

SODIUM BISULFITE

This dossier on sodium bisulfite presents the most critical studies pertinent to the risk assessment of sodium bisulfite in water treatment systems. It does not represent an exhaustive or critical review of all available data. The information presented in this dossier was obtained mainly 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 bisulfite is classified as a **tier 1** chemical and requires a hazard assessment only.

1 BACKGROUND

At environmental pHs, sodium bisulfite dissociates in water to form sodium (Na⁺) ions, bisulfite ions (HSO₃⁻), sulfite (SO₃²⁻) ions and sulfur dioxide (SO₂) which is a gas. Sodium bisulfite is not expected to bioaccumulate in the environment because of its dissociation to ionic species and a gas.

Furthermore, sulfite will oxidise to sulfate, which is ubiquitous in the environment. Sodium bisulfite and its dissociated species are expected to have a low potential to adsorb to soil and sediment. No aquatic toxicity studies have been conducted on sodium bisulfite. Other inorganic sulfite compounds show low to moderate toxicity concern to aquatic organisms.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Sodium hydrogen sulfite

CAS RN: 7631-90-5

Molecular formula: NaHSO₃

Molecular weight: 104.1 g/mol

Synonyms: Sodium bisulfite; sodium hydrogen sulfite; sodium hydrogensulfite; monosodium sulfite; sodium sulfhydrate; hydrogen sodium sulfite; sulfurous acid, monosodium salt

3 PHYSICO-CHEMICAL PROPERTIES

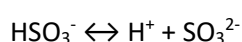
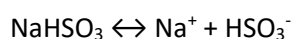
Key physical and chemical properties for the substance are shown in Table 1.

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

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	White, crystalline, solid	-	PubChem
Melting Point	Decomposes	-	PubChem
Boiling Point	Decomposes	-	PubChem
Density	1348 kg/m ³ @ 20° C	1	ECHA

Property	Value	Klimisch score	Reference
Vapour Pressure	Not applicable	-	-
Partition Coefficient (log K _{ow})	Not applicable	-	-
Water Solubility	Very soluble (> 10 g/L) @ 20° C	2	ECHA
Viscosity	3.64 mPa s @ 20° C	-	PubChem

Sodium bisulfite is a weak acid with a pK_a of 6.97. Its conjugate base is the sulfite ion (SO₃²⁻).



At neutral pH, a mixture of 50% sulfite (SO₃²⁻) and 50% bisulfite (HSO₃²⁻) is present.

In surface waters, sulfite is oxidised to sulfate either catalytically by air oxygen or by microbial action (OECD, 2008). The presence of cations like iron, copper or manganese in the environment accelerates the oxidation rate significantly.

Dissociation of sodium bisulfite in aqueous solutions can also liberate sulfur dioxide (SO₂), which is a gas.

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 bisulfite.

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
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

At environmental pHs, sodium bisulfite dissociates in water to form sodium (Na^+) ions, bisulfite ions (HSO_3^-), sulfite (SO_3^{2-}) ions, and sulfur dioxide (SO_2) which is a gas.

Sodium bisulfite is not expected to bioaccumulate in the environment because of its dissociation to ionic species and a gas. Furthermore, sulfite will oxidise to sulfate, which is ubiquitous in the environment.

Sodium bisulfite and its dissociated species are expected to have a low potential to adsorb to soil and sediment.

6 ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

No aquatic toxicity studies have been conducted on sodium bisulfite. Other inorganic sulfite compounds show low to moderate toxicity concern to aquatic organisms.

B. Aquatic Toxicity

Acute Studies

No acute aquatic studies are available on sodium bisulfite; however, studies are available on other inorganic sulfite compounds. The studies on these inorganic sulfite compounds can be used to read-across to sodium bisulfite since sulfite ions are formed in water upon dissociation of sodium bisulfite. Table 3 lists the results of acute aquatic toxicity studies on the structural analogues of sodium bisulfite.

Table 3 Acute Aquatic Toxicity Studies on the Structural Analogues of Sodium Bisulfite

Test Species	Test Substance	Endpoint	Results (mg/L)	Klimisch score	Reference
<i>Leuciscus idus</i>	Potassium sulfite	96-hour LC_{50}	316	2	ECHA
<i>Salmo gairdneri</i>	Sodium pyrosulfite	96-hour LC_{50}	147-215 (177.8*)	2	ECHA
<i>Brachydanio rerio</i>	Potassium metabisulfite	96-hour LC_{50}	464-1,000 (681.2*)	1	ECHA
<i>Daphnia magna</i>	Sodium disulfite	48-hour EC_{50}	88.8	2	ECHA
<i>S. subspicatus</i>	Sodium disulfite	96-hour EC_{50} 72-hour EC_{10}	43.9 33.3	2	ECHA

*Geometric mean.

Chronic Studies

No chronic studies are available on sodium bisulfite; however, studies are available on sodium sulfite. Table 4 lists the results of chronic aquatic toxicity studies conducted on sodium sulfite.

Table 4 Chronic Aquatic Toxicity Studies on Sodium Sulfite (CAS No. 7757-83-7)

Test Species	Endpoint	Results (mg/L)	Klimisch score	Reference
<i>Danio rerio</i>	34-day NOEC	>316	1	ECHA
<i>Daphnia magna</i>	21-day NOEC	>10	2	ECHA

C. Terrestrial Toxicity

No studies were located.

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 bisulfite is an inorganic compound that dissociates completely to ionic species and sulfur dioxide gas. Biodegradation is not applicable to these compounds. For the purposes of this PBT assessment, the persistent criterion is not considered applicable to sodium bisulfite or its dissociated compounds.

Sodium bisulfite is not expected to bioaccumulate because its dissociated species are inorganic ions and a gas. Thus, sodium bisulfite does not meet the screening criteria for bioaccumulation.

There are no aquatic toxicity data on sodium bisulfite. The lowest NOEC from chronic aquatic toxicity studies on sodium sulfite, a structural analogue of sodium bisulfite, is >0.1 mg/L. The acute E(L)C₅₀ values for structural analogues of sodium bisulfite are >1 mg/L in fish, invertebrates and algae. Thus, sodium bisulfite is not expected to meet the criteria for toxicity.

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

B. Other Characteristics of Concern

No other characteristics of concern were identified for sodium bisulfite.

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 Bisulfite	7631-90-5	Not a PBT	No	No	NA	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.

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.

OECD. (2008). Screening Information Dataset (SIDS) Initial Assessment Report for Sodium Sulfite (CAS No. 7757-83-7). Available at: <https://hpvchemicals.oecd.org/UI/Default.aspx>

PubChem. PubChem open chemistry database: <https://pubchem.ncbi.nlm.nih.gov>

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
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	kilogram per cubic metre
kPa	kilopascal
LC	lethal concentration
mg/L	milligrams per litre
NOEC	no observed effect concentration
PBT	Persistent, Bioaccumulative and Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases

