

GRASS Assessment Report

ERUCYLAMIDE (C₂₂H₄₃NO)

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1. SUBSTANCE DESCRIPTION SUMMARY

Substance name		Erucamide
1.1.	Alternative names and synonyms	(Z)-Docos-13-enamide; Erucyl amide; Cis-13-Docosenoamide; 13-docosenamide; erucamide; erucilamide; erucic acid amide;
1.2	Pubchem Database link	https://pubchem.ncbi.nlm.nih.gov/compound/Erucylamide#section=Top
1.3	TOXNET database link	http://toxnet.nlm.nih.gov/cgi-bin/sis/search2/r?dbs+hsdb:@term+@DOCNO+5577
1.4	Chemical formula	C ₂₂ H ₄₃ ON
1.5	Molar mass	337.5829 g/mol
1.6	IUPAC ID	(Z)-docos-13-enamide
1.7	CAS number	112-84-5
1.8	Melting point	75-82 °C
	Boiling point	474.2 °C
1.9	Specific Migration limit	5 mg/kg food contents
1.10	Density:	0.908 (relative density at 20 degrees C)
	Particle size distribution (D10)	No Information Available from any designated sources for all synonyms
	Particle size distribution (D50)	No Information Available from any designated sources for all synonyms
	Particle size distribution (D90)	No Information Available from any designated sources for all synonyms
1.11	Solubility in water	7.74E-07 mol/L
	Solubility in acids	No Information Available from any designated sources for all synonyms
	Solubility in alkalines	No Information Available from any designated sources for all synonyms
	Solubility in solvent	Soluble in isopropanol; slightly soluble in ethanol and acetone
	Solubility partition coefficient (Log P)	8.44-8.49

2. HARMFUL EFFECTS TO HEALTH

H315: Causes skin irritation.^{1,2}

- Skin Contact Irritant
- Irritation may occur upon direct contact. R38 / H315 (81.91%): [Warning Skin corrosion/irritation - Category 2].
- Exposure route: dermal contact (single)
- Concentration required for toxicity: No Information Available from any designated sources for all synonyms

H319: Causes serious eye irritation^{1,2}

- Irritating to eyes
- Irritation may occur upon direct contact. R36 / H319 (81.91%): [Warning Serious eye damage/eye irritation - Category 2A]
- Exposure route: direct eye contact (single)
- Concentration required for toxicity: No Information Available from any designated sources for all synonyms

H335: May cause respiratory irritation^{1,2}

- Respiratory system
- Irritation may occur with direct inhalation. R37 / H335 (81.91%): [Warning Specific target organ toxicity, single exposure; Respiratory tract irritation - Category 3]
- Exposure route: Inhalation (single)
- Concentration required for toxicity: No Information Available from any designated sources for all synonyms

OCH3: Any other Human Health Hazard which cannot be classified by a listed GHS code^{3, 4, 5, 6, 7}

- heart defects (interstitial oedema, abnormal fat accumulation, myocytolysis and some focal areas of necrosis)
- observed in the myocardium in rats exposed to 10% rapeseed oil in the diet (containing erucylamide)
- Exposure route: Oral (repeated)
- Concentration required for toxicity: 3 g/kg bw/day

Accumulative effects: Bioconcentration factor of 2.48 according to CompTox.²

Combinatory effects: --

3. HARMFUL EFFECTS TO ENVIRONMENT

OCH4: Any other Environmental Hazard which cannot be classified by a listed GHS code⁸

- Potential atmospheric release
- While there is no direct evidence of environmental risk, little is known, and with large scale industrial release problems may be encountered. The estimated vapor pressure suggests that erucamide should be present both in the vapor and particulate phase in air. If present in the atmosphere in the vapor form, erucamide should react with photochemically produced hydroxyl radicals and ozone with an estimated half-life of 3.2 hrs and 2.1 hrs, respectively. Particulate erucamide salt may be partially removed from the atmosphere by dry deposition. ToxNet Environmental Fate/Exposure Summary
- Exposure source: no information available from any designated sources for any synonyms
- Concentration required for toxicity: no information available from any designated sources for any synonyms

OCH4: Any other Environmental Hazard which cannot be classified by a listed GHS code⁸

- Potential persistence in soils
- While there is no direct evidence of environmental risk, little is known, and with large scale industrial release problems may be encountered. Based upon an estimated Koc value, erucamide may have very low mobility in soil and should remain strongly sorbed to suspended solids and sediments. Erucamide was found to be readily assimilated by fungi but its biodegradation in soil and water is unknown. ToxNet Environmental Fate/Exposure Summary
- Exposure source: no information available from any designated sources for any synonyms
- Concentration required for toxicity: no information available from any designated sources for any synonyms

OCH4: Any other Environmental Hazard which cannot be classified by a listed GHS code⁸

