. One case of haemangiopericytoma was reported in a man exposed to polyvinyl alcohol.

The high levels of production of vinyl acetate, polyvinyl acetate and polyvinyl alcohol indicate that occupationally exposed groups could be identified for epidemiological investigation. The widespread use of polyvinyl acetate and polyvinyl alcohol in diverse applications indicates that the general population is also exposed.

5.3 Evaluation

No case reports or epidemiological studies concerning vinyl acetate were available to the Working Group. Animal studies involving implantation of polyvinyl acetate and polyvinyl alcohol powder in rats did not result in local sarcomas, whereas in similar experiments with polyvinyl alcohol sponges, local sarcomas were produced. Both polyvinyl acetate and polyvinyl alcohol have substantial commercial applications. Further studies are required before an evaluation can be made of the carcinogenicity of these compounds.

Subsequent evaluation: Suppl. 7 (1987) (Polyvinyl acetate, p. 70: **Group 3**) (Polyvinyl alcohol, p. 70: **Group 3**); [Vol. 63 \(1995\) \(Vinyl acetate\)](#)

For definition of Groups, see [Preamble Evaluation](#).

Synonyms for Vinyl acetate

- Acetic acid vinyl ester
- 1-Acetoxyethylene
- 2,4-Diisocyanatotoluene
- Vinyl A monomer
- VAc
- VyAc

Synonyms for Polyvinyl acetate

- Acetic acid vinyl ester polymers
- Asahisol 1527
- ASB 516
- AYAA
- AYAF
- AYJV
- Bakelite AYAA
- Bond CH 3
- Borden 2123
- Cemedine 196
- Cevian 380
- D 50
- D 50(polymer)
- DCA 70
- Duvilax
- Elvacet 81-900
- Emultex F
- En-Cor
- EP 1208
- Esnil P 18
- Everflex B
- Formvar 1285
- Gelva
- Gohensil E 50Y
- Kurare OM 100
- Lemac
- Meikatex 5000NG60
- Merckogel OR
- Merckogen 6000
- Mokotex D 2602
- Movinyl
- Movinyl 801
- Movinyl 50M
- Mowilith 30
- National 120-1207
- National Starch 1014
- NS 2842
- OM 100
- OR 1500
- P-170
- Pioloform F
- Plyamul 40-155
- Plyamul 40-350
- Polisol S-3

- Polyco 953
- Polyfox P 20
- Poly(vinylacetate)
- Protex
- PS 3h
- PVAE
- R 10688
- Resyn 25-1025
- Rhodopas
- RV 225-5B
- S-nyl-p 42
- Soloid
- Soviol
- SP 60
- SP 60 (ester)
- Toabond 2
- TS2
- Ucar 15
- UK 131
- V 501
- VA-0112
- Vinac ASB 10
- Vinalite D 50N
- Vinamul 9300
- Vinapol A 16
- Vinnapas B
- Vinyl acetate homopolymer
- Vinyl acetate polymer
- Vinyl acetate resin
- Vinylite AYAF
- Vinyl Products R 10688
- Winacet D

Synonyms for Polyvinyl Alcohol

- Poly(vinyl alcohol)
- PVA
- vinyl alcohol polymer
- Alcotex 88/05
- Alkotex
- Alvyl
- Aracet A-PV
- Cipoviol W 72
- Covol
- Elvanol
- EP 160
- Gelvatol
- GH 20
- GL 02
- GL 03
- GLO 5
- GM 14
- Gohsenol AH 22
- Kuralon VP
- Kurare Poval 120
- Lemol
- M 13/20
- Mowiol

- NH 18
- Polydesis
- Polysizer 173
- Polyvinol
- Polyviol
- Polyviol M 13/140
- Poval 117
- PVA 008
- PVS 4
- Resistoflex
- Rhodoviол
- Solvar
- Sumitex H 10
- Vibatex S
- Vinacol MH
- Vinalak
- Vinarol
- Vinavilol 2-98
- Vinnarol
- Vinol
- Vinylon Film 2000

Last updated: 30 March 1998

VINYL CHLORIDE, POLYVINYL CHLORIDE AND VINYL CHLORIDE-VINYL ACETATE COPOLYMERS

VOL.: 19 (1979) (p. 377)

Vinyl chloride

CAS No.: 75-01-4

Chem. Abstr. Name: Chloroethene

Polyvinyl chloride

CAS No.: 9002-86-2

Chem. Abstr. Name: Chloroethene homopolymer

Vinyl Chloride-vinyl acetate copolymers

CAS No.: 9003-22-9

Chem. Abstr. Name: Acetic acid ethenyl ester polymer with chloroethene

5. Summary of Data Reported and Evaluation

5.1 Experimental data

Vinyl chloride was tested in rats by oral, subcutaneous and intraperitoneal administration and in mice, rats and hamsters by inhalation exposure. Following oral and inhalation exposure, vinyl chloride was carcinogenic in all three species, producing tumours at different sites, including angiosarcomas of the liver. Vinyl chloride was carcinogenic in rats following prenatal exposure. A dose-response effect has been demonstrated.

