

SODIUM ERYTHORBATE

This dossier on sodium erythorbate presents the most critical studies pertinent to the risk assessment of these substances in their use in drilling muds. It does not represent an exhaustive or critical review of all available data. The information presented in this dossier was obtained primarily from the ECHA database that provides information on chemicals that have been registered under the EU REACH (ECHA). Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – Sodium erythorbate is classified as a **tier 1** chemicals and requires a hazard assessment only.

1 BACKGROUND

Sodium erythorbate is an ascorbic acid. It is used as an antioxidant and preservative. It is also used in coal seam gas extraction activities to prevent precipitation of metal oxides (iron control).

Sodium erythorbate is highly soluble in water and has a low potential to bind to soil or sediment. It is ultimately biodegradable and is not expected to bioaccumulate. It is of low aquatic toxicity concern.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): sodium;(2R)-2-[(1R)-1,2-dihydroxyethyl]-4-hydroxy-5-oxo-2H-furan-3-olate

CAS RN: 6381-77-7

Molecular formula: C₆H₇NaO₆

Molecular weight: 198.11 g/mol

Synonyms: D-araboascorbic acid, erythorbic acid, erythroascorbic acid, isoascorbic acid, isoascorbic acid, disodium salt, isoascorbic acid, monosodium salt, isoascorbic acid, sodium salt, 2,3-didehydro-3-O-sodio-D-erythro-hexono-1,4-lactone

3 PHYSICO-CHEMICAL PROPERTIES

Key physical and chemical properties for the substance are shown in Table 1.

Table 1 Overview of the Physico-chemical Properties of Sodium Erythorbate

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Odorless solid	2	ECHA
Melting Point	160°C @ 101.3 kPa	1	ECHA
Boiling Point	-	-	ECHA
Density	1702 kg/m ³ @ 20°C	2	ECHA
Vapour Pressure	0 Pa @ 20°C	2	ECHA-
Partition Coefficient (log K _{ow})	-3.29 @ 25°C	2	ECHA
Water Solubility	146 g/L at 20°C	2	ECHA

4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 2). This chemical is listed on the Australian Inventory of Chemical Substances – AICS (Inventory). No conditions for its use were identified. No specific environmental regulatory controls or concerns were identified within Australia and internationally for sodium erythorbate.

Table 2 Existing International Controls

Convention, Protocol or other international control	Listed Yes or No?
Montreal Protocol	No
Synthetic Greenhouse Gases (SGG)	No
Rotterdam Convention	No

Convention, Protocol or other international control	Listed Yes or No?
Stockholm Convention	No
REACH (Substances of Very High Concern)	No
United States Endocrine Disrupter Screening Program	No
European Commission Endocrine Disruptors Strategy	No

5 ENVIRONMENTAL FATE SUMMARY

A. Summary

Sodium erythorbate is highly soluble in water and has a low potential to bind to soil or sediment. It is ultimately biodegradable and is not expected to bioaccumulate.

B. Biodegradation

In an OECD compliant test, the degradation after the 28-day plateau was not yet visible in the degradation curve. Thus, under strict test conditions, the substance appears to be ultimately biodegradable (under the subclassification of inherent biodegradability) (ECHA) [KI Score = 2].

If a chemical is found to be inherently or readily biodegradable, it is categorised as Not Persistent since its half-life is substantially less than 60 days (DoEE, 2017).

C. Environmental Distribution

No experimental data are available for sodium erythorbate. Based on its low log K_{ow} and high water solubility values, if released to soil, sodium erythorbate is expected to have low potential for adsorption and a high potential for mobility. If released to water, it is likely to remain in water and not adsorb to sediment.

D. Bioaccumulation

There are no bioaccumulation studies on sodium erythorbate. The bioconcentration factor (BCF) was estimated to be 0.8933 based on the Arnot-Gobas method (for the upper trophic level) (USEPA 2020). Based on the estimated BCF, bioaccumulation is not expected.

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

Sodium erythorbate exhibits low acute toxicity to aquatic organisms. Details are provided below.

B. Aquatic Toxicity

Acute Studies

Table 3 lists the results of acute aquatic toxicity studies on sodium erythorbate.

