Australian Government
Department of Health and Aged Care
Australian Industrial Chemicals Introduction Scheme

2-Propenoic acid, 1,1′-(alkanediyl) ester

Assessment statement (CA09721)

30 May 2023

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AICIS assessment (CA09721)

Chemical in this assessment

AICIS Approved Chemical Name (AACN)
2-Propenoic acid, 1,1′-(alkanediyl) ester

Reason for the assessment

An application for an assessment certificate under section 31 of the *Industrial Chemicals Act 2019* (the Act).

Certificate Application type

The application is a Health and Environment Focus.

Defined scope of assessment

The chemical was assessed for use in the manufacture of printing components (articles) by workers and only in commercial or industrial settings with the following:

- imported into Australia at up to 5 tonnes each year
- imported as a formulation containing the chemical at up to 10% concentration
- the use of the chemical does not result in direct release to natural water ways, municipal water supplies or municipal sewerage systems.

Summary of assessment

Summary of introduction, use and end use

The assessed chemical will not be manufactured in Australia and will be imported as part of a formulation (at up to 10% concentration) that will be used to manufacture printing components (articles).

The formulation containing the assessed chemical will be imported in 20 L containers or 205 L drums. The formulation will be distributed to printing facilities, where it will be poured or pumped into the tanks of processing machines. From there, the formulation is automatically pumped into processing equipment to manufacture printing components (articles). During the manufacturing process, the assessed chemical will be cured and bound to the printing components (articles).

There will be no consumer use of the formulation containing the assessed chemical.

Human health

Summary of health hazards

Based on the data submitted on the assessed chemical, the assessed chemical is:

- of low acute oral and inhalation toxicity
- slightly irritating to skin and eyes

The assessed chemical is sensitising to the skin and warrants hazard classification (see **Hazard classifications relevant for worker health and safety**).

Based on the 28-day repeated dose oral toxicity study provided, the assessed chemical is not likely to cause adverse effects following repeated oral exposure (up to 1,000 mg/kg bw/day in rats).

The provided *in vitro* and *in vivo* studies for genotoxicity cannot completely rule out genotoxicity potential of the assessed chemical.

For further details of the health hazard information see **Supporting information**.

Hazard classifications relevant for worker health and safety

The chemical satisfies the criteria for classification according to the *Globally Harmonized System of Classification and Labelling of Chemicals* (GHS) (UNECE 2017) for hazard classes relevant for worker health and safety as follows.

Health hazards	Hazard category	Hazard statement
Skin sensitisation	Skin Sens. 1	H317: May cause an allergic skin reaction

Summary of health risk

Public

When introduced and used in the proposed manner, it is unlikely that the public will be exposed to the assessed chemical. No risks are identified for public health during this assessment that require specific risk management measures if the assessed chemical is introduced and used in accordance with the terms of the assessment certificate.

Workers

Potential exposure of workers to the assessed chemical at up to 10% concentration may occur during transfer, manufacturing of printing components containing the assessed chemical, and cleaning or maintenance of equipment. While the exposure to the assessed chemical will be mainly dermal, ocular and inhalation exposure may also occur. Once cured and bound to the printing components (articles), the assessed chemical will not be available for exposure.

Given that the assessed chemical is a skin sensitiser, control measures to minimise dermal exposure are needed to manage the risk to workers (see **Means for managing risk**). As the inhalation toxicity of the chemical following repeated exposure is unknown, control measures

to minimise inhalation exposure are also needed if mists or aerosols are formed during handling of the chemical.

Environment

Summary of environmental hazard characteristics

According to domestic environmental hazard thresholds and based on the provided data the chemical is:

- Not persistent (not P)
- Bioaccumulative (B)
- Toxic (T)

Environmental hazard classification

The chemical satisfies the criteria for classification according to the *Globally Harmonized System of Classification and Labelling of Chemicals* (GHS) (UNECE, 2017) as Acute Category 1 (H400) based on acute toxicity data for fish, invertebrates, and algae and Chronic Category 1 (H410) based on chronic toxicity data for algae. Considerations were also made for the rapid degradation of the assessed chemical.

