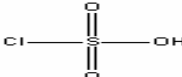


SIDS INITIAL ASSESSMENT PROFILE

CAS No.	7790-94-5
Chemical Name	Chlorosulfuric acid
Structural Formula	

SUMMARY CONCLUSIONS OF THE SIAR**Human Health**

Chlorosulfuric acid undergoes immediate hydrolysis in the water of body fluids after contact with any tissue. The hydrolysis products are hydrogen chloride (HCl; CAS 7647-01-0) and sulfuric acid (H₂SO₄; CAS 7664-93-9); SIDS documents have been prepared for SIAM 11 (H₂SO₄) and SIAM 15 (HCl). For the assessment of effects of the hydrolysis products on human health it is referred to the validated hazard assessment within the OECD HPV Chemical Program.

Toxicity of the hydrolysis products HCl and H₂SO₄ is the result of the hydrogen ion and the local reduction of the pH at the site of contact. Under normal conditions the uptake of hydrogen ions will not change the pH in the body fluids because of the available buffer systems. No hazard is expected from the anions, the chloride and sulfate ions which are normal constituents of the body fluids and enter the body electrolyte pool.

In acute inhalation toxicity studies chlorosulfuric acid and/or the reaction products HCl and H₂SO₄ are extremely irritating to the eyes, mucous membranes and the respiratory tract. They cause rapid destruction of tissues and severe burns. Airways obstruction resulting from tracheal lesions was presumed to be the cause of death. The estimated LC₅₀ (4 h) for male and female rats combined is > 1765 mg/m³. The estimated LC₁₀ (1 h) for male and female rats combined is 926 mg/m³; the NOAEL is 282 mg/m³ following 1-hour exposure. In humans effects of H₂SO₄ aerosols on lung function parameters have been demonstrated at concentrations below 1 mg/m³. No valid data are available on the acute dermal or oral toxicity of chlorosulfuric acid. But, based on the chemical and physical nature of chlorosulfuric acid, it can be concluded that chlorosulfuric acid is corrosive to the skin and mucous membranes and extremely damaging to the eyes.

For chlorosulfuric acid itself no data are available on the following toxicological endpoints: sensitization, toxicity after repeated exposure, genotoxicity, carcinogenicity and toxicity for reproduction. However, data are given for the hydrolysis products. HCl and H₂SO₄ gave no evidence for a sensitizing potential in humans.

The observed effects after repeated inhalation exposure to the hydrolysis products are related to the irritant properties of HCl and H₂SO₄ and are most likely due to decrease in the pH value. The described effects are restricted to alterations in structure and function of the respiratory tract. Potential systemic effects are considered to be a result of the local effects. Laboratory animal studies performed with H₂SO₄ gave LOAELs in the range of 0.3 mg/m³. The LOAEL reported in a subchronic study with HCl on rats and mice was 15 mg/m³; no NOAELs could be determined.

Data on *in vitro* mutagenicity of the hydrolysis products have shown no gene mutagenic activity in the *Salmonella* microsome assay as well as negative results in studies for direct or indirect measurement of DNA damage in bacteria and eucaryotic cells. However, there is some evidence for chromosome aberration in mammalian cells at pH values not inducing general cytotoxicity. Furthermore mutagenic activity has also been detected in the SLRL assay in *Drosophila melanogaster*. No further *in vivo* mutagenicity data are available, but the performance of traditional *in vivo* studies is not considered useful, since systemic genotoxic effects are not expected. Effects including possible genotoxicity due to decreased pH are restricted to the site of first contact. Since the effects are

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related to an exhaustion of the physiological buffer capacity of the target tissue a threshold for the genotoxic effects is also expected.

Carcinogenicity studies with the hydrolysis products on experimental animals do not meet present-day requirements. In an inhalation study using a single dose level HCl induced hyperplasia in the larynx and trachea but no neoplasia. An excess risk for lung cancer was seen in one cohort study on steel-pickling workers exposed to acid mists primarily to HCl mist. No association between exposure to HCl and cancer of the lung was reported in a case-control study. IARC classified HCl in Group 3 (not classifiable as to its carcinogenicity in humans). But data from cohort and case-control studies indicate an association between H₂SO₄ mists and laryngeal cancer. IARC classified strong inorganic acid mists containing sulfuric acid as a Group 1 carcinogen (carcinogenic to humans). However, the mechanism of carcinogenicity is still in discussion. Nongenotoxic mechanisms are suggested and it is assumed that the laryngeal cancer in humans is associated with regenerative cell proliferation at the site of contact.

In a 90 day inhalation study no effects were observed on the gonads of male and female mice and rats at dose levels up to 70 mg/m³ HCl. Because chlorosulfuric acid and the hydrolysis products act at the site of contact due to local reduction of the pH value, effects on reproduction are not expected following exposure by any route.

In a study on developmental toxicity in mice and rabbits borderline effects concerning a certain type of skeletal variation were observed in fetal rabbits at H₂SO₄ aerosol concentrations of 20 mg/m³. The NOEL for developmental toxicity is 5 mg/m³. Local maternal effects were detected in rabbits at 5 mg/m³, the NOEL is below 5 mg/m³. No developmental toxicity was observed in mice. Because chlorosulfuric acid and the hydrolysis products act at the site of contact, prenatal toxicity is only expected secondary to local maternal toxicity of chlorosulfuric acid and/or the hydrolysis products.

Environment

Chlorosulfuric acid is a moisture/water sensitive liquid. It will be hydrolysed in water with explosive violence. The products of hydrolysis are HCl (hydrogen chloride in aqueous solution) and H₂SO₄. The vapour pressure of chlorosulfuric acid is 1.33 hPa at 32 °C, a partition coefficient can not be determined due to hydrolysis. HCl as well as H₂SO₄ are strong mineral acids, which completely dissociate in water into hydrated protons and the corresponding anions. For the assessment of environmental effects of the hydrolysis products it is referred to the validated hazard assessment on HCl (CAS 7647-01-0) and H₂SO₄ (CAS 7664-93-9) within the OECD HPV Chemical Program.

The total ionisation of the hydrolysis products will imply that no absorption to particular matters or surfaces and no accumulation in living organisms take place.

A calculation of the environmental distribution according to a multimedia model of type Mackay level I is not applicable. Taking into account the reactivity of the substance and the nature of the hydrolysis products water can be considered to be the main target environmental compartment for chlorosulfuric acid and its hydrolysis products.

For indirect photodegradation in air due to reaction with OH radicals a half-life of 76.4 days is calculated. However, this reaction can not occur in the presence of moisture since chlorosulfuric acid is then hydrolysed.

As inorganic substance, chlorosulfuric acid does not undergo biodegradation. If it is released into water or moist soil it will be hydrolysed immediately. Biodegradation is therefore not expected to be a significant process.

No data are available on the aquatic toxicity of chlorosulfuric acid itself. Rational: In the presence of water chlorosulfuric acid will be immediately hydrolysed. As chlorosulfuric acid has a proven potential to degrade rapidly in the aquatic environment no classification on the basis of environmental effects is relevant. Aquatic effects of the hydrolysis products are due to acidification and are related to the hydrogen ion concentration (pH value). If chlorosulfuric acid reaches an aquatic ecosystem the decrease in the pH due to the hydrolysis products is influenced by the buffer capacity of the specific ecosystem.

