Hazard profile of Deviron® 13-S9 detergent for GHS classification

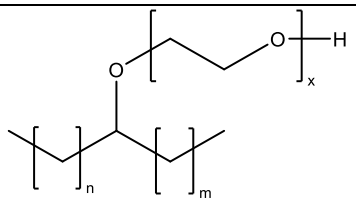
1. Introduction

Deviron® 13-S9 detergent is a fatty alcohol ethoxylate which contains an alkyl chain of 11 to 15 carbon atoms and an ethoxylate chain of 9 ethylene oxide (EO) units. It therefore fulfils the REACH definition of polymer, i.e., *a molecule that contains a sequence of at least 3 monomer units, which are covalently bound to at least one other monomer unit or other reactant* (ECHA, 2023). At the time of writing, polymers are exempted from the provisions of registration under REACH (ECHA, 2023).

The present summary collects the key toxicological and ecotoxicological data that were used for the **GHS hazard classification** of Deviron® 13-S9 detergent. In such evaluation, toxicological and ecotoxicological data available in the public literature on the alkyl PEG ethers group of chemicals were taken into account, based on the documented rationale for grouping fatty alcohol alkoxylates (or alkyl PEG ethers). However, a greater attention was given to alcohol ethoxylates showing an alkyl chain length ranging from C_{11} to C_{15}, and an EO chain of 9 units. (Q)SAR predictions for several endpoints were also generated for the homologues of Deviron® 13-S9 detergent and considered within a weight of evidence approach.

The weight-of-evidence assessment undertaken for the proposed GHS Classification is described in a more detailed report, which can be provided upon request.

2. Chemical identity

Trade Name	Deviron® 13-S9 detergent
Chemical Name	Alcohols, C11-15-secondary, ethoxylated
Alternative chemical name	$C_{11\text{-}15}$ sec-Pareth-9 ($C_{11\text{-}15}EO_9$)
CAS No.	68131-40-8*
Alternative CAS No./Chemical Name	84133-50-6 related to Alcohols, C12-14-secondary, ethoxylated
Chemical representation	 n+m = 8 to 12 x=9
Molecular formula	$CH_3(CH_2)_n(OCH_2CH_2)_yOH$, where *n* is 11-15, and *y* is 9
Type of Substance	Fatty alcohol ethoxylate; alkyl PEG ether; oligomer
Appearance	Clear to yellow
Degree of purity	>98%
List of potential impurities with the related concentration (% w/w)	Acetaldehyde ≤ 0.0005% Dioxane ≤ 0.001% Ethyleneglycol ≤ 0.05% Ethyleneoxide ≤ 0.0001%

*Alcohols, C11-15-secondary, ethoxylates is a broad group of substances. Therefore, it should be noted that several trade names can be found under the given CAS No. due to structural differences that can be observed in the final product, e.g., number of ethylene oxide, percentage of homologues with different ranging of *n* and *m*.

3. Hazard Identification

3.1. Classification of the substance according to Regulation (EC) No 1272/2008

Acute Toxicity – Category 4 – Oral – H302
Skin Irritation – Category 2 – H315
Serious Eye Damage – Category 1 – H318
Aquatic Chronic – Category 3 – H412

3.2. Classification according to UN GHS

Acute Toxicity – Category 4 – Oral – H302
Acute Toxicity – Category 5 – Dermal – H313

Skin Irritation – Category 2 – H315
Serious Eye Damage – Category 1 – H318
Aquatic Acute – Category 2 – H401
Aquatic Chronic – Category 3 – H412

3.3. Label elements

Pictogram(s) according to UN GHS and Regulation (EC) No 1272/2008

Signal word according to UN GHS and Regulation (EC) No 1272/2008

Danger

Hazard statement(s) according to Regulation (EC) No 1272/2008

H302	Harmful if swallowed
H315	Causes skin irritation
H318	Causes serious eye damage
H412	Harmful to aquatic life with long lasting effects