Environmental Hazard	Hazard Category	Hazard Statement
Hazardous to the aquatic environment (acute / short-term)	Aquatic Acute 1	H400: Very toxic to aquatic life
Hazardous to the aquatic environment (long-term)	Aquatic Chronic 1	H410: Very toxic to aquatic life with long lasting effects

Summary of environmental risk

The assessed chemical will be introduced as a formulation (at up to 10% concentration) that will be used to manufacture printing components (articles). No significant release of the assessed chemical is expected to occur as a result of its end use as the assessed chemical will be cured and bound to the printing components (articles). These components and any residues will be disposed of appropriately. Hence, no release to the aquatic compartment is expected.

The assessed chemical is readily biodegradable, and not persistent. The assessed chemical has the potential to bioaccumulate and is toxic to aquatic organisms.

Based on its assessed use pattern and lack of environmental release, the environmental risk from the introduction of the assessed chemical can be managed within existing frameworks.

Means for managing risk

Workers

Recommendation to Safe Work Australia

- It is recommended that Safe Work Australia (SWA) update the *Hazardous Chemical Information System* (HCIS) to include classifications relevant to work health and safety (see **Hazard classifications relevant for worker health and safety**).

Information relating to safe introduction and use

- The information in this statement including recommended hazard classifications, should be used by a person conducting a business or undertaking (PCBU) at a workplace (such as an employer) to determine the appropriate controls under the relevant jurisdiction Work Health and Safety laws.

- The following control measures could be implemented to manage the risk arising from exposure to the assessed chemical during handling of formulations containing the chemical:

    - Use of engineering controls such as
        - Enclosed and automated processes where possible
        - Adequate workplace ventilation to avoid accumulation of mists or aerosols

    - Use of safe work practices to
        - Avoid contact with skin and eyes
        - Avoid inhalation of mists or aerosols

    - Workers should wear the following personal protective equipment (PPE)
        - Impervious gloves
        - Protective clothing
        - Safety glasses / goggles or face mask
        - Respiratory protection where local ventilation may be inadequate

- As the assessed polymer is a skin sensitiser, the control measures may need to be supplemented with health monitoring for any worker who is at significant risk of exposure to the chemical, if valid techniques are available to monitor the effect on the worker's health.

- A copy of the Safety Data Sheet (SDS) should be easily accessible to employees.

Environment

Information relating to safe introduction and use

The chemical may be scheduled under the *Industrial Chemicals Environmental Management (Register) Act 2021*. Information from this assessment statement will be considered as part of any scheduling process. This may include information on chemical identity, environmental hazard characteristics, GHS classification and environmental risk.

Conclusions

The conclusions of this assessment are based on the information described in this statement.

Considering the means for managing risks, the Executive Director is satisfied that when the assessed chemical is introduced and used in accordance with the terms of the assessment certificate, the human health and environment risks can be managed. This is provided that:

- all requirements are met under environmental, workplace health and safety and poisons legislation as adopted by the relevant state or territory; and
- the means of managing the risks identified during this assessment are implemented.

Note: Obligations to report additional information about hazards under section 100 of the *Industrial Chemicals Act 2019* apply.

Supporting information

Chemical identity

Chemical name	2-Propenoic acid, 1,1′-(alkanediyl) ester (AACN)
Molecular weight (g/mol)	< 500

Relevant physical and chemical properties

Physical form	Clear colourless liquid
Melting point	5.8 °C
Boiling point	Decomposes at 177 °C
Density	985 kg/m^3 at 20 °C
Vapour pressure	0.025 Pa at 25 °C
Water solubility	3.46 mg/L at 20°C and pH = 7.4
Ionisable in the environment?	No
log K_{ow}	4.64
log K_{oc}	3.77
Flash point	163 °C
Autoignition temperature	262 °C

Human exposure

Workers

Transport and storage workers are not expected to be exposed to the assessed chemical, except in the unlikely event of an accidental rupture of containers.

During transfer from the container to the tank of the processing machine, the manufacturing process of printing components, and cleaning and maintenance of equipment, there is potential for worker exposure to the assessed chemical at up to 10% concentration. According to the applicant, engineering controls (such as automated, closed systems where possible and adequate ventilation) and appropriate personal protective equipment (PPE) (including impervious gloves, protective clothing, safety glasses and respiratory protection where local ventilation may not be inadequate) are expected to be in place to minimise dermal, ocular and inhalation exposure.