The following aquatic effect data from the three trophic levels are available from studies with HCl:

<i>Cyprinus carpio</i> (fish):	LC ₅₀ (96 h) = pH 4.3 (1.95 mg/l ClSO ₃ H)
<i>Daphnia magna</i> (invertebrates):	EC ₅₀ (48 h) = pH 5.3 (0.195 mg/l ClSO ₃ H)
<i>Selenastrum capricornutum</i> (algae):	ErC ₅₀ (72 h) = pH 5.3 (growth rate) (0.195 mg/l ClSO ₃ H)

In a chronic study on a lake experimentally acidified with H₂SO₄ the following effect values were obtained:

Fish population recruitment	NOEC = pH 5.93 (0.046 mg/l ClSO ₃ H)
Zooplankton population repartition	NOEC = pH 5.59 (0.1 mg/l ClSO ₃ H)
Phytoplankton community structure	NOEC = pH 5.6 (0.098 mg/l ClSO ₃ H)

The quantities of chlorosulfuric acid indicated in brackets are calculated without taking into account the buffer capacity of the aquatic system.

Further chronic laboratory studies on fish (*Jordanella floridae* and *Salvelinus fontinalis*) and invertebrates (*Tanytarsus dissimilis*) have confirmed these values.

No data are available on terrestrial organisms. It is not considered useful to calculate a PNEC for chlorosulfuric acid and/or the hydrolysis products because the buffer capacity of a specific ecosystem is relevant for the effects of the emissions of these acids into the aquatic environment. Further relevant factors are the natural pH and the fluctuation of the pH in a certain ecosystem.

Exposure

Chlorosulfuric acid is produced worldwide. The following production volumes are estimated in the different regions: Europe 30000 – 50000 t/year, NAFTA 50000 – 70000 t/year, Asia 300000 – 500000 t/year. Chlorosulfuric acid is used exclusively as an intermediate in the chemical and pharmaceutical industry. The breakdown of chlorosulfuric acid production according to the end use is the following: detergents (40%), pharmaceuticals (20%), dyes (15%), crop protection agents (10%), ion exchange resins, plasticizers and others (10%).

We assume that also due to its phys-chem properties chlorosulfuric acid is produced and processed in closed systems and is transported under controlled conditions. No emission to the environment has been identified at the specific production site. There is no information about environmental emissions at other production and/or processing sites. If any chlorosulfuric acid is emitted accidentally into the environment it hydrolyses in water to HCl and H₂SO₄. Thus the effects of chlorosulfuric acid itself are not taken into account. After dissociation of the hydrolysis products in water the hydrogen, chloride and sulfate ions occur which are commonly found in the environment.

We can assume that already in the air where certain moisture is present chlorosulfuric acid undergoes hydrolysis but we do not know the percentage of the moisture in the air which can be variable in different regions of the world where the production is taking place. This effects the external concentrations of the substances. Workers may potentially be exposed through the inhalation of vapor/aerosols or dermally by splashing from liquid. However, the production and processing of chlorosulfuric acid takes place in closed systems where the exposure is negligible. Due to efficient personal protective equipment during production, transport and processing of chlorosulfuric acid exposure of operators/workers can be excluded.

No exposure of the general public to chlorosulfuric acid is expected.

RECOMMENDATION AND RATIONALE FOR THE RECOMMENDATION AND NATURE OF FURTHER WORK RECOMMENDED

The data base on chlorosulfuric acid itself is limited. No data are available for a number of endpoints, but the data on HCl and H₂SO₄ have been used as surrogates where available.

Human Health: The chemical is currently of low priority for further work. The chemical possess properties indicating a hazard for human health (corrosivity, skin and eye irritation, potential carcinogenicity caused by mists of sulphuric acid). Based on data presented by the sponsor country, exposure to humans is anticipated to be low, and therefore this chemical is currently of low priority for further work. Countries may desire to investigate any exposure scenarios that were not presented by the sponsor country.

Environment: The chemical is currently of low priority for further work because it hydrolyses rapidly to HCl and H₂SO₄ and therefore environmental releases of chlorosulfuric acid are not expected. The hydrolysis products hydrochloric acid and sulfuric acid have been already assessed within the OECD HPV Chemical Program.