The results of subcutaneous and intraperitoneal injection studies in rats are incomplete and cannot be evaluated.

Vinyl chloride is mutagenic.

Polyvinyl chloride was tested in rats by subcutaneous and intraperitoneal implantation; local sarcomas were induced, the incidence of which varied with the size and form of the implant.

Vinyl chloride-vinyl acetate copolymers were tested in mice by subcutaneous implantation as films or powder; local sarcomas were induced following implantation of films.

5.2 Human data

Vinyl chloride is manufactured on a vast scale, and exposure involves workers in the production, polymerization and processing industries. Also, large sections of the general population may have some exposure to vinyl chloride, particularly through direct or indirect contact with polymer products.

Several independent but mutually confirmatory studies have shown that exposure to vinyl chloride results in an increased carcinogenic risk in humans, involving the liver, brain, lung and haemo-lymphopoietic system.

In one epidemiological study, an excess of foetal mortality was reported among wives of workers who had been exposed to vinyl chloride, indicating a possible mutagenic effect in human germ cells. Several investigations have detected an increase in chromosomal aberrations in the lymphocytes of workers exposed to vinyl chloride. Increased rates of birth defects among children of parents residing in communities where vinyl chloride-polyvinyl chloride or other chemical processing plants are located have been reported in several other studies. These suggest teratogenic and/or mutagenic effects of vinyl chloride in humans.

In two proportionate mortality studies, in which death certificates of workers who had been involved in the fabrication of plastics, including polyvinyl chloride, were analysed, there appeared to be an increased proportion of cancer of the digestive system in both sexes and possibly of the urinary system and of the breast in women.

5.3 Evaluation

Vinyl chloride is a human carcinogen. Its target organs are the liver, brain, lung and haemo-lymphopoietic system. Similar carcinogenic effects were first demonstrated in rats and were later confirmed in mice and hamsters. Although evidence of a carcinogenic effect of vinyl chloride in humans has come from groups occupationally exposed to high doses of vinyl chloride, there is no evidence that there is an exposure level below which no increased risk of cancer would occur in humans.

Epidemiological reports regarding clastogenic effects among vinyl chloride-exposed workers and a single study of increased foetal mortality among the wives of workers who had been exposed to vinyl chloride suggest that vinyl chloride could be mutagenic to humans. Additional support for this suggestion derives from experimental evidence of its mutagenicity.

Studies which indicate increased rates of birth defects among the children of parents residing in communities where vinyl chloride production and polymerization plants are located indicate the necessity for further investigation of the teratogenicity of vinyl chloride and its polymers in both animals and humans.

The available studies on polyvinyl chloride, which indicate an elevated proportion of digestive system cancer in male and female workers and possibly of cancers of the breast and urinary organs in female workers involved in the fabrication of plastics, including polyvinyl chloride, are insufficient to evaluate the carcinogenicity of this compound.

Previous evaluation: [Vol. 7 \(1974\)](#)

Subsequent evaluations: [Suppl. 7 \(1987\) \(Vinyl chloride\)](#) (Polyvinyl chloride, p. 70: **Group 3**) (Vinylidene chloride-vinyl chloride copolymers, p. 73: **Group 3**)

For definition of Groups, see [Preamble Evaluation](#).

Synonyms for Vinyl chloride

- Chloroethylene
- Monochloroethylene
- VC
- VCM
- Vinyl C monomer

Synonyms for Polyvinyl chloride

- Airex
- AL 30
- AL 31
- Armodour
- Aron compound HW
- Astralon
- Atactic poly(vinyl chloride)
- Bakelite OYNV