Health hazard information

Acute toxicity

Oral

In an acute oral toxicity study (OECD TG 423), the assessed chemical was administered to two groups of fasted female Sprague-Dawley rats (n = 3 per group) at a single dose of 2,000 mg/kg bw via oral gavage. The animals were observed for 14 days after administration. All animals survived until the end of the 14-day study period and no signs of clinical toxicity were noted. All animals showed expected body weight gains over the study period. No treatment-related gross necropsy findings were observed. The acute oral median lethal dose (LD50) of the assessed chemical was determined to be > 2,000 mg/kg bw.

Dermal

No acute dermal toxicity data are provided for the assessed chemical.

Inhalation

In an acute inhalation toxicity study (OECD TG 403), a group of Sprague-Dawley rats (n = 5/sex) were exposed to the assessed chemical in aerosol form for 4 hours using a nose-only exposure system. The mean achieved atmosphere concentration was 5.05 mg/L. The animals were observed for 14 days after administration. All animals survived until the end of the 14-day study period. Common clinical signs included increased respiratory rate, hunched posture, piloerection and wet fur. All animals recovered from Days 2-3 post-exposure and showed expected body weight gains over the study period. The only macroscopic abnormalities observed was one animal with darkened lungs. The acute inhalation median lethal concentration (4-hour LC50) of the assessed chemical was determined to be > 5.05 mg/L.

Corrosion/Irritation

Skin irritation

A skin irritation study was conducted on the assessed chemical following OECD TG 404. The test was conducted in 3 New Zealand white rabbits using semi-occlusive patches (2.5 cm × 2.5 cm) with 0.5 mL of the chemical applied to different treated sites for 3 minutes, 1 hour and 4 hours respectively. The site was evaluated for irritation upon the patch removal at 60 minutes followed by 24, 48 and 72 hours, as well as 7 days. After application of the test substance for 4 hours, two treated sites showed well-defined erythema and very slight oedema. At the 24-hour and 48-hour observations, well-defined erythema and very slight oedema were observed at all treated sites. At the 72-hour observation, very slight erythema was observed in all treated sites. All treated sites had completely recovered by day 7. The mean individual erythema scores from gradings at 24, 48 and 72 hours were 1.7, 1.7, 1.7, respectively. The mean individual oedema scores from gradings at 24, 48 and 72 hours were 0.7, 0.7, 0.7, respectively. Based on the results, the assessed chemical is considered to be slightly irritating to the skin and is not classified as a skin irritant according to the GHS criteria.

Eye irritation

An eye irritation study was conducted on the assessed chemical following OECD TG 405. The test was conducted in 3 New Zealand white rabbits. A volume of 0.1 mL of the test substance

was instilled into one eye of each rabbit and ocular irritation was evaluated after exposure at 1, 24, 48 and 72 hours. Minimal conjunctival redness and discharge were observed one hour after treatment, which completely recovered at the 24-hour observation. No effects on the cornea and iris were observed. Based on the results, the assessed chemical is considered to be slightly irritating to the eyes and is not classified as an eye irritant according to the GHS criteria.

Sensitisation

Skin sensitisation

A local lymph node assay (LLNA) was conducted on the assessed chemical following OECD TG 429. Female CBA/Ca mice (4 animals/group) were treated at 10%, 25% or 50% concentration on both ears for 3 consecutive days. All treated animals survived and no signs of systemic toxicity were observed. Moderate redness was observed on the ears, head, and neck of animals treated at 50% concentration. The Stimulation Indices (SI) were calculated to be 9.76, 8.71 and 13.62 for 10%, 25% and 50% concentrations, respectively. Based on the results, the assessed chemical is considered to be a skin sensitiser, warranting a hazard classification for skin sensitisation (Category 1, H317: May cause an allergic skin reaction) according to GHS criteria.

Repeat dose toxicity

Oral

In a repeated dose oral toxicity study (OECD TG 407), the assessed chemical was administered to Sprague-Dawley rats (5/sex/group) by oral gavage at 0, 15, 150 and 1,000 mg/kg bw/day for 28 days. There were no unscheduled deaths and no effects of toxicological importance were observed. The No Observed Adverse Effect Level (NOAEL) was considered to be 1,000 mg/kg bw/day.

