

DIMETHYLSILOXANE, ETHYLENE OXIDE BLOCK COPOLYMER (POLYSILOXANE)

This dossier on dimethylsiloxane, ethylene oxide block copolymer (polysiloxane) presents the most critical studies pertinent to the risk assessment of this substance in its use in coal seam gas extraction activities. This dossier does not represent an exhaustive or critical review of all available data. Where possible, study quality was evaluated using the Klimisch scoring system (Klimisch et al., 1997).

Screening Assessment Conclusion – Dimethylsiloxane, ethylene oxide block copolymer (polysiloxane) is classified as a **tier 1** chemical and requires a hazard assessment only.

1. BACKGROUND

Dimethylsiloxane, ethylene oxide block copolymer (polysiloxane) belongs to a group of polymeric organosilicon compounds that are commonly referred to as silicones with use as a lubricant, levelling aid, anti-fog and anti-static agent.

Dimethylsiloxane, ethylene oxide block copolymer (polysiloxane) is not readily biodegradable, is not expected to bioaccumulate nor be substantially toxic to environmental receptors.

2. CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): 3-(2-methoxyethoxy)propyl-methyl-bis(trimethylsilyloxy)silane

CAS RN: 27306-78-1

Molecular formula: $(C_2H_4O)_n C_{11}H_{30}O_3Si_3$ [This substance is a polymer]

Molecular weight: polymer variable (UVCB)

Synonyms: dimethylsiloxane, ethylene oxide block copolymer; polyethylene glycol monomethyl ether mono[3-[methylbis(trimethylsiloxy)silyl]propyl] ether; Silwet L 77

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 Dimethylsiloxane, ethylene oxide block copolymer

Property	Value	Klimisch score	Reference
Physical state at 20°C and 101.3 kPa	Pale yellow clear viscous liquid with polyether odour	-	MPM, 2021a
Melting Point	Not Available	-	MPM, 2021a
Boiling Point	> 205°C (pressure not provided)	-	MPM, 2021a
Density	1,007 kg/m ³ @ 25°C	-	MPM, 2021a
Vapour Pressure	< 133 Pa @ 20°C	-	MPM, 2021a

Property	Value	Klimisch score	Reference
Partition coefficient (log K _{ow})	> 3.29 @ pH 5	-	MPM, 2021a
Water Solubility	Miscible	-	MPM, 2021a
Viscosity	24 mPA s (dynamic) (temperature not provided)	-	MPM, 2021a

*Based on Material Safety Data Sheet (MSDS) for Silwet L 77, lowest molecular weight hydrophilic silicone containing 6 – 8 ethylene oxide (EO) units

Dimethylsiloxane, ethylene oxide block copolymer is a hydrophilic silicone. Hydrophilic silicones differ from conventional silicones by demonstrating a much greater compatibility with aqueous systems. They have slight to complete solubility in water. They are composed of dimethylsiloxane molecular backbones in which some of the methyl groups are replaced by polyalkylenoxy or pyrrolidone groups linked through a propyl group to the silicone atom (MPM, 2021b).

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 dimethylsiloxane, ethylene oxide block copolymer.

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

Dimethylsiloxane, ethylene oxide block copolymer (polysiloxane) is a large molecular weight block polymer for which very little environmental fate data exists. Silicone-based polymers can be attacked and hydrolysed under acidic or alkaline conditions. Trisiloxane-based polymers, such as dimethylsiloxane, ethylene oxide block copolymer (polysiloxane), are especially vulnerable as they can degrade outside neutral pH conditions over time (MPM, 2021b).

Dimethylsiloxane, ethylene oxide block copolymer (polysiloxane) is not readily biodegradable. Copolymers of this type typically have a molecular weight greater than 1,000 g/mol. Based on this molecular weight, the substance is not expected to bioaccumulate (as concluded in the Categorization Results from the Canadian Domestic Substance List).

6. ENVIRONMENTAL EFFECTS SUMMARY

A. Summary

No data on the environmental effects of the polymer were found. However, the high molecular weight of the substance is expected to negate or limit the bioavailability of the substance thus minimizing toxic effects on environmental receptors.

NICNAS has assessed dimethylsiloxane, ethylene oxide block copolymer (under generic CAS No. 68937-54-2) in an IMAP Tier 1 assessment and considers it a “polymer identified as a low concern to the environment.”¹ As a polymer of low concern, the substance is not expected to bioaccumulate or bioconcentrate. It may sorb to sediments and soil; however, it is not expected to exhibit toxicity to environmental receptors.

B. Aquatic Toxicity

No studies are available.

C. Terrestrial Toxicity

No studies are 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).

Dimethylsiloxane, ethylene oxide block copolymer (polysiloxane) is not readily biodegradable; thus, it meets the screening criteria for persistence.

Dimethylsiloxane, ethylene oxide block copolymer (polysiloxane) is a high molecular weight polymer that is not expected to bioaccumulate. Thus, the substance does not meet the screening criteria for bioaccumulation.

There are no acute or chronic toxicity studies on dimethylsiloxane, ethylene oxide block copolymer (polysiloxane). However, as a polymer of low concern, it is not expected to exhibit toxicity to environmental receptors. Thus, dimethylsiloxane, ethylene oxide block copolymer (polysiloxane) does not meet the screening criteria for toxicity.

The overall conclusion is that dimethylsiloxane, ethylene oxide block copolymer (polysiloxane) is not a PBT substance.

¹ <https://www.nicnas.gov.au/chemical-information/imap-assessments/how-chemicals-are-assessed/Low-concern-polymers>.
<https://www.industrialchemicals.gov.au/chemical-information/search-assessments?assessmentcasnumber=68937-54-2>

B. Other Characteristics of Concern

No other characteristics of concern were identified for dimethylsiloxane, ethylene oxide block copolymer (polysiloxane).

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	
Dimethylsiloxane, ethylene oxide block copolymer	27306-78-1	Not a PBT	No	Yes	Yes	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. REFERENCE, 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: <http://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.

Momentive Performance Materials (MPM). (2021a). Silwet* L-77 Safety Data Sheet. Version 1.16. Revision Date 04/05/2021.

MPM. (2021b). Silwet* Copolymers Chameleon Solutions. MPM 100-017-00E-GL.

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
IUPAC	International Union of Pure and Applied Chemistry
kPa	kilopascal
LC	lethal concentration
mg/L	milligrams per litre
OECD	Organisation for Economic Co-operation and Development
PBT	Persistent Bioaccumulative Toxic
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG	Synthetic Greenhouse Gases
ThOD	Theoretical oxygen demand