

Green Screen Assessment for Vinyl Acetate (CAS #108-05-4)

Green Screen Version 1.2 (CPA 2011a)

Note: Draft Assessment -- Validation Has Not Been Performed on *this* Green Screen Assessment

Green Screen Assessment Prepared By:

Name: Christopher Schlosser, M.F.S.
 Title: Associate Toxicologist
 Organization: ToxServices LLC
 Date: May 24, 2011

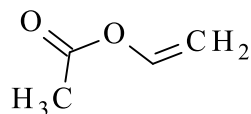
Green Screen Assessment QC'd By:

Name: Margaret H. Whittaker, Ph.D., M.P.H., E.R.T., D.A.B.T
 Title: Managing Director and Chief Toxicologist
 Organization: ToxServices LLC
 Date: June 2, 2011

Also Called:

1-Acetoxyethylene, Acetic acid vinyl ester, Acetic acid, ethenyl ester, Acetic acid, ethylene ether, Acetoxyethene, Ethanoic acid, ethenyl ester, Ethenyl acetate, Ethenyl ethanoate, Vinyl A monomer, Vinyl ethanoate

Chemical Structure(s):



Identify Applications/Functional Uses:

(e.g., Cleaning product, TV casing)

Vinyl acetate is used in the manufacture of polyvinyl and vinyl acetate copolymers, which are used in water-based paints, adhesives, paper coatings, and applications not requiring service at extreme temperatures. Additionally, it is used in safety glass and hairspray (HSDB 2009).

Green Screen Rating¹: Vinyl acetate was assigned a Benchmark Score of 2 based on several hazard ratings, including: Moderate classifications for Carcinogenicity (C), Mutagenicity (M), Reproductive (R) and Developmental (D) Toxicity; High classification for Systemic Toxicity (S) and Reactivity (R); and Very High classification for Skin Irritation/Corrosion (IrS) and Flammability (F). *NOTE: Data gaps (dg) exist for Endocrine Activity (E) (not listed, but not tested), Neurotoxicity (N), and Skin Sensitization (SnS). In a worst-case scenario, if vinyl acetate was assigned a High score for E it would be assigned a Benchmark Score of 1.*

Green Screen Hazard Ratings: Vinyl Acetate (CAS #108-05-4)																	
Group I Human					Group II Human							Ecotox		Fate		Physical	
C	M	R	D	E	A T	S T	N	Sn S	Sn R	Ir S	Ir E	AA	CA	P	B	Rx	F
M	M	M	M	dg	M	H	dg	dg	L	vH	H	M	M	vL	vL	H	vH

*Hazard levels (vH, H, M, L, vL) in *italics* reflect a lower level of confidence (See Guidance).

¹ For inorganic chemicals with low human and ecotoxicity across all hazard endpoints and low bioaccumulation potential, persistence alone will not be deemed problematic. Inorganic chemicals that are only persistent will be evaluated under the criteria for Benchmark 4.

Transformation Products and Ratings:

Identify relevant fate and transformation products (i.e., dissociation products, transformation products, valence states) and/or moieties of concern²

Life Cycle Stage	Transformation Pathway	Transformation Products	CAS #	On CPA Red List ³ ?	Green Screen Rating ⁴
End of Life	Atmospheric breakdown	Acetaldehyde	75-07-0	Present on the Red List of Chemicals	Potential carcinogen (CPA 2011b)
End of Life	Hydrolysis	Acetic acid	64-19-7	Not present on the Red List of Chemicals (CPA 2011b).	n/a
End of Life	Combustion	Carbon monoxide	630-08-0	Present on the Red List of Chemicals	Reproductive/developmental toxicant, neurotoxicant (CPA 2011b)
End of Life	Combustion	Carbon dioxide	124-38-9	Not present on the Red List of Chemicals (CPA 2011b).	n/a

*The above transformation products were screened against the CPA's table of Red List chemicals (CPA 2011b).

Introduction

Vinyl acetate is used as a monomer for making polyvinyl acetate and vinyl acetate copolymers. These polymers are used as components in coatings, paints, sealant, binders (adhesives, nonwovens, construction products, and carpet backing) and in miscellaneous uses such as chewing gum and tablet coatings. Vinyl acetate is also copolymerized as the minor constituent with vinyl chloride and with ethylene to form commercial polymers and with acrylonitrile to form acrylic fibers (HSDB 2009).

Group I Human Health Effects (Group I Human)

Carcinogenicity (C) Score (H, M or L): M

Vinyl acetate was assigned a score of Moderate for carcinogenicity based on limited evidence in animals of carcinogenic activity and being classified by IARC as a Group 2B carcinogen.

- Not listed as a known carcinogen by NTP, U.S. EPA, or CA Prop 65.
- Vinyl acetate *is possibly carcinogenic to humans* (Group 2B), based on *limited evidence* in experimental animals for carcinogenicity (IARC 1995).
- A 2-year chronic toxicity/carcinogenicity study (GLP-compliance and method not reported) was conducted using F344 rats and BDF₁ mice (50/sex/group). Animals were administered

² A moiety is a discrete chemical entity that is a constituent part or component of a substance. A moiety of concern is often the parent substance itself for organic compounds. For inorganic compounds, the moiety of concern is typically a dissociated component of the substance or a transformation product.

³ Use the **most recent revision** of the CPA Red List spreadsheet (See Guidance).

⁴ The way you conduct assessments for transformation products depends on the Benchmark Score of the parent chemical (See Guidance).

doses of 0, 400, 2,000, and 10,000 ppm of vinyl acetate (purity not reported) in drinking water for 2 years. Significantly (P-values not reported) increased incidences of squamous cell tumors in the oral cavity and forestomach of male and female mice and in the esophagus of male mice were observed in a dose dependent manner. Furthermore, squamous cell carcinomas were also metastasized into the lungs, pancreas, liver kidneys and lymph nodes. In rats, squamous cell carcinomas and squamous cell papillomas were also observed in the oral cavity and the esophagus (SCHER 2008; Vinyl Acetate Council 2004).

- A 2-year inhalation toxicity study (GLP-compliance and method not reported) was conducted using male and female rats and mice (strains not reported; 60/sex/group). Papillomas and carcinomas were found in the olfactory epithelium of rats. No tumors were reported in mice. No further details were provided (SCHER 2008; ESIS 2000).
- Vinyl acetate is carcinogenic at portals of entry. Following exposure to vinyl acetate it is rapidly hydrolyzed into acetic acid and acetaldehyde. Acetaldehyde is genotoxic and mutagenic. The Scientific Committee on Health and Environmental Risks reports that the carcinogenic potential of vinyl acetate is expressed only when tissue exposure to acetaldehyde is high and when *cellular* proliferation is simultaneously elevated (SCHER 2008).

Mutagenicity/Genotoxicity (M) Score (H, M or L): M

Vinyl acetate was assigned a score of Moderate for mutagenicity based on classification as a GHS Category 2 germ cell mutagen, due to positive *in vitro*, and weakly positive *in vivo* assays.

- *In vitro* - Several Ames bacterial reverse mutation assays (GLP-compliance not reported; only one study was identified as following OECD 471 Guidelines) were identified utilizing *Salmonella typhimurium* tester strains TA 97, TA98, TA100, TA102, TA1530, TA1535 and TA1537 with and without metabolic activation (concentrations not reported). Vinyl acetate was determined to be negative for mutagenicity under all tested conditions (ESIS 2000).
- *In vitro* – Several cytogenetic assays (GLP-compliance and method not reported) were identified utilizing human lymphocytes and Chinese Hamster Ovary (CHO) cells with and without metabolic activation (concentrations not reported). Vinyl acetate (purity not reported) tested positive for clastogenicity in human lymphocytes and CHO cells under tested conditions (ESIS 2000).
- *In vitro* – A mouse lymphoma assay was conducted (GLP-compliance and method not reported) utilizing L5178Y cells without metabolic activation (concentration not reported). Vinyl acetate (purity not reported) was found to be positive for mutagenicity under the tested conditions (ESIS 2000).
- *In vitro* – A micronucleus assay (GLP-compliance not reported; high content cytotoxicity method developed by Litton Laboratories) was conducted utilizing human TK6 cells without metabolic activation at concentrations of 0, 0.001, 0.005, 0.01, 0.05, 0.25, 0.5, 1.0 and 2.0 mM of vinyl acetate (purity not reported). Increased incidences of micronucleated events occurred at concentrations of 0.5 to 2.0 mM of vinyl acetate in a dose-dependent manner (Vinyl Acetate Council 2010).
- *In vivo* – Several micronucleus assays (GLP-compliance and method not reported) have been identified using SD rats and CD-1 mice (numbers not reported). Vinyl acetate was found to be weakly positive for clastogenicity following I.P. administration. However, several oral and inhalation studies in both rats and mice did not show a significant difference in the number micronucleated cells. Also, the SCHER determined that the data available from I.P.

administration studies did not warrant classification as a germ cell mutagen (SCHER 2008; ESIS 2000).

Reproductive Toxicity (R) Score (H, M, or L): M

Vinyl acetate was assigned a score of Moderate for reproductive toxicity based on classification as a GHS Category 2 reproductive toxicant, due to some evidence of toxicity in experimental animals.

- A two generation reproductive toxicity study (GLP-Compliance and method not reported) was conducted using male and female Sprague-Dawley rats (18 male and 36 female/group in the parental group and 25/sex/group in the F1 generation). Rats were administered doses of 0, 200, 1,000 and 5,000 ppm (0, 30, 152, or 760 mg/kg/day for females, 0, 28, 139, or 693 mg/kg/day for males) of vinyl acetate (purity not reported) in drinking water from 10 weeks before mating until after lactation, and from 10 weeks after weaning until termination of study for F1 mice. There was a significant reduction in body weight gain of the high-dose F1 pups. Body weight gain was reduced by 8% in the high dose parental females and in both mid and high dose parental and F1 females during lactation. A slight reduction in the number of pregnant females was reported at 500 mg/kg, due to a slight reduction in male fertility. A NOAEL and LOAEL of 139 and 693 mg/kg were established, respectively, based on a reduced number of pregnant females and reduced fertility of male rats. (ESIS 2000; IRIS 1990).

Developmental Toxicity incl. developmental neurotoxicity (D) Score (H, M or L): M

Vinyl acetate was assigned a score of Moderate for developmental toxicity based on classification as a GHS Category 2 reproductive toxicant, due to some evidence of toxicity in experimental animals.