Genotoxicity

The assessed chemical was found to be non-mutagenic in a bacterial reverse mutation assay (OECD TG 471) using TA1535, TA1537, TA98 and TA100 strains of *Salmonella typhimurium* and WP2uvrA- strain of *Escherichia coli*. No signs of cytotoxicity were observed, and no positive results for mutagenicity were observed in any of the tested strains, up to a concentration of 5,000 µg/plate.

The assessed chemical was found to be clastogenic to Chinese Hamster Lung (CHL) cells in an *in vitro* mammalian chromosome aberration test (similar to OECD TG 473). There was a statistically significant and dose dependant increase of chromosomal aberrations in cells treated at 10 and 15 µg/mL concentrations, with 24 hours exposure time in the absence of metabolic activation. The study authors commented that the mitotic index data for the 15 µg/mL dose level gave a toxicity value that exceeded the acceptable levels (though the cell count data did not), and the positive response at this dose level may have questionable biological relevance.

The assessed chemical was found to be negative in an *in vivo* mouse bone marrow micronucleus test (OECD TG 474). The assessed chemical was administered intraperitoneally at up to 2,000 mg/kg bw. No premature deaths or signs of systemic toxicity were observed. There were no statistically significant decreases in the polychromatic and normochromatic erythrocytes (PCE/NCE) ratio, and no evidence of a statistically significant increase in the

incidence of micronucleated polychromatic erythrocytes, when compared with the control. However, there was no confirmation that the test substance or its metabolites had reached the bone marrow. Additionally, intraperitoneal injection is generally not recommended for this type of study as it is not an intended route of human exposure.

Based on the results of the provided studies, genotoxicity potential of the assessed chemical cannot be completely ruled out.

Environmental exposure

The assessed chemical will be imported into Australia as a formulation that will be employed to manufacture printing components (articles). The formulation containing the assessed chemical will be imported in containers and drums and will be poured or pumped into tanks of processing machines. From there, the formulation is automatically pumped into processing equipment to manufacture printing components (articles).

The assessed chemical has an industrial end use in printing components (articles). During the manufacturing process the assessed chemical will be cured and bound to the printing components (articles) and no release to the environment is expected. The assessed chemical is not expected to be transferred onto printed substrates during use of the printing components (articles). Used printing components (articles) containing the bound assessed chemical are expected to be disposed of according to federal, state and local regulations at the end of their useful life.

The excess formulation is recycled within the processing equipment until it is spent. Any residual spent formulation will be collected and disposed of according to federal, state, and local regulations. There is no release to the sewer and the assessed chemical will not be available for public use.

Residues in empty containers are sent off-site for disposal according to federal, state, and local regulations.

Environmental fate

Partitioning

The assessed chemical is slightly water soluble (water solubility = 3.46 mg/L), moderately volatile (vapour pressure = 0.025 Pa), has a high log K_{ow} (log K_{ow} = 4.64) and high log K_{oc} value (log K_{oc} = 3.77). If the assessed chemical is released to water, a small proportion of the chemical is expected to evaporate and partition to air. Based on its slight water solubility, high log K_{oc} value and high K_{ow}, the remainder of the assessed chemical is expected to readily partition to organic matter in soil and sediments and become immobile.

Degradation

Based on its measured degradation in water and predicted degradation in air, the assessed chemical is not persistent.

A supplied degradation study (OECD TG 301B) of the assessed chemical indicates that it is readily biodegradable in water. The assessed chemical showed 83% of degradation in 28 days and greater than 60% degradation was achieved in 6 days, fulfilling the 10-day window. Therefore, the assessed chemical is not persistent in water.

Supplied hydrolysis data (OECD TG 111) indicate a half-life > 1 year at pH 4 and pH 7 and a half-life of 63.5 hours at pH 9 at 25°C for the assessed chemical. This suggests that the assessed chemical will be hydrolytically stable in water between pH 4 to 7 and will readily hydrolyse at pH 9.