Hazard statement(s) according to UN GHS

H302	Harmful if swallowed
H313	May be harmful in contact with skin
H315	Causes skin irritation
H318	Causes serious eye damage
H401	Toxic to aquatic life
H412	Harmful to aquatic life with long lasting effects

4. Toxicological information

As mentioned in the introduction, the toxicological evaluation of Deviron® 13-S9 detergent was based on toxicity data collected on members of the alkyl PEG ether group (also called, alcohol ethoxylates) based on a grouping approach. Such clustering was also adopted in formal evaluations conducted by National Authorities, e.g., Australia (IMAP, 2020), Environment Canada (Environment Canada, 2013), and relevant Scientific Committees, e.g., the Cosmetic Ingredient Review (CIR) (Fiume et al., 2012), the EU SCCP (SCCP, 2007).

Acute oral toxicity

Rat, LD_{50} of 1000 mg/kg based on $C_{14\text{-}15}$ Pareth 11 (Fiume et al., 2012)

Acute dermal toxicity

Rabbit, LD_{50} > 2000 mg/kg based on $C_{12\text{-}14}$ EO_9 (Fiume et al., 2012)

Acute inhalation toxicity

Rat, 8-h exposure to concentrated vapor of PEG-3 methyl ether, no mortality observed; no LC_{50} established (Fiume et al., 2012)

Skin corrosion/irritation

Based on the collected experimental evidence, it was concluded that $C_{11\text{-}15}EO_9$ can cause skin irritation.

Serious eye damage/eye irritation

Alcohol ethoxylates were found to be mildly to severely irritating to rabbits' eyes (Fiume et al., 2012). Irreversible effects on the eye, such as corneal opacity, were also reported (Maurer and Kung, 2020).

Respiratory or skin sensitization

Based on the collected evidence, alcohol ethoxylates are not skin sensitizers.

No data available to assess the respiratory sensitization.

Germ cell mutagenicity

Not mutagenic.

Carcinogenicity

Not carcinogenic.

Reproductive and developmental toxicity

Not causing reproduction and developmental toxicity.

$NOAEL_{maternal\ and\ developmental\ toxicity}$: 50 mg/kg bw/day based on a two-generation rat oral study with $C_{12}EO_6$. No treatment-related effects on behavior, appearance, survival, or fertility were observed in any of the test groups. No test article-related developmental toxicity effects were observed (Fiume et al., 2012; SCCP, 2007).

$NOAEL_{maternal\ and\ developmental\ toxicity}$: 50 mg/kg bw/day based on a two-generation rat oral study with $C_{14\text{-}15}EO_7$. No test-compound related effects on maternal and fetal indices were found. Compound-related effects were limited to increased liver weights (Fiume et al., 2012; SCCP, 2007).

Specific target organ toxicity

Based on available data, repeated exposure is not anticipated to cause significant adverse effects to organs.

NOAEL: 50 mg/kg bw/day based on a 90-day subchronic oral feeding toxicity study in rats with $C_{14\text{-}15}EO_7$, due to reduced body weight, reduced food intake, increased organ weight, and increased total leukocytes and lymphocytes. However, histopathology revealed no compound-related effects at any dose level. No effects were observed in the organs of the reproductive system. Changes in liver weight, kidney weights and plasma urea concentration were not of toxicological significance (SCCP, 2007).

NOAEL: 50 mg/kg bw/day based on a 2-year chronic dietary feeding study in rats with $C_{14\text{-}15}EO_7$ or $C_{12\text{-}13}EO_{6.5}$, due to the increased relative organ weight (Fiume et al., 2012; SCCP, 2007).

Endocrine disrupting properties

Based on an *in silico* (Q)SAR evaluation and on currently available data, no potential for endocrine bioactivity was found in relation to the endpoints evaluated, i.e., estrogen, androgen, and thyroid activity. No data on steroidogenesis were found.