- A developmental toxicity study (GLP-compliance and method not reported) was conducted using female Sprague-Dawley rats (24/group). Rats were exposed to concentrations of 0, 50, 200, or 1000 ppm (0, 182, 696, or 3,533 mg/m³) vinyl acetate (purity not reported) for 6 hours/day on days 6-15 of gestation. Fetotoxicity, as measured by reduced crown-rump length, reduced body weight, and increased incidence of ossification defects in the sternbrae and occipital regions, was observed in the 3,533 mg/m³ groups. No fetal effects were seen at the lower two vinyl acetate treatments (OEHHA 2001; ESIS 2000). ToxServices established a NOAEL and LOAEL of 696 and 3,533 mg/m³, based on available data.
- A second development toxicity study (GLP-compliance and method not reported) was conducted using female Sprague-Dawley rats (24/group). Rats were administered doses of 0, 200, 1,000, or 5,000 ppm (est. 0, 25, 100 and 500 mg/kg) vinyl acetate (purity not reported) in drinking water on gestation days 6-15. Vinyl acetate in the drinking water produced no evidence of developmental toxicity at any dose. The NOAEL was determined to be greater than 5,000 ppm (500 mg/kg) (OEHHA 2001; ESIS 2000).

Endocrine Activity (E) Score (H, M or L): Data Gap

Vinyl acetate was assigned a Data Gap score for endocrine activity based on no relevant data being available.

- Not listed as a potential endocrine disruptor on the EU Priority List of Suspected Endocrine Disruptors.

- Not listed as a potential endocrine disruptor on the OSPAR List of Chemicals of Possible Concern.
- Not listed as a potential endocrine disruptor on the Red List of Chemicals (CPA 2011b).
- No other relevant data were identified for vinyl acetate.

Group II Human Health Effects (Group II Human)

Acute Mammalian Toxicity (AT) Score (vH, H, M or L): vH

Vinyl acetate was assigned a score of Very high for acute mammalian toxicity based on GHS Category 2 classification for inhalation toxicity values. LC₅₀ values were compared against vapor exposure guidance values.

- *Oral*: An LD₅₀ of 2920 to 3480 mg/kg was determined in rats (ESIS 2000).
- *Oral*: An LD₅₀ of 1610 to 2250 mg/kg was determined in mice (ESIS 2000).
- *Dermal*: An LD₅₀ of 2335 to 7470 mg/kg was determined in rabbits (ESIS 2000).
- *Inhalation*: An LC₅₀ of 11.4 to 16 mg/L (was determined in rats (ESIS 2000).
- *Inhalation*: An LC₅₀ of 5.2 to 10.6 mg/L ppm was determined in mice (ESIS 2000).
- *Inhalation*: An LC₅₀ of 8.9 to 9.8 mg/L was determined in rabbits (ESIS 2000).
- *Inhalation*: An LC₅₀ of greater than 11.7 mg/L was determined in dogs (ESIS 2000).
- *Inhalation*: An LC₅₀ of 18.6 mg/L was determined in guinea pigs (ESIS 2000).

Systemic Toxicity/Organ Effects incl. immunotoxicity (ST) Score (vH, H, M or L): H

Vinyl acetate was assigned a score of High for systemic toxicity/organ effects based on being classified as a GHS Category 1 repeat exposure toxicant.

- A 2-year chronic toxicity/carcinogenicity study (GLP-compliance and method not reported) was conducted using F344 rats and BDF₁ mice (50/sex/group). Animals were administered doses of 0, 400, 2,000, and 10,000 ppm of vinyl acetate (purity not reported) in drinking water for 2 years. There was a significant reduction in body weights and water consumption in the high-dose group of both species. Significant changes were reported in the absolute and relative organ weights of several organs of the high dose group in mice and rats. However, these changes were not associated with histopathological changes. In mice, mandibular nodules were observed in 3 males and 5 females in the high dose groups, and maxillary nodules were observed in 3 males and 1 female in the high dose groups. In rats, mandibular nodules were observed in 3 males in the high dose group and 1 female in the mid dose group, and maxillary nodules were observed in 1 female in the high dose group. No other relevant effects were reported for systemic toxicity (Vinyl Acetate Council 2004). Based on available data, ToxServices established a NOEL and LOEL of 2,000 ppm and 10,000 ppm, respectively, for both species. These values correspond to an estimated NOAEL and LOAEL based on U.S. EPA Biological Values for Risk Assessment for female F344 rats of approximately 270 mg/kg and 1,350 mg/kg⁵ (U.S. EPA 1988). Values for female F344 rats were used as they resulted in the most conservative estimated values.
- A 13-week oral toxicity study (GLP-compliance and method not reported) was conducted using male and female Sprague-Dawley rats and CD-1 (10/sex/group). Rats and mice were administered doses of 0, 200, 1,000, and 5,000 ppm of vinyl acetate (purity not reported)

⁵ $\frac{10,000 \text{ ppm} \times 0.932 \text{ mg/L (density)} \times 0.033 \text{ L/day (consumption)}}{0.229 \text{ kg (average body weight)}} = \sim 1,350 \text{ mg/kg}$

daily for 13 weeks. In rats, slightly reduced body weights were reported in the high dose groups, and a dose-dependent reduction in water consumption was also reported. In mice, slightly reduced water consumption was reported in the high dose group. No other adverse signs of toxicity were reported for either species (ESIS 2000). Based on available data, ToxServices established a NOAEL of 5,000 ppm, equivalent to 620 mg/kg⁶. Values for female Sprague-Dawley rats were used as they resulted in the most conservative estimated values.