- Potential persistent aquatic pollution
- While there is no direct evidence of environmental risk, little is known, and with large scale industrial release problems may be encountered. There is the potential for bioaccumulation of this organic substance in aquatic organisms, suggesting environmental release should be limited. "The estimated Henry's Law constant suggests that volatilization of erucamide from water should be negligible. ToxNet Environmental Fate/Exposure Summary
- Exposure source: no information available from any designated sources for any synonyms
- Concentration required for toxicity: no information available from any designated sources for any synonyms

Accumulative effects: --

Combinatory effects: --

4. REGULATORY LIMITS AND RESTRICTIONS

ADI / TDI EU	An EU directive allows 5% maximum Erucylamide concentrations in oils and fats intended to be used for human consumption. For erucic acid a tolerable daily intake (TDI) of 7 mg/kg body weight (bw) per day has recently been established, based on a no observed adverse effect level of 0.7 g/kg bw per day for lipidosis in rats and piglets. Mean chronic exposures established in different population groups in the population did not exceed the TDI. The 95th percentile dietary exposure level was found to be highest in infants and children, ranging from 1.3 to 7.4 mg/kg bw per day; which indicates a potential risk to vulnerable populations of high erucic acid exposure. (Note this is supported by the NOEL of 7.5 mg erucic acid/kg bw/day, solely extrapolated from animal studies). Exposure route: Oral. ^{9, 10}
ADI / TDI WHO	None
ADI / TDI USA	no data available for the element, but, regarding the use of the element for adhesive in food packaging, regulations exists to ensure the element can be considered as "safe" for food packaging use. ^{11, 12, 13}
OSHA PEL (1)	15 mg/m ³ (Particulates not otherwise regulated PNOR) (OSHA PEL TWA). Exposure route: Inhalation. ¹⁴
OSHA PEL (2)	10 mg/m ³ (Particulates not otherwise specified PNOS) (ACGIH TLV TWA). Exposure route: Inhalation. ¹⁴
Safety of substance according to CDC NIOSH website	No Information Available from any designated sources for all synonyms
ICSC card if available	No Information Available from any designated sources for all synonyms
Haz-Map link	https://hazmap.nlm.nih.gov/category-details?id=5115&table=copytblagents
OSHA.gov link	No Information Available from any designated sources for all synonyms

5. PI SUMMARY STATEMENTS

Primary PI statement on human health

With some basic limits and restrictions, this substance can be considered as safe to human health to a GRASS Class C and there is sufficient evidence to establish a class outcome with reasonable scientific confidence.

At present there are no doubts or any lack of certainty, to the safety of the substance with regards to human health.

Erucylamide is associated with some irritant and harmful effects on humans including skin, eyes and the pulmonary system, however no data are available regarding the importance of these harmful effects and they are likely to only be relevant in occupational environments. Occupational exposure is a significant risk, as substance can cause skin contact Irritation (H315: Causes skin irritation), irritation to eyes (H319: Causes serious eye irritation) and respiratory system (H335: May cause respiratory irritation) with direct contact although concentrations required for toxicity are unknown. Restrictions and PPE must mitigate any risk of harmful effect. Exposure can be limited to ensure safety, by ensuring no direct contact with high doses, no ingestion under any circumstances and no inhalation within the range of the PEL 10 mg/m³ (Particulates not otherwise specified PNOS) (ACGIH TLV TWA).

The most concerning risk to the general public is the risk of oral ingestion. Association with heart defects with repeated oral intake at an overdose to recommended intake exists with repeated high levels (427-fold higher than the TDI) of oral intake (OCH3: Any other Human Health Hazard which cannot be classified by a listed GHS code). In animal models, this results in abnormal fat accumulation in the myocardium from 10% rapeseed oil in the diet (3000 mg/kg bw equivalent) and heart defects (i.e. interstitial oedema, myocytolysis and some focal areas of necrosis), this has not been identified in humans though.

A tolerable level for human exposure should not exceed 7 mg. erucic acid/kg bw/day (approximately 500 mg erucic acid/day for the average adult). 5 % maximum in in oils and fats intended to be used as such for human consumption and foodstuffs containing added oils or fats.

Due to abnormal fat accumulation in the myocardium (studies mostly performed in rats), an EU directive allows 5% maximum of the element in oils and fats intended to be used as such for human consumption and foodstuffs containing added oils or fats. The only other data available involves a NOEL solely extrapolated from animal studies (approximately 500mg erucic acid/day for the average adult). For erucic acid, the EU recently established a tolerable daily intake (TDI) of 7 mg/kg body weight (bw) per day has recently been established, based on a no observed adverse effect level of 0.7 g/kg bw per day for lipidosis in young rats and newborn piglets. Mean chronic exposure of the different groups of the population did not exceed the TDI.

There are no serious or irreversible effects on human health associated with overdose, misuse or unconventional use. Harmful effects are well known and are associated only with an

oral ingestion of the compound. Myocardial lipodosis effects are reversible and transient during prolonged exposure.¹⁰

Migration tests must be performed when used as a plastic component, as in LDPE 98% migration is reported. Due to the high migration levels (98%), SML MUST be established prior to use in PP and HDPE products and materials.