The half-life of the assessed chemical in air is calculated to be 4.01 hours, based on reactions with hydroxyl radicals (US EPA, 2012; calculated using AOPWIN v1.92). As its half-life in air is below the domestic threshold value of 2 days, the assessed chemical is not expected to persist in the air compartment.

Bioaccumulation

Based on its log K_{ow} value, the assessed chemical has the potential to bioaccumulate.

No bioaccumulation information was provided for the assessed chemical. The measured partition coefficient of the assessed chemical is log K_{ow} = 4.64, which exceeds the domestic bioaccumulation threshold of log K_{ow} = 4.2 (EPHC, 2009). This determination is conservative as the assessed chemical is readily biodegradable.

Predicted environmental concentration (PEC)

The predicted environmental concentration (PEC) has not been calculated as release of the assessed chemical to the aquatic environment is expected to be negligible based on its assessed use patterns.

Environmental effects

Effects on aquatic Life

Acute toxicity

The following measured median lethal concentration (LC50) and median effective concentration (EC50) values for model organisms were supplied for the assessed chemical:

Taxon	Endpoint	Method
Fish	96 h LC50 = 0.67 mg/L	*Oncorhynchus mykiss* (rainbow trout) Mortality OECD TG 203 Semi-static conditions Time-weighted mean measured concentration
Invertebrate	48 h EC50 = 0.62 mg/L	*Daphnia magna* (water flea) Immobility OECD TG 202 Semi-static conditions Time-weighted mean measured concentration
Algae	72 h E_rC50 = 0.0036 mg/L	*Scenedesmus subspicatus* (green algae) Growth rate OECD TG 201 Static conditions Geometric mean measured concentration
Microorganisms	3 h EC50 = 210 mg/L	Activated sewage sludge Respiration inhibition OECD TG 209 Nominal concentration

Chronic toxicity

The following measured no-observed-effect concentration (NOEC) value for a model organism was supplied for the assessed chemical:

Taxon	Endpoint	Method
Algae	72 h NOEC = 0.00068 mg/L	*Scenedesmus subspicatus* (green algae) Growth rate OECD TG 201 Static conditions Geometric mean measured concentration

Predicted no-effect concentration (PNEC)

A predicted no-effect concentration (PNEC) of 0.036 µg/L was calculated for the assessed chemical in the aquatic environment. This value was derived using the most sensitive endpoint value for algae (0.0036 mg/L). An assessment factor of 100 was applied to this endpoint as acute toxicity data was available for three trophic levels and chronic toxicity data was available for one trophic level (EPHC, 2009). The acute algae endpoint was selected, over the algal chronic endpoint, in the absence of additional chronic endpoints to support the algal growth rate NOEC (ECHA 2008).

Categorisation of environmental hazard

The categorisation of the environmental hazards of the assessed chemical according to domestic environmental hazard thresholds is presented below:

Persistence

Not Persistent (Not P). Based on measured degradation under screening test conditions and predicted degradation in air, the assessed chemical is categorised as Not Persistent.

Bioaccumulation

Bioaccumulative (B). Based on measured log K_{ow} value exceeding the domestic threshold value, the assessed chemical is categorised as Bioaccumulative.

Toxicity

Toxic (T). Based on available acute ecotoxicity values below 1 mg/L for all three trophic levels, the assessed chemical is categorised as Toxic.

Environmental risk characterisation

Based on its assessed use, the chemical is not expected to be released to the environment. Therefore, a Risk Quotient (PEC/PNEC) for the aquatic compartment could not be calculated.

The assessed chemical has an end use in a formulation that will be used to manufacture printing components (articles). The assessed chemical will be cured and bound to the printing components (articles) which are disposed of according to federal, state and local regulations at the end of their useful life. Any formulation wastes containing the assessed chemical will be disposed of according to federal, state and local regulations and no release to the sewer is expected. Overall, no release to the environment is expected.

Although the assessed chemical is toxic and potentially bioaccumulative, it does not meet all three PBT criteria. It is hence unlikely to have unpredictable long-term effects (EPHC 2009).

Therefore, based on the assessed hazard characteristics (not P, B, T) and the assessed use pattern, the environmental risk from the assessed chemical can be managed within existing frameworks.

References

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