- A 28-day toxicity study (GLP-compliance and method not reported) was conducted in male and female Sprague-Dawley rats and CD-1 mice (5/sex/group). Animals were administered doses of 0, 50, 200, 1,000, and 5,000 ppm of vinyl acetate (purity not reported) for 28-days. The only effects reported were a reduction in body weights and water consumption in rats and mice at 1,000, and 5,000 ppm, respectively (ESIS 2000). Based on available data, ToxServices established a NOAEL of 10,000 ppm (est. 1,240 mg/kg) for this study.
- A 104-week inhalation study (GLP-compliance and method not reported) was conducted using male and female rats and mice (strain not reported; 90/sex/group). Animals were administered concentrations of 0, 50, 200, or 600 ppm (0, 176, 704, or 2,113 mg/m³) vinyl acetate (purity not reported)
 - for 6 hours/day, 5 days/week. There was no mortality resulting from these exposures. A close examination of the effects of vinyl acetate on the lung and nasal passages showed significant lesions in the nasal cavity, bronchi, and lungs of rats exposed to 600 ppm vinyl acetate. Lesions included olfactory epithelial metaplasia/atropy and nest-like epithelial folds in the nasal cavity, exfoliation of bronchial epithelium, fibrous intraluminal projections in the bronchi, and pigmented histiocyte accumulation in the lungs. Body weight gain was significantly decreased in the 600 ppm vinyl acetate group. Rats treated with 200 ppm vinyl acetate showed some evidence of epithelial atrophy and metaplasia in the nasal cavity. No effects were observed in the rats exposed to 50 ppm (176 mg/m³) vinyl acetate (OEHHA 2001).
- A 13-week inhalation toxicity study (GLP compliance and method not reported) was conducted using male and female Sprague-Dawley rats and CD-1 mice (10/sex/group). Animals were exposed to concentration of 0, 176, 706, 3520 mg/m³ vinyl acetate (purity not reported) for 6 hours/day, 5 days/week for 13 weeks. In rats, body weight gain was significantly reduced in males and females in the high dose group. A statistically significant increase in hemoglobin (P < 0.05) was observed in high dose males only. In mice, histopathological analysis revealed focal pneumonitis in the lungs and diffuse rhinitis in this nasal cavity in the mid and high dose groups. Both effects occurred in a dose-dependent manner, and were not present in control groups. A NOAEL and LOAEL of 706 mg/m³ and 176 mg/m³ were established by the study authors based on histopathological effects in mice (IRIS 1990).

Neurotoxicity (N) Score (vH, H, M or L): Data Gap

Vinyl acetate was assigned a Data Gap score of for neurotoxicity based on no relevant data being identified.

- No relevant data were identified for vinyl acetate.

⁶ $\frac{5,000 \text{ ppm} \times 0.932 \text{ mg/L (density)} \times 0.045 \text{ L/day (consumption)}}{0.338 \text{ kg (average body weight)}} = \sim 620 \text{ mg/kg}$

Skin Sensitization (SnS) Score (H, M or L): M

Vinyl acetate was assigned a score of Moderate for skin sensitization based on results obtained from an animal patch test, and limited data from human exposure and testing.

- No cases of skin sensitization from the handling of vinyl acetate in the workplace have been reported in the last years. However, the data obtained for humans at the workplace are of limited value for assessing skin sensitizing potential of vinyl acetate. There are no data on negative patch tests to substantiate the conclusion that the substance has no skin sensitizing potential. The absence of positive findings and the absence of adequate data do not allow the conclusion that vinyl acetate has no skin sensitizing potential (FIOOSH 2008).
- Results from an animal skin sensitization study (Buehler Test) showed a moderate skin sensitizing potential of vinyl acetate (commercial grade). With the use of the Local Lymph Nodes Assay (LLNA) no positive stimulation responses were detected at concentrations of 5% - 100%. Increased ear thickness after treatment with concentrations >5% support the skin irritative properties seen after prolonged dermal exposure. However, the results obtained with this LLNA may not fully reflect the potential of concentrations >10%, since higher concentrations of vinyl acetate show increasing volatility, due to decreased proportions of acetone/olive oil. As a result, samples applied to the skin of the ear may have been quickly evaporated. SI values support this assumption, since a constant decrease was obtained for concentrations > 10%. Overall, the outcome of both studies may indicate that vinyl acetate is not devoid of a skin sensitizing potential. The results of the LLNA do confirm the weak-moderate effects seen in the Buehler test. However, since the positive threshold level was not exceeded in the LLNA, classification and labeling with R 43 is not warranted. The LLNA was given a higher reliability since pure vinyl acetate was used for testing whereas a commercial grade test substance was applied in the Buehler test. In addition, the Buehler test was not fully compliant to the EU testing guideline due to some deviations of the test protocol (FIOOSH 2008).