Oral intake is must be avoided under all circumstances. Whilst the Organics Council® do not approve the use of this substance as a food additive or component, we acknowledge it occurs naturally in some food goods at low levels. We believe this compound should only be used in its natural source form and isolated from foods, and is only to be used in products where no direct contact with food items, or likely oral exposure will occur.

Direct contact with skin and eyes should be avoided. This is also relevant when general public contact may occur due to use as an adhesive or other application. (According to FDA regulations, only trace and minimal amounts should be utilised).

No banned or high alert H codes exist.

Additional secondary PI notes on human health

Despite a lack of human evidence, due to the very high dose repeated oral intake required for potential heart defects, these may be fully mitigated with adequate restrictions of use. According to the FS agency for Australia and NZ, at risk groups would be those that are likely to consume significant amounts of high erucic acid rapeseed oil or mustard seed oil. There is a 120-fold margin of safety between the TDI and a level of intake of erucic acid that has been associated with increased myocardial lipodosis in pigs, so no human risk should be expected with reasonable use of this substance.

Primary PI statement on environmental health

With some basic limits and restrictions, this substance can be considered as safe to environmental health to a GRASS Class C, although it is of concern that there is very little available information on the environmental impact of this substance.

At present there are no doubts or any lack of certainty, to the safety of the substance with regards to environmental health.

There are no associated sustainability impacts that have been reported as a result of sourcing, processing, usage or disposal of this substance.

There are no serious or irreversible effects on environmental health associated with overdose, misuse or unconventional use.

This substance can be considered as safe to the environment ensuring some basic restrictions avoid excessive direct release into aquatic systems or soils. However, uncontrolled

disposal to the environment should be minimized. There is the potential for bioaccumulation of this organic substance in aquatic organisms, suggesting environmental release should be limited. Erucamide was found to be readily assimilated by fungi but its biodegradation in soil and water is unknown. Based upon an estimated Koc value, erucamide may have very low mobility in soil and should remain strongly sorbed to suspended solids and sediments in water. Particulate erucamide salt may be partially removed from the atmosphere by dry deposition.

Natural biopolymer versions of this substance are available, extracted from High Erucic Acid Rapeseed (HEAR), are recommended and encouraged by the Organics Council[®], although these should never be produced by GMO sources.

No high alert or banned H codes exist. No known sustainability issues or environmental hazards have been reported with synthetic erucylamide, therefore, this substance can be considered safe with a GRASS Class C for Environmental health.

Additional secondary PI notes on environmental health

GRASS Class B is reasonable in this case as although there is no evidence of negative environmental impact or lack of sustainability, there is at present too little information to make a full and informed assessment. Data suggests that long-term persistence may be an issue and that large scale release should be avoided via atmospheric and aquatic sources and that soil contamination may also be a risk, resulting in the need for strict disposal restrictions.

6. FINAL CLASS

Human health - Class C

Environmental health – Class B

7. RESEARCHER NAME AND DATES OF ASSESSMENT

Researcher 1:	Lounis Zenad
Researcher 2:	Dr. Olga Snurnikova
Primary review PI:	Dr. Nicolas Goffette
Secondary review PI:	Dr. Esme L Purdie
Date of assessment completion:	19.02.2017

8. REFERENCES

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- ² ECHA. European Chemical Agency. <https://echa.europa.eu/registration-dossier/-/registered-dossier/14899/1>
- ³ Kanishka Bhunia, Shyam S. Sablani, Juming Tang, Barbara Rasco (2013) Comprehensive Reviews in Food Science and Food Safety (12) P. 523
- ⁴ Molnar, N.M., Erucamide Journal of the American Oil Chemists Society March, 51(3), 1974, 84-87.
- ⁵ Yamashiro S, Clandinin MT. Myocardial ultrastructure of rats fed high and low erucic acid rapeseed oils. Exp Mol Pathol. 1980 Aug;33(1):55-64.
- ⁶ FOOD STANDARDS AUSTRALIA NEW ZEALAND. ERUCIC ACID IN FOOD. <http://www.foodstandards.gov.au/publications/documents/Erucic%20acid%20monograph.pdf>
- ⁷ 21CFR178.3860. Code of Federal Regulations. <http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcr/CFRSearch.cfm?fr=178.3860>
- ⁸ ToxNet. NIH - U.S. National Library of Medicine. <http://toxnet.nlm.nih.gov/cgi-bin/sis/search2/r?dbs+hsdb:@term+@DOCNO+5577>
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- ¹¹ 21CFR175.105. CFR - Code of Federal Regulations Title 21. <http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfCFR/CFRSearch.cfm?fr=175.105>
- ¹² 21CFR177.1200. CFR - Code of Federal Regulations Title 21. <http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfCFR/CFRSearch.cfm?fr=177.1200>
- ¹³ 21CFR178.3860. Code of Federal Regulations. <http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfcr/CFRSearch.cfm?fr=178.3860>
- ¹⁴ Chemtura MSDS data - 01601, for Anox™ NDB™ 2306 MAB and Anox™ 2306 MAB Powder. <http://formosa.msdssoftware.com/imagedir/i011C861.pdf>