- QSAH 7
- Bakelite QYAC 10
- Benvic
- Blacar 1716
- Bolatron 6200
- Bonloid
- Breon
- C 65
- Caliplast
- Carina S 70-01
- Chemosol
- Chloroethylene polymer
- Chlorostop
- Cobex (polymer)
- Contizell
- Corvic 55/9
- Dacovin
- Danuvil 70
- Darvic 110
- Darvis Clear 025
- Daycell
- Decelith H
- Denka Vinyl SS 80
- Diamond Shamrock 40
- DN 4
- DN 5
- Dorlyl
- Durofol P
- Dynadur
- E 62
- E 66
- Ekavyl SD 2
- E 66P
- 103EP8
- E-PVC
- Escambia 2160
- Europhan
- Exon 605
- FC 4648
- Flocor
- Genotherm
- Geon 51
- Guttagea
- Halvic 223
- HC 825
- Hi-S Film No. 111L
- Hishirex 502
- Hispavic 229
- Hostalit
- HX-M
- Igelite F
- Improved Wilt Pruf
- Kanevinyl PSH 10
- KhS 010
- KhSE 3
- Klegecell
- Kohiner R 687
- KR 800
- Kureha S 901

- L 5
- Lak Kh SL
- Lonza 380 ES
- Lucoflex
- Lucovyl BB 800
- Lutofan
- Marvinal
- Mirrex MCFD 1025
- Movinyl 100
- Mowilith F
- Myraform
- NIKA-TEMP
- Nikavinyl SG 700
- Nipeon A 21
- Nipol 576
- Nipolit CM 081
- Norvinyl
- Novon 712
- Ongrovil S 165
- Ongrovil S 470
- Opalon
- Ortodur
- P 400 (vinyl polymer)
- Pantasote R 873
- Pattina V 82
- Pevikon D 61
- Pliovic D 100X
- POK 60
- Polivinit
- Polwinit
- Poly(chloroethylene)
- Polyco 2622
- Polytherm
- Poly(vinyl chloride)
- Poly(vinylchloride)
- Polyvinylchloride
- Porodur
- Prototype III Soft
- PVC
- PVKhL 4
- PVKhS 60
- PVKh-S 60
- PVKh-S 65
- PVKh-S 63Zh
- QSAH 7
- QSAN 7
- Quirvil
- QYSA
- Ravinil R 100/65D
- Rucon B 20
- Ryurene S 800B
- S 61
- S 65 (polymer)
- S 70
- S 901
- Scon 5300
- Sicron
- SKhV 71
- S-Lon

- SM 200
- Solvic
- SP 60
- SP 60 (chlorocarbon)
- SR11
- Sumilit EXA 13
- Sumitomo PX 11
- SV 55
- SX 11
- SX 7G
- SX 8T
- Takilon
- Technopor
- Tenneco 1742
- TK 1000
- Tocryl C 440
- Trovidur
- Trovithern HTL
- TS 1100
- U 1
- U 1 (polymer)
- Ultron
- VA 15
- VC 100
- VC 410
- Veron P 130/1
- Vestolit B 7021
- Vinika KR 600
- Vinikulon
- Viniplast
- Viniplen P 73
- Vinnol E 75
- Vinoflex
- Vinylchlon 4000LL
- Vinyl chloride homopolymer
- Vinyl chloride polymer
- Vinylite QYJV
- Viplast RA/F
- Volgovinyl E 62
- VSKh-S
- Vygen 85
- Welvic G 2/5
- Wilt Pruf
- Winidur
- X-AB
- Yugovinyl

Synonyms for Vinyl chloride-vinyl acetate copolymers

- A 15
- A 15 (polymer)
- Acetic acid vinyl ester polymer with chloroethylene
- Bakelite LP 70
- Breon 351
- Chloroethylenevinyl acetate polymer
- Corvic 51/83
- Denkalac 41M
- Denka Vinyl MM 90

- Diamond Shamrock 744
- Exon 450
- Flovic
- Geon 100x150
- Hostalit PVP
- Leucovyl PA 1302
- Lucovyl GA 8502
- Marvinol VP 56
- 50ME
- Norvinyl P 6
- Opalon 400
- Pevikon C 870
- Pliovac AO
- Pliovic AO
- Polyvinyl chloride-polyvinyl acetate
- PVC Cordo
- Resin 4301
- Rhodopas 6000
- Sarpifan HP 1
- Solvic 523KC
- Sumilit PCX
- Tennus 0565
- VA 3 (copolymer)
- VAGD
- VH 10/60
- Vilit 40
- Vinnol H 10/60
- Vinyl acetate-vinyl chloride copolymer
- Vinyl acetate-vinyl chloride polymer
- Vinyl chloride-vinyl acetate polymer
- Vinylite VGHH
- Vinyon
- VLVF
- VIICC
- VYHH
- VYNS
- VYNW