CALCIUM LIGNOSULFONATE

This dossier on calcium lignosulfonate presents the most critical studies pertinent to use as a cement additive chemical. It 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 – Calcium lignosulfonate is classified as a tier 1 chemical and requires a hazard assessment only.

1 BACKGROUND

Lignin is the second largest component of wood. It is a highly polymerised material that makes up the middle lamella of woody fibres and holds the fibres together. The basic units of the polymeric structure consist of three aromatic propenyl alcohols (monolignols): coniferyl alcohol (4-(3-hydroxy-1-propenyl)-2-methoxyphenol); p-coumaryl alcohol (4-[(E)-3-hydroxyprop-1-enyl]phenol); and sinapyl alcohol (4-hydroxy-3,5-dimethoxycinnamyl alcohol). Coniferyl alcohol represents the principle unit in lignin.

Calcium lignosulfonate is obtained from the spent sulfite and sulfate pulping liquor of wood or from the sulfate (kraft) pulping process. It may contain up to 30% reducing sugars.

This dossier contains toxicity data on calcium lignosulfonate (40-65). Calcium lignosulfonate (40-65) is produced from softwood in the sulfite pulping method for manufacturing paper. In this process, bisulfite ions react with the native lignin polymer of the wood to form sulfonated lignin (lignosulfonate). This reaction increases the water solubility of the hydrophobic lignin polymer. Calcium lignosulfonate contains <5% reducing sugars. The calcium bisulfite provides the calcium ions that stabilise the anionic sulfonate groups in the lignosulfonates. The average molecular weight is in the range of 40,000 to 65,000 daltons, with >90% ranging from 1,000 to 250,000 (EFSA, 2010). Calcium lignosulfonate (40-65) is of higher purity than calcium lignosulfonate, with a higher degree of polymerisation and lower content of sugars.

2 CHEMICAL NAME AND IDENTIFICATION

Chemical Name (IUPAC): Calcium lignosulfonate

CAS RN: 8061-52-7

Molecular formula: Not applicable.

Molecular weight: Unknown

Synonyms: Calcium lignosulfonate; lignosulfonic acid, calcium salt; lignin calcium sulfonate

3 PHYSICO-CHEMICAL PROPERTIES

Calcium lignosulfonate and calcium lignosulfonate (40-65) occur as a brown, amorphous polymer (EFSA, 2010). They are soluble in water, but not in any of the common organic solvents.

The pH of a 1:100 aqueous solution of calcium lignosulfonate is between ca. 3 and 11 (EFSA, 2010).
4 DOMESTIC AND INTERNATIONAL REGULATORY INFORMATION

A review of international and national environmental regulatory information was undertaken (Table 1). 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 calcium lignosulfonate.

NICNAS has assessed calcium lignosulfonate in an IMAP Tier 1 assessment and concluded that it poses no unreasonable risk to human health.

Table 1  Existing International Controls

<table>
<thead>
<tr>
<th>Convention, Protocol or other international control</th>
<th>Listed Yes or No?</th>
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<tbody>
<tr>
<td>Montreal Protocol</td>
<td>No</td>
</tr>
<tr>
<td>Synthetic Greenhouse Gases (SGG)</td>
<td>No</td>
</tr>
<tr>
<td>Rotterdam Convention</td>
<td>No</td>
</tr>
<tr>
<td>Stockholm Convention</td>
<td>No</td>
</tr>
<tr>
<td>REACH (Substances of Very High Concern)</td>
<td>No</td>
</tr>
<tr>
<td>United States Endocrine Disrupter Screening Program</td>
<td>No</td>
</tr>
<tr>
<td>European Commission Endocrine Disruptors Strategy</td>
<td>No</td>
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</table>

5 ENVIRONMENTAL FATE SUMMARY

No specific data could be located on the environmental fate/transport of calcium lignosulfonate. The United States Environmental Protection Agency (USEPA) reviewed the environmental fate and environmental hazards of various lignosulfonate chemicals, including sodium lignosulfonate, for a proposed rule to establish 44 tolerance exemptions for residues of these substances (FR, 2005). The USEPA determined “that the various salts of lignosulfonic acid are soluble to very highly water soluble depending on the cation. Once in water dissociation of the cation is expected depending on pH. These lignosulfonates are not expected to be mobile in terrestrial environments, moving equally with the water and sediment phase to surface water. Ground water migration is not likely. Once in water, the dissociated cation and anion are likely to remain in dissolution. The available information suggest that lignosulfonates may be persistent in aquatic environment of low microbial activity and much less persistent in environments with ample microbial activity...though the time for complete aerobic degradation is predicted to be months, the lignosulfonates are strongly absorbed to soils and sediments due to their high-molecular weights.” Based on the USEPA assessment, it is concluded that sodium lignosulfonate would meet the EU screening criteria for persistence.

Due to its high-molecular weight, sodium lignosulfonate is not expected to be bioavailable. This is supported by pharmacokinetic data on calcium lignosulfonate which showed that it is poorly absorbed from the gastrointestinal tract of rats (Beck and Rossi, 2005). Thus, it is not expected to bioaccumulate.

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6 ENVIRONMENTAL EFFECTS SUMMARY

Because of the lack of data, the EFSA Panel on Additives and Products or Substances used in Animal Feed (FEEDAP) could not conclude on the safety of calcium lignosulfonate for the environment (EFSA, 2015).

A. Aquatic Toxicity

No data are available.

B. Terrestrial Toxicity

No data 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).

Based on the assessment by the USEPA (FR, 2005), calcium lignosulfonate meets the criteria for persistence.

Calcium lignosulfonate is not expected to bioaccumulate due to its low potential for bioavailability because of its molecular weight and size. Thus, it does not meet the criteria for bioaccumulation.

No aquatic toxicity studies are available for calcium lignosulfonate. It is expected to be a low concern of toxicity to aquatic organisms because of its low potential for bioavailability.

The overall conclusion is calcium lignosulfonate is not a PBT substance.

B. Other Characteristics of Concern

No other characteristics of concern were identified for calcium lignosulfonate.
### SCREENING ASSESSMENT

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS No.</th>
<th>Overall PBT Assessment</th>
<th>Chemical Databases of Concern Assessment Step</th>
<th>Persistence Assessment Step</th>
<th>Bioaccumulative Assessment Step</th>
<th>Toxicity Assessment Step</th>
<th>Risk Assessment Actions Required</th>
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<tbody>
<tr>
<td>Calcium lignosulfonate</td>
<td>8061-52-7</td>
<td>Not a PBT</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
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</tbody>
</table>

**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
REFERENCES, ABBREVIATIONS AND ACRONYMS

A. References


B. Abbreviations and Acronyms

AICS Australian Inventory of Chemical Substances
COC constituent of concern
DEWHA Department of the Environment, Water, Heritage and the Arts
ECHA European Chemicals Agency
EFSA European Food Safety Authority
EU European Union
IUPAC International Union of Pure and Applied Chemistry
KI Klimisch scoring system
PBT Persistent, Bioaccumulative and Toxic
REACH Registration, Evaluation, Authorisation and Restriction of Chemicals
SGG  Synthetic Greenhouse Gases
USEPA  United States Environmental Protection Agency