5. Ecological information

The aquatic toxicity of alcohol ethoxylates increases with increasing alkyl chain length and with decreasing EO length (U.S. EPA, 2010), e.g., a C_{16}-alcohol ethoxylate with 3 EO would be more toxic than a C_{14}-alcohol ethoxylate with 9 EO. Furthermore, linear alcohol ethoxylates are more toxic than the branched ones (Environment Canada, 2013). The lowest ecotoxicological values of Deviron® 13-S9 detergent ($C_{11\text{-}15}EO_9$ branched) were therefore identified among a set of laboratory-based ecotoxicity data collected and assessed on linear and branched alcohol ethoxylates having the same alkyl and ethoxylate chain length of Deviron® 13-S9 detergent.

A QSAR evaluation was also undertaken, where additional ecotoxicity data related to alcohol ethoxylates having a different alkyl chain length and degree of ethoxylation were identified and normalized to $C_{11\text{-}15}EO_9$, representing Deviron® 13-S9 detergent. Such additional evaluation, which also confirms the proposed GHS classification for aquatic toxicity, is available in the detailed report upon request.

Acute Aquatic Toxicity

Toxicity to fish	96-h mortality, *Pimephales promelas*, LC_{50} 1.6 mg/L (based $C_{12\text{-}15}EO_9$ linear) (Dorn et al., 1993)

Toxicity to *Daphnia* and other aquatic invertebrates	48-h immobility, *Daphnia magna*, EC_{50} 1.3 mg/L (based $C_{12\text{-}15}EO_9$ linear) (Dorn et al., 1993)
Toxicity to algae	48-h growth, *Raphidocelis subcapitata*, EC_{50} 4-8 mg/L (based on $C_{12\text{-}14}EO_9$ linear) (Yamane et al., 1984)

Chronic Aquatic Toxicity

Toxicity to fish	7-d growth, *Pimephales promelas*, NOEC 0.4 mg/L (based $C_{12\text{-}15}EO_9$ linear) (Dorn et al., 1993)
Toxicity to Daphnia and other aquatic invertebrates	7-d growth, *Daphnia magna*, NOEC 1 mg/L (based $C_{12\text{-}15}EO_9$ linear) (Dorn et al., 1993)
Toxicity to algae	48-h growth (cell density), *Raphidocelis subcapitata*, EC_{10} 0.151 mg/L (based on $C_{12\text{-}14}EO_9$ linear) (Yamane et al., 1984 in Belanger et al., 2006)

6. Persistence and degradability

Biodegradability	OECD TG 301B: ≥ 60 % - Readily biodegradable

7. Bioaccumulative potential

- Alcohol ethoxylates are highly metabolizable in fish (Bragin et al., 2020)
- Estimated $LogK_{ow}$ of 4.97 for $C_{11\text{-}15}EO_9$ based on the $LogK_{ow}$ equation found in Boeije et al., 2006 for alcohol ethoxylates with EO >0.

8. Mobility in soil

- Estimated $logK_d$ of 3.09 (high solid absorption) for $C_{11\text{-}15}EO_9$, based on the equation developed by van Compernolle et al., 2006 for predicting $logK_d$ of alcohol ethoxylates.

Abbreviations

CIR – Cosmetic Ingredient Review
EC – European Commission
ECHA – European CHemicals Agency
EC_{10} – concentration causing effects in 10% of a population
EC_{50} – concentration causing effects in 50% of a population
EO - ethylene oxide
EU – European Union
GHS – Globally Harmonized System of Classification and Labelling of Chemicals
IMAP - Inventory Multi-tiered Assessment and Prioritisation
LC_{50} – Lethal Concentration causing 50% of deaths
Kd – soil adsorption coefficient
Kow - octanol-water partition coefficient
LD_{50} – Lethal Dose for 50% of organisms
NOAEL – No Observed Adverse Effect Level
NOEC – No Observed Effect Concentration
OECD – Organisation for Economic Co-operation and Development
PEG - PolyEthylene Glycol
(Q)SAR – (Quantitative) Structure Activity Relationship
REACH - Registration, Evaluation, Authorisation and Restriction of Chemicals
SCCP - Scientific Committee on Consumer Products
TG – Test Guideline
UN – United Nations
U.S. EPA - United States Environmental Protection Agency

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