Respiratory Sensitization (SnR) Score (H, M or L): L

Vinyl acetate was assigned a Data Gap score of Low for respiratory sensitization based on a long history of use in without reported cases of sensitization.

- No direct information is available from studies in humans on respiratory sensitization. In view of the widespread use, the absence of any reports suggests that vinyl acetate may not be a respiratory sensitizer (FIOOSH 2008).

Skin Irritation/Corrosivity (IrS) Score (vH, H, M or L): vH

Vinyl acetate was assigned a score of Very High for skin irritation/corrosivity based on the production of blisters from immediate exposure to human skin. Prolonged exposure to human skin may likely result in irreversible damage.

- Vinyl acetate is irritating to the skin of rabbits. No other details provided (ESIS 2000).
- Vinyl acetate has caused skin irritation and blisters in worker who accidentally spilled it on their skin (ATSDR 1995).
- Dermal contact with vinyl acetate may produce irritation with blister formation (OSHA 2009).

Eye Irritation/Corrosivity (IrE) Score (vH, H, M or L): H

Vinyl acetate was assigned a score of High for eye irritation/corrosivity based on severe irritation to the eyes of rabbits.

- Vinyl acetate is highly irritating to the eyes of rabbits. No other details provided (ESIS 2000).
- Eye irritation has been seen when people were exposed to vinyl acetate in the air or through accidents when the eyes were exposed to the chemical (ATSDR 1995).
- Vinyl acetate vapors were irritating to the eyes at a concentration of 21.6 ppm, but no irritation was noted at a concentration of 10 ppm (OSHA 2009).
- Instillation of 470 mg of undiluted vinyl acetate into the rabbit eye caused severe irritation (OSHA 2009).

Ecotoxicity (Ecotox)**Acute Aquatic Toxicity (AA) Score (vH, H, M or L): M**

Vinyl acetate was assigned a score of Moderate for acute aquatic toxicity based on reported L/EC₅₀ values between 10 and 100 mg/L.

- An LC₅₀ of 18 mg/L was identified in *Lepomis macrochirus* (freshwater fish, 96 hour) (ESIS 2000).
- An LC₅₀ of 42.3 mg/L was identified in *Carassius auratus* (freshwater fish, 96 hour) (ESIS 2000).
- An LC₅₀ of 31.1 mg/L was identified in *Lebistes reticulatus* (freshwater fish, 96 hour) (ESIS 2000).
- LC₅₀ values of 14 to 44 mg/L have been identified in *Pimephales promelas* (freshwater fish, 96 hour) (ESIS 2000).
- An LC₅₀ of 10 mg/L was identified in *Artemia salina* (aquatic invertebrate, 48 hour) (ESIS 2000).
- An LC₅₀ of 330 mg/L was identified in *Daphnia magna* (aquatic invertebrate, 24 hour) (ESIS 2000).
- Vinyl acetate has a predicted EC₅₀ value of 73.932 mg/L (Green Algae, 96 hour) (U.S. EPA 2009).

Chronic Aquatic Toxicity (CA) Score (vH, H, M or L): M

Vinyl acetate was assigned a score of Moderate for chronic aquatic toxicity based on a predicted ChV value between 1 and 10 mg/L for fish.

- Vinyl acetate has a predicted ChV of 7.621 mg/L in fish (fish, 32/33 day) (U.S. EPA 2009).
- Vinyl acetate has a predicted ChV of 132.450 mg/L in daphnid (daphnid, 21 day) (U.S. EPA 2009).
- Vinyl acetate has a predicted ChV of 12.319 mg/L in algae (Green Algae, 21day) (U.S. EPA 2009).

Environmental Fate (Fate)

Persistence (P) Score (vH, H, M, L, or vL): vL

Vinyl acetate was assigned a score of Very Low for persistence based on meeting requirements for classification of readily biodegradable following OECD test guidelines.

- Vinyl acetate is expected to be readily biodegradable with reported 82-98% biodegradation after 14 days following OECD 301C “Ready biodegradability: Modified MITI Test” (ESIS 2000).
- Vinyl acetate was reported to have 70% aerobic biodegradation after 10 days, and 72% aerobic biodegradation after 20 days following a similar method as the American Public Health Association’s determination of biochemical oxygen demand (ESIS 2000).

Bioaccumulation (B) Score (vH, H, M, L, or vL): vL

Vinyl acetate was assigned a score of Very Low for bioaccumulation based on experimental and predicted BCF values of less than 100.

- Vinyl acetate has a reported BCF of 2.09 to 2.34 (species not reported) @ 20°C (ESIS 2000).
- BCFBAF predicts a bioconcentration factor (BCF) of 1.124 (U.S. EPA 2011).

Physical Hazards (Physical)

Reactivity (Rx) Score (vH, H, M or L): H

Vinyl acetate was assigned a score of High for reactivity based on reports indicating explosive potentials of the substance.

- Vapor/Air mixtures of vinyl acetate are explosive (WHO 1995).

Flammability (F) Score (vH, H, M or L): vH

Vinyl acetate was assigned a score of Very High for flammability based on being reported as highly flammable and classified as a GHS Category 1 Flammable liquid with a flash point below 23°C.

- Vinyl acetate is highly flammable (WHO 1995).
- Flash point = -8°C (ESIS 2000).

References

- Agency for Toxic Substances and Disease Registry (ATSDR). 1995. ToxFAQs™ for Vinyl Acetate. Available: <http://www.atsdr.cdc.gov/tfacts59.html#>
- Clean Production Action (CPA). 2011a. DRAFT- The Green Screen for Safer Chemical Version 1.2. Available: http://www.cleanproduction.org/library/cpa-fact%20grscreen_Jan09_final.pdf
- Clean Production Action (CPA). 2011b. Red List of Chemicals. Available: <http://www.cleanproduction.org/Greenscreen.php>
- European Chemical Substances Information System (ESIS). 2000. IUCLID Dataset for vinyl acetate. European Commission Joint Research Centre. Available: <http://ecb.jrc.ec.europa.eu/iuclid-datasheet/108054.pdf>
- Federal Institute for Occupational Safety and Health (FIOSH). 2008. Risk Assessment for Vinyl Acetate. Division for Chemicals and Biocides Regulation, Germany. Available: <http://ecb.jrc.ec.europa.eu/esis/>
- Grandjean, P. and P.J. Landrigan. 2006. Developmental neurotoxicity of industrial chemicals. *Lancet* 368: 2167-2178.
- Hazardous Substances Data Bank (HSDB). 2009. Entry for vinyl acetate. United States National Library of Medicine. Available: <http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB>
- International Agency for Research on Cancer (IARC). 1995. Monograph for vinyl acetate. Volume 63: Dry Cleaning, Some Chlorinated Solvents and Other Industrial Chemicals. Available: <http://monographs.iarc.fr/ENG/Monographs/vol63/index.php>
- Office of Environmental Health Hazard Assessment (OEHHA). 2001. Chronic Toxicity Summary for Vinyl Acetate. Determination of Noncancer Reference Exposure Levels Batch 2B. Available: http://oehha.ca.gov/air/chronic_rels/pdf/vinylace.pdf
- Occupational Safety & Health Administration (OSHA). 2009. Occupational Safety and Health Guideline for Vinyl Acetate. Available: <http://www.osha.gov/SLTC/healthguidelines/vinylacetate/recognition.html>
- Scientific Committee on Health and Environmental Risks (SCHER). 2008. Risk Assessment Report on Vinyl acetate: Human Health Part. European Commission. Dated November 17th, 2008.
- United States Environmental Protection Agency (U.S. EPA)(IRIS). 1988. Recommendations for and Documentation of Biological Values for Use in Risk Assessment. EPA/600/6-87/008.

United States Environmental Protection Agency (U.S. EPA). 1990. Summary for vinyl acetate. Integrated Risk Information System (IRIS). Available: <http://www.epa.gov/iris/>

United States Environmental Protection Agency (U.S. EPA). 2009. ECOSAR v1.00a. Washington, DC, USA.

United States Environmental Protection Agency (U.S. EPA). 2011. Estimation Programs Interface (EPI) Suite™ Web, v4.10, Washington, DC, USA.

Vinyl Acetate Council. 2004. Results of a 2-year Carcinogenicity Drinking Water Study in Mice and Rats. TSCA Supplemental Submission Related to Japan Bioassay Research Center Study; Follow-up Submission to Filing Doc #99020000132 and FYI-OTS-0297-12866.

Vinyl Acetate Council. 2010. Preliminary Results of Micronucleus Assay in TK6 Cells for Vinyl Acetate (CAS #108-05-4) and Acetaldehyde (CAS #75-07-0). TSCA Submission Doc #88100000122 and 8EHQ-10-17763.

World Health Organization (WHO). 1995. International Chemical Safety Cards. International Programme for Chemical Safety (IPCS). Available: <http://www.inchem.org/documents/icsc/icsc/eics0347.htm>

Appendix 1 Modeling Results

- **EPI Suite Results for Vinyl Acetate (CAS #108-05-4)**

SMILES : O=C(OC=C)C
CHEM : Acetic acid ethenyl ester
MOL FOR: C4 H6 O2
MOL WT : 86.09

----- EPI SUMMARY (v4.00) -----

Physical Property Inputs:

Log Kow (octanol-water): -----
Boiling Point (deg C) : -----
Melting Point (deg C) : -----
Vapor Pressure (mm Hg) : -----
Water Solubility (mg/L): -----
Henry LC (atm-m³/mole) : -----

Log Octanol-Water Partition Coef (SRC):
Log Kow (KOWWIN v1.68 estimate) = 0.73
Log Kow (Exper. database match) = 0.73
Exper. Ref: HANSCH,C ET AL. (1995)

Boiling Pt, Melting Pt, Vapor Pressure Estimations (MPBPVP v1.43):
Boiling Pt (deg C): 76.05 (Adapted Stein & Brown method)
Melting Pt (deg C): -83.50 (Mean or Weighted MP)
VP(mm Hg,25 deg C): 119 (Mean VP of Antoine & Grain methods)
VP (Pa, 25 deg C) : 1.58E+004 (Mean VP of Antoine & Grain methods)
MP (exp database): -93.2 deg C
BP (exp database): 72.5 deg C
VP (exp database): 9.02E+01 mm Hg (1.20E+004 Pa) at 20 deg C

Water Solubility Estimate from Log Kow (WSKOW v1.42):
Water Solubility at 25 deg C (mg/L): 3.025e+004
log Kow used: 0.73 (expkow database)
no-melting pt equation used
Water Sol (Exper. database match) = 2e+004 mg/L (20 deg C)
Exper. Ref: RIDDICK,JA ET AL. (1986)

Water Sol Estimate from Fragments:
Wat Sol (v1.01 est) = 39371 mg/L

ECOSAR Class Program (ECOSAR v1.00):
Class(es) found:
Esters
Vinyl/Allyl Esters

Henry's Law Constant (25 deg C) [HENRYWIN v3.20]:

Bond Method : 1.17E-003 atm-m³/mole (1.18E+002 Pa-m³/mole)

Group Method: 3.01E-004 atm-m³/mole (3.05E+001 Pa-m³/mole)

Exper Database: 5.11E-04 atm-m³/mole (5.18E+001 Pa-m³/mole)

For Henry LC Comparison Purposes:

User-Entered Henry LC: not entered

Henry's LC [via VP/WSol estimate using User-Entered or Estimated values]:

HLC: 4.456E-004 atm-m³/mole (4.515E+001 Pa-m³/mole)

VP: 119 mm Hg (source: MPBPVP)

WS: 3.03E+004 mg/L (source: WSKOWWIN)

Log Octanol-Air Partition Coefficient (25 deg C) [KOAWIN v1.10]:

Log Kow used: 0.73 (exp database)

Log Kaw used: -1.680 (exp database)

Log Koa (KOAWIN v1.10 estimate): 2.410

Log Koa (experimental database): None

Probability of Rapid Biodegradation (BIOWIN v4.10):

Biowin1 (Linear Model) : 0.8807

Biowin2 (Non-Linear Model) : 0.9972

Expert Survey Biodegradation Results:

Biowin3 (Ultimate Survey Model): 3.1491 (weeks)

Biowin4 (Primary Survey Model) : 3.9525 (days)

MITI Biodegradation Probability:

Biowin5 (MITI Linear Model) : 0.8187

Biowin6 (MITI Non-Linear Model): 0.9303

Anaerobic Biodegradation Probability:

Biowin7 (Anaerobic Linear Model): 0.7078

Ready Biodegradability Prediction: YES

Hydrocarbon Biodegradation (BioHCwin v1.01):

Structure incompatible with current estimation method!

Sorption to aerosols (25 Dec C)[AEROWIN v1.00]:

Vapor pressure (liquid/subcooled): 1.2E+004 Pa (90.2 mm Hg)

Log Koa (Koawin est): 2.410

Kp (particle/gas partition coef. (m³/ug)):

Mackay model : 2.49E-010

Octanol/air (Koa) model: 6.31E-011

Fraction sorbed to airborne particulates (phi):

Junge-Pankow model : 9.01E-009

Mackay model : 2E-008

Octanol/air (Koa) model: 5.05E-009

Atmospheric Oxidation (25 deg C) [AopWin v1.92]:

Hydroxyl Radicals Reaction:

OVERALL OH Rate Constant = 26.3422 E-12 cm³/molecule-sec
Half-Life = 0.406 Days (12-hr day; 1.5E6 OH/cm³)
Half-Life = 4.872 Hrs
Ozone Reaction:
OVERALL Ozone Rate Constant = 0.175000 E-17 cm³/molecule-sec
Half-Life = 6.549 Days (at 7E11 mol/cm³)
Fraction sorbed to airborne particulates (phi):
1.45E-008 (Junge-Pankow, Mackay avg)
5.05E-009 (Koa method)
Note: the sorbed fraction may be resistant to atmospheric oxidation

Soil Adsorption Coefficient (KOCWIN v2.00):
Koc : 5.583 L/kg (MCI method)
Log Koc: 0.747 (MCI method)
Koc : 18.34 L/kg (Kow method)
Log Koc: 1.263 (Kow method)

Aqueous Base/Acid-Catalyzed Hydrolysis (25 deg C) [HYDROWIN v2.00]:
Total Kb for pH > 8 at 25 deg C : 5.666E-001 L/mol-sec
Kb Half-Life at pH 8: 14.157 days
Kb Half-Life at pH 7: 141.574 days
(Total Kb applies only to esters, carbmates, alkyl halides)

Bioaccumulation Estimates (BCFBAF v3.01):
Log BCF from regression-based method = 0.500 (BCF = 3.162 L/kg wet-wt)
Log Biotransformation Half-life (HL) = -1.7524 days (HL = 0.01769 days)
Log BCF Arnot-Gobas method (upper trophic) = 0.051 (BCF = 1.124)
Log BAF Arnot-Gobas method (upper trophic) = 0.051 (BAF = 1.124)
log Kow used: 0.73 (expkow database)

Volatilization from Water:
Henry LC: 0.000511 atm-m³/mole (Henry experimental database)
Half-Life from Model River: 2.01 hours
Half-Life from Model Lake : 99.73 hours (4.155 days)

Removal In Wastewater Treatment:
Total removal: 19.94 percent
Total biodegradation: 0.08 percent
Total sludge adsorption: 1.49 percent
Total to Air: 18.36 percent
(using 10000 hr Bio P,A,S)

Removal In Wastewater Treatment:
Total removal: 92.40 percent
Total biodegradation: 89.22 percent
Total sludge adsorption: 0.34 percent

Total to Air: 2.84 percent
(using Biowin/EPA draft method)

Level III Fugacity Model:

Mass Amount (percent)	Half-Life (hr)	Emissions (kg/hr)
Air 6.02	9.17	1000
Water 56.5	360	1000
Soil 37.3	720	1000
Sediment 0.117	3.24e+003	0

Persistence Time: 140 hr

• **ECOSAR Results for Vinyl Acetate (CAS #108-05-4)**

SMILES : O=C(OC=C)C

CHEM : Acetic acid ethenyl ester

CAS Num: 000108-05-4

ChemID1:

ChemID2:

ChemID3:

MOL FOR: C4 H6 O2

MOL WT : 86.09

Log Kow: 0.73 (KowWin estimate)

Melt Pt:

Wat Sol: 2E+004 mg/L (experimental database)

ECOSAR v1.00 Class(es) Found

Esters

Vinyl/Allyl Esters

ECOSAR Class	Organism	Predicted		
		Duration	End Pt	mg/L (ppm)
Esters	: Fish	96-hr	LC50	62.471
Esters	: Fish	14-day	LC50	60640.020 *
Esters	: Daphnid	48-hr	LC50	151.293
Esters	: Green Algae	96-hr	EC50	73.932
Esters	: Fish	32/33-d	ChV	7.621
Esters	: Daphnid	21-day	ChV	132.450
Esters	: Green Algae		ChV	12.319
Esters	: Fish (SW)	96-hr	LC50	106.525
Esters	: Mysid Shrimp	96-hr	LC50	176.036
Esters	: Fish (SW)		ChV	12.220 !
Esters	: Mysid Shrimp (SW)		ChV	1.9e+005 *
Esters	: Earthworm	14-day	LC50	2886.131

Vinyl/Allyl Esters	: Fish	96-hr	LC50	1.036
Vinyl/Allyl Esters	: Daphnid	48-hr	LC50	14.857
Vinyl/Allyl Esters	: Green Algae	96-hr	EC50	4.469
Vinyl/Allyl Esters	: Fish		ChV	0.066 !
Vinyl/Allyl Esters	: Daphnid		ChV	1.089 !
Vinyl/Allyl Esters	: Green Algae		ChV	0.761

Neutral Organic SAR	: Fish	96-hr	LC50	791.033
(Baseline Toxicity)	: Daphnid	48-hr	LC50	391.385
	: Green Algae	96-hr	EC50	100.115
	: Fish		ChV	77.234
	: Daphnid		ChV	28.867
	: Green Algae		ChV	28.722

Note: * = asterisk designates: Chemical may not be soluble enough to measure this predicted effect.

Note: ! = exclamation designates: The toxicity value was determined from a predicted SAR using established acute-to-chronic ratios and ECOSAR regression techniques which are documented in the supporting Technical Reference Manual. When possible, this toxicity value should be considered in a weight of evidence approach.

Esters:

For Fish LC50 (96-h), Daphnid LC50, Mysid: If the log Kow is greater than 5.0, or if the compound is solid and the LC50 exceeds the water solubility by 10X, no effects at saturation are predicted.

For Fish LC50 (14-day) and Earthworm LC50: If the log Kow is greater than 6.0, or if the compound is solid and the LC50 exceeds the water solubility by 10X, no effects at saturation are predicted.

For Green Algae Acute Toxicity Values: If the log Kow of the chemical is greater than 6.4, or if the compound is solid and the EC50 exceeds the water solubility by 10X, no effects at saturation are predicted for these endpoints.

For All Chronic Toxicity Values: If the log Kow of the chemical is greater than 8.0, or if the compound is solid and the ChV exceeds the water solubility by 10X, no effects at saturation are predicted for these endpoints.

ECOSAR v1.00 SAR Limitations:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50, Mysid LC50)
Maximum LogKow: 6.0 (Fish 14-day LC50; Earthworm LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)
Maximum Mol Wt: 1000

Vinyl/Allyl Esters:

For Fish and Daphnid Acute Toxicity Values: If the log Kow of the chemical is greater than 5.0, or if the compound is solid and the LC50 exceeds the water solubility by 10X, no effects at saturation are predicted for these endpoints.

For Green Algae Acute Toxicity Values: If the log Kow of the chemical is greater than 6.4, or if the compound is solid and the EC50 exceeds the water solubility by 10X, no effects at saturation are predicted for these endpoints.

For All Chronic Toxicity Values: If the log Kow of the chemical is greater than 8.0, or if the compound is solid and the ChV exceeds the water solubility by 10X, no effects at saturation are predicted for these endpoints.

ECOSAR v1.00 SAR Limitations:

Maximum LogKow: 5.0 (LC50)
Maximum LogKow: 6.4 (EC50)
Maximum LogKow: 8.0 (ChV)
Maximum Mol Wt: 1000

Baseline Toxicity SAR Limitations:

Maximum LogKow: 5.0 (Fish 96-hr LC50; Daphnid LC50)
Maximum LogKow: 6.4 (Green Algae EC50)
Maximum LogKow: 8.0 (ChV)
Maximum Mol Wt: 1000