Table 3: Acute Aquatic Toxicity Studies on Sodium Erythorbate

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
<i>Oncorhynchus mykiss</i>	96-h LC ₅₀	>100	2	ECHA
<i>Daphnia magna</i>	48-h EC ₅₀	>100	2	ECHA
<i>Freshwater algae</i> ¹	72-h EC ₅₀	>160	2	ECHA

¹ – species not identified in database

Chronic Studies

No chronic aquatic toxicity studies were available for sodium erythorbate.

C. Terrestrial Toxicity

No terrestrial toxicity data were available.

7 CATEGORISATION AND OTHER CHARACTERISTICS OF CONCERN

A. PBT Categorisation

The methodology for the Persistent, Bioaccumulative and Toxic (PBT) substances assessment is based on the Australian and EU REACH Criteria methodology (DEWHA, 2009; ECHA, 2008).

Sodium erythorbate appears to be ultimately biodegradable. Moreover, the probability for rapid biodegradation according to BIOWIN v4.10 is nearly unity. Thus, sodium erythorbate does not meet the screening criteria for persistence.

The estimated log BCF value for sodium erythorbate calculated from the Arnot-Gobas method (upper trophic) QSAR model is 0.8933. Thus, it does not meet the criteria for bioaccumulation.

There are no chronic aquatic toxicity data available on sodium erythorbate. The acute E(L)C₅₀ values > 1 mg/L. Thus, sodium erythorbate does not meet the screening criteria for toxicity.

The overall conclusion is that sodium erythorbate not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for sodium erythorbate.

8 SCREENING ASSESSMENT

Chemical Name	CAS No.	Overall PBT Assessment ¹	Chemical Databases of Concern Assessment Step		Persistence Assessment Step		Bioaccumulative Assessment Step	Toxicity Assessment Step			Risk Assessment Actions Required ³
			Listed as a COC on relevant databases?	Identified as Polymer of Low Concern	P criteria fulfilled?	Other P Concerns	B criteria fulfilled?	T criteria fulfilled?	Acute Toxicity ²	Chronic Toxicity ²	
Sodium erythorbate	6381-77-7	Not a PBT	No	No	No	No	No	No	1	1	1

Footnotes:

1 - PBT Assessment based on PBT Framework.

2 - Acute and chronic aquatic toxicity evaluated consistent with assessment criteria (see Framework).

3 - Tier 1 - Hazard Assessment only.

Notes:

NA = not applicable

PBT = Persistent, Bioaccumulative and Toxic

B = bioaccumulative

P = persistent

T = toxic

9 REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References

Department of the Environment, Water, Heritage and the Arts (DEWHA). (2009). Environmental risk assessment guidance manual for industrial chemicals, Department of the Environment, Water, Heritage and the Arts, Commonwealth of Australia.

Department of the Environment and Energy [DoEE]. (2017). Chemical Risk Assessment Guidance Manual: for chemicals associated with coal seam gas extraction, Guidance manual prepared by Hydrobiology and ToxConsult Pty Ltd for the Department of the Environment and Energy, Commonwealth of Australia, Canberra.

ECHA. ECHA REACH database: <https://echa.europa.eu/information-on-chemicals/registered-substances>

European Chemicals Agency (ECHA). (2008). Guidance on Information Requirements and Chemical Safety Assessment, Chapter R11: PBT Assessment, European Chemicals Agency, Helsinki, Finland.

Klimisch, H.J., Andreae, M., and Tillmann, U. (1997). A systematic approach for evaluating the quality of experimental and toxicological and ecotoxicological data. Regul. Toxicol, Pharmacol. 25:1-5.

USEPA 2020. Estimation Programs Interface Suite™ for Microsoft® Windows, v 4.11. United States Environmental Protection Agency, Washington, DC, USA.

B. Abbreviations and Acronyms

°C	degrees Celsius
AICS	Australian Inventory of Chemical Substances
COC	constituent of concern
DEWHA	Department of the Environment, Water, Heritage and the Arts
dw	dry weight
EC	effective concentration
ECHA	European Chemicals Agency
EU	European Union
g/L	grams per litre
IUPAC	International Union of Pure and Applied Chemistry
kg/m ³	kilograms per cubic metre
kPa	kilopascal
LC	lethal concentration
mg/kg	milligrams per kilogram

mg/L	milligrams per litre
NOEC	no observed effective concentration
PBT	Persistent, Bioaccumulative and Toxic
PEC	Predicted exposure concentrations
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases