

I U C L I D

D a t a s e t

Existing Chemical Substance ID: 1318-02-1
CAS No. 1318-02-1
EINECS Name Zeolites
EINECS No. 215-283-8
Molecular Formula <no data>

Dataset created by: EUROPEAN COMMISSION - European Chemicals Bureau

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1.0.1 OECD and Company Information

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Name: Bayer AG
Town: 51368 Leverkusen
Country: Germany

Name: Belgian Shell SA
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Name: CECA SA
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Name: Chemiewerk Bad Köstritz GmbH
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Town: 07586 Bad Köstritz
Country: Germany
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Telex: 331678 cwk d

Name: Crosfield B.V.
Street: P. O. Box 1
Town: 6245 ZG Eijsden
Country: Netherlands
Phone: 0031 4409 9333
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Name: Crosfield Group
Street: P. O. Box 26, Liverpool Road
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Country: United Kingdom
Phone: 0044 925 416100
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Name: Degussa AG
Street: Weissfrauenstrasse 9
Town: 60287 Frankfurt am Main
Country: Germany

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Town: 3606 AN Maarssen
Country: Netherlands
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Town: 00808 BARCELONA
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Name: Grace G.m.b.H
Street: In der Hollerhecke 1
Town: 67545 Worms
Country: Germany
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Street: Wandsbeker Zollstr. 13
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Name: Silquimica S.A. Espanola De Productos Quimicos
Street: Apartado 165
Town: 09200 Miranda da Ebro (Burgos)
Country: Spain

Name: Süd-Chemie AG
Street: Lenbachplatz 6
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Name: UOP M.S., S.p.A.
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Phone: +39/2 57540-1
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Name: UOP MS. S.p.A.
Street: Viale Milanofiori, Strada 1, Palazzo E1
Town: 20122 Assago MI
Country: Italy

Name: UOP, successor to Katalistiks, b.v.
Street: 25 E. Algonquin Road
Town: 60017 Des Plaines, Illinois
Country: United States
Phone: (708) 391-2643
Telefax: (708) 391-2953

Name: Woellner-Werke GmbH & Co.
Street: Woellnerstraße 26
Town: 67065 Ludwigshafen
Country: Germany
Phone: 0621/5402-255
Telefax: 0621/5402-420

Name: Zeoline
Street: 144 Rue Joseph Wanters
Town: B4480 Engis
Country: Belgium

Name: Zeolyst C.V.
Street: Oosterhorn 36
Town: 9936HD Delfzijl
Country: Netherlands
Phone: 31 596 643333
Telefax: 31 596 630392

1.0.2 Location of Production Site

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1.0.3 Identity of Recipients

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1.1 General Substance Information**Substance type:** inorganic**Physical status:** solid**1.1.1 Spectra**

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1.2 Synonyms

Aluminatesilicate

Source: Crosfield B.V. Eijsden
Crosfield Group Warrington

Aluminium sodium silicate

Source: Crosfield B.V. Eijsden
Crosfield Group Warrington

Aluminosilicate

Source: Omya Peralta GmbH Hamburg

Aluminosilicates

Source: Akzo Nobel Chemicals b.v. Amersfoort
Crosfield B.V. Eijsden
Crosfield Group Warrington

Aluminosilicato de sodio

Source: FMC FORET SA BARCELONA

Aluminosilicic acid, sodium salt

Source: Silquimica S.A. Espanola De Productos Quimicos Miranda da
Ebro (Burgos)
Degussa AG Frankfurt am Main

Aluminum sodium silicate

Source: Silquimica S.A. Espanola De Productos Quimicos Miranda da
Ebro (Burgos)
Degussa AG Frankfurt am Main

Ion exchanged zeolite

Source: Zeolyst C.V. Delfzijl

kaoline

Source: Aalborg Portland Aalborg

Katalysator

Source: Süd-Chemie AG München

Katalysatorträger

Source: Süd-Chemie AG München

Mol. sieves, zeolites

Source: Akzo Nobel Chemicals b.v. Amersfoort

Molecular seive

Source: Crosfield B.V. Eijsden
Crosfield Group Warrington

Molecular sieves, zeolitic

Source: Akzo Nobel Chemicals b.v. Amersfoort

Natrium - Aluminium - Silikat

Source: Süd-Chemie AG München

Natriumaluminiumsilikat

Source: Woellner-Werke GmbH & Co. Ludwigshafen

Sal sódica del ácido aluminosilícico

Source: FMC FORET SA BARCELONA

Sasil

Source: FMC FORET SA BARCELONA

Sieves, mol.

Source: Akzo Nobel Chemicals b.v. Amersfoort

Silicates, alumino

Source: Akzo Nobel Chemicals b.v. Amersfoort

Silicates, alumino-, zeolites

Source: Akzo Nobel Chemicals b.v. Amersfoort

Silicates, alumino-, zeolitic

Source: Akzo Nobel Chemicals b.v. Amersfoort

Silicato aluminosódico

Source: FMC FORET SA BARCELONA

Silicic acid, aluminium sodium salt

Source: Crosfield B.V. Eijsden
Crosfield Group Warrington

Silicoaluminato de sodio

Source: FMC FORET SA BARCELONA

Sodium aluminium silicate

Source: Crosfield B.V. Eijsden
Crosfield Group Warrington

Sodium aluminiumsilicate

Source: DiverseyLever Maarssen

Sodium aluminosilicate

Source: Crosfield B.V. Eijsden
Silquímica S.A. Espanola De Productos Quimicos Miranda da
Ebro (Burgos)
Crosfield Group Warrington
Degussa AG Frankfurt am Main

Sodium Aluminosilicate

Source: Zeoline Engis

Sodium aluminum silicate

Source: Silquimica S.A. Espanola De Productos Quimicos Miranda da Ebro (Burgos)
Degussa AG Frankfurt am Main

Sodium silicoaluminate

Source: Zeoline Engis
Silquimica S.A. Espanola De Productos Quimicos Miranda da Ebro (Burgos)
Degussa AG Frankfurt am Main

Synthetic molecular sieve, zeolite A, zeolite X, zeolite Y

Source: CECA SA Paris-La Defence 2

Synthetic molecular sieve; Zeolite A, X, Y

Source: Grace G.m.b.H Worms

Synthetic Molecular Sieves

Source: Bayer AG Leverkusen

Synthetic Molecular Sieves; Zeolite Type A, X, Y

Source: UOP MS. S.p.A. Assago MI
UOP M.S., S.p.A. Assago MI

Synthetic Molecular Sieves; Zeolite Type Y

Source: UOP, successor to Katalistiks, b.v. Des Plaines, Illinois

Synthetic zeolite

Source: Belgian Shell SA Ghent

Synthetische Molekularsiebe, Zeolith A, X bzw. Y

Source: Chemiewerk Bad Köstritz GmbH Bad Köstritz

Tamiz molecular

Source: FMC FORET SA BARCELONA

Zeolita A

Source: FMC FORET SA BARCELONA

Zeolitas, NaA

Source: FMC FORET SA BARCELONA

zeolite

Source: Aalborg Portland Aalborg

Zeolite A

Source: Silquimica S.A. Espanola De Productos Quimicos Miranda da Ebro (Burgos)
Degussa AG Frankfurt am Main

Zeolite A, X, Y

Source: Bayer AG Leverkusen

Zeolites, NaA

Source: Silquimica S.A. Espanola De Productos Quimicos Miranda da Ebro (Burgos)
Degussa AG Frankfurt am Main

Zeolyte Y

Source: Belgian Shell SA Ghent

Source: Grace G.m.b.H Worms

1.3 Impurities

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1.4 Additives

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1.5 Quantity

Quantity 500 000 - 1 000 000 tonnes

1.6.1 Labelling

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1.6.2 Classification

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1.7 Use Pattern

Type: type
Category: Non dispersive use

Type: type
Category: Use in closed system

Type: type
Category: Use resulting in inclusion into or onto matrix

Type: type
Category: Wide dispersive use

Type: industrial
Category: Basic industry: basic chemicals

Type: industrial
Category: Chemical industry: used in synthesis

Type: industrial
Category: Electrical/electronic engineering industry

Type: industrial
Category: Fuel industry

Type: industrial
Category: Paints, lacquers and varnishes industry

Type: industrial
Category: Personal and domestic use

Type: industrial
Category: Public domain

Type: industrial
Category: other: Building Construction

Type: industrial
Category: other: Electrical Appliances

Type: industrial
Category: other: Electrical Appliances

Type: industrial
Category: other: cement industry

Type: industrial
Category: other: electrical appliances

Type: industrial
Category: other: secteur du bâtiment

Type: industrial
Category: other

Type: use
Category: Absorbents and adsorbents

Type: use
Category: Cleaning/washing agents and disinfectants

Type: use
Category: Complexing agents

Type: use
Category: other: Petroleum Refining

Type: use
Category: other: Ingredient of various catalysts for oil refining processes and chemical industries.

Type: use
Category: other: as a catalyst

Type: use
Category: other: catalyseur

Type: use
Category: other: catalyst

Type: use
Category: other: cement

Type: use
Category: other

1.7.1 Technology Production/Use

-

1.8 Occupational Exposure Limit Values

Type of limit: MAC (NL)
Limit value: 10 mg/m³
Remark: Inspirable dust; For respirable dust MAC = 5 mg/m³.
 Inspirable fraction (diameter \geq 20 μ m) is less than 1%.
 Extrapolation results to less than 0.1% for the respirable
 fraction of zeolite.
Source: Akzo Nobel Chemicals b.v. Amersfoort

(1)

Type of limit: MAK (DE)
Limit value: 6 mg/m³
Remark: Fine dust < 5 μ m.
Source: Akzo Nobel Chemicals b.v. Amersfoort

(2)

Type of limit: MAK (DE)
Limit value: 6 mg/m³
Remark: The MAK-value of 6 mg/m³ is for inert dust in general. Even
 if this value is not exceeded, human health risks may exist.
 To exclud health risks, is has to be shown that the dust
 under consideration has no mutagenic, carcinogenic,
 fibrogenic, toxic, or allergenic effects.
Source: Silquímica S.A. Espanola De Productos Quimicos Miranda da
 Ebro (Burgos)

(3)

Type of limit: MAK (DE)
Limit value: 60 mg/m³
Remark: El valor MAK de 6 mg/m³ es para polvo inerte en general.
 Aunque este valor no sea superado, puede existir riesgo para
 la salud humana.
 Para eliminar el riesgo, se tiene que demostrar que el polvo
 no tiene consideraciones mutagénicas, carcinogénicas,
 fibrogénicas, tóxicas o efectos alérgicos.
Source: FMC FORET SA BARCELONA

1. General Information

Substance ID: 1318-02-1

Type of limit: MAK (DE)
Limit value: 6 mg/m³
Remark: general limit for respirable dust
Source: Bayer AG Leverkusen

Type of limit: MAK (DE)
Limit value: 6 mg/m³
Remark: The MAK-value of 6 mg/m³ is for inert dust in general. Even if this value is not exceeded, human health risks may exist. To exclud health risks, is has to be shown that the dust under consideration has no mutagenic, carcinogenic, fibrogenic, toxic, or allergenic effects.
Source: Degussa AG Frankfurt am Main

(3)

Type of limit: MAK (DE)
Limit value: 6 mg/m³
Remark: fine dust
Source: Grace G.m.b.H Worms

(4)

Type of limit: MAK (DE)
Limit value: 6 mg/g
Remark: Wert gilt allgemein für Feinstaub
Source: Chemiewerk Bad Köstritz GmbH Bad Köstritz

Type of limit: MAK (DE)
Limit value: 6 mg/m³
Source: Süd-Chemie AG München

Type of limit: MAK (DE)
Limit value: .15 mg/m³
Source: Süd-Chemie AG München

Type of limit: MAK (DE)
Limit value: 6 mg/m³
Source: Woellner-Werke GmbH & Co. Ludwigshafen

Type of limit: OES (UK)
Limit value: 10 mg/m³
Remark: Personal exposure should be kept below 10 mg/m³ TWA total inhalable dust.
Source: Silquimica S.A. Espanola De Productos Quimicos Miranda da Ebro (Burgos)
 Degussa AG Frankfurt am Main

(5)

Type of limit: OES (UK)
Limit value: 5 mg/m3
Remark: Personal exposure should be kept below 5 mg/m3 TWA total respirable dust.
Source: Silquimica S.A. Espanola De Productos Quimicos Miranda da Ebro (Burgos)
Degussa AG Frankfurt am Main

(5)

Type of limit: OES (UK)
Limit value: 10 mg/m3
Remark: La exposición personal debe ser mantenida por debajo de 10 mg/m3 TWA polvo total inhalable.
Source: FMC FORET SA BARCELONA

Type of limit: OES (UK)
Limit value: 5 mg/m3
Remark: La exposición personal debe mantenerse por debajo de 5 mg/m3 TWA polvo total respirable.
Source: FMC FORET SA BARCELONA

Type of limit: TLV (US)
Limit value: 10 mg/m3
Remark: TLV is for Nuisance Dust.
Source: UOP, successor to Katalistiks, b.v. Des Plaines, Illinois

Type of limit: TLV (US)
Limit value: 10 mg/m3
Remark: As for total dust.
Source: Akzo Nobel Chemicals b.v. Amersfoort

(6)

Type of limit: TLV (US)
Limit value: 10 mg/m3
Remark: Aluminium oxide
Source: Zeolyst C.V. Delfzijl

Type of limit: TLV (US)
Limit value: 10 mg/m3
Remark: Silica, amorphous
inhalable dust
Source: Zeolyst C.V. Delfzijl

Type of limit: TLV (US)
Limit value: 3 mg/m3
Remark: Silica, amorphous
respirable dust
Source: Zeolyst C.V. Delfzijl

Type of limit: TLV (US)
Limit value: 15 other: mg/m3 total dust
Source: Zeoline Engis

Type of limit: TLV (US)
Limit value: 15 other: mg/m3 resperable dust
Source: Zeoline Engis

Type of limit: TLV (US)
Limit value: 10 mg/m3
Source: UOP MS. S.p.A. Assago MI

Type of limit: other
Limit value:
Remark: 6 mg/m3 (allg. Staubgrenzwert)
Source: Süd-Chemie AG München

Type of limit: other
Limit value:
Remark: 0.15 mg/m3 Quarz (als Feinstaub)
Source: Süd-Chemie AG München

Type of limit: other: GV (DK)
Limit value: 10 mg/m3
Source: Aalborg Portland Aalborg

Type of limit: other: GV (DK)
Limit value: 5 other: mg/m3 respirable
Source: Aalborg Portland Aalborg

Type of limit: other: OSHA PEL resperable dust
Limit value: 5 mg/m3
Source: Zeoline Engis

Type of limit: other: OSHA PEL total dust
Limit value: 15 mg/m3
Source: Zeoline Engis

Type of limit: other: VME France 1988 Poussières totales
Limit value: 10 mg/m3
Source: CECA SA Paris-La Defence 2

Type of limit:**Limit value:****Remark:** Zeolites have not been given an occupational exposure limit value. In the UK there is a generally applicable occupational exposure limit for dusts of 5 mg/m³ respirable and 10 mg/m³ total dust, 8 hour TWA.

In Germany there is a MAK-value of 6 mg/m³ for inert dust ingeneral.

Source: Crosfield B.V. Eijsden
Crosfield Group Warrington**1.9 Source of Exposure****Remark:** FCC handling operations have the potential for creating dusty work atmospheres and due care and attention is necessary to minimize dust generation.**Source:** UOP, successor to Katalistiks, b.v. Des Plaines, Illinois**Remark:** Dust during production and handling.**Source:** Akzo Nobel Chemicals b.v. Amersfoort**Remark:** Zeolite is a non hazardous material used in consumer products.**Source:** Crosfield B.V. Eijsden**Remark:** Zeolite can come into the environment during production if there is an emmision of dust.
Or it can leave the plant with the effluent.
There are procedures which take care that this will not happen and in the case of a problem there is a procedure howto act.

Last two years no emission, above the allowed levels.

Source: Zeolyst C.V. Delfzijl**Remark:** dust inhalation

Skin contact

Source: Zeoline Engis**Source:** Belgian Shell SA Ghent**Remark:** Synthèse en milieu aqueux, cristallisation, filtration, séchage puis activation.
Le séchage et l'activation sont réalisés en milieu clos, les fours sont équipés de matériel de dépoussiérage, les fines étant recyclées.**Source:** CECA SA Paris-La Defence 2**Remark:** Zeolite A is a non hazardous material used in consumer products.**Source:** Silquímica S.A. Espanola De Productos Quimicos Miranda da Ebro (Burgos)

Remark: La zeolita A no es un material dañino utilizado en productos de consumo.

Source: FMC FORET SA BARCELONA

Remark: Zeolite handling operations have the potential for creating dusty work atmospheres and due care and attention is necessary to minimize dust generation.

Source: UOP MS. S.p.A. Assago MI

Remark: Zeolite is a non hazardous material used in consumer products.

Source: Crosfield Group Warrington

Remark: dust in the plant

Source: Bayer AG Leverkusen

Remark: Zeolite A is a non hazardous material used in consumer products.

Source: Degussa AG Frankfurt am Main

Remark: Zeolite type A, X and Y handling operations have the potential for creating dusty work atmospheres and due care and attention is required to minimize dust generation.

Source: Grace G.m.b.H Worms

Remark: Staubentwicklung bei Benutzung des Stoffes in Haushaltswaschmitteln
Staubentwicklung bei Umschlagsprozessen
Staubentwicklung beim Hersteller

Source: Chemiewerk Bad Köstritz GmbH Bad Köstritz

1.10.1 Recommendations/Precautionary Measures

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1.10.2 Emergency Measures

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1.11 Packaging

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1.12 Possib. of Rendering Subst. Harmless

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1.13 Statements Concerning Waste

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1.14.1 Water Pollution

Classified by: KBWS (DE)
Labelled by: KBWS (DE)
Class of danger: 1 (weakly water polluting)
Remark: Water Pollution Class 1 due to high alkalinity of suspension in water.
Source: Silquimica S.A. Espanola De Productos Quimicos Miranda da Ebro (Burgos)
Degussa AG Frankfurt am Main

(7)

Classified by: KBWS (DE)
Labelled by:
Class of danger: 0 (generally not water polluting)
Source: Süd-Chemie AG München

Classified by: other: provisionally by Bayer AG
Labelled by:
Class of danger: 1 (weakly water polluting)
Source: Bayer AG Leverkusen

1.14.2 Major Accident Hazards

Legislation:
Substance listed:
Remark: not classified
Source: Bayer AG Leverkusen

1.14.3 Air Pollution

Classified by:
Labelled by:
Number:
Class of danger:
Remark: not classified
Source: Bayer AG Leverkusen

1.15 Additional Remarks

Remark: Waste disposal according to applicable regulations.
Source: UOP, successor to Katalistiks, b.v. Des Plaines, Illinois
UOP MS. S.p.A. Assago MI

Remark: Inspirable fraction (diameter \geq 20 μ m) is less than 1%.
Extrapolation results to less than 0.1% for the respirable fraction of zeolite.
Source: Akzo Nobel Chemicals b.v. Amersfoort

Remark: Only danger is the fact that it is dust (based upon literature and the MSD sheet), the ACGIH values (total dust) are added
The material is shipped in Bigbags, in containers by sea and in bigbags by road and air.

Source: Zeolyst C.V. Delfzijl

Remark: Avoid prolonged breathing of the dust or contact of dust with the skin. The drying action of this material can cause irritation of the mucous membranes of the nose and throat and irritation of the skin. If its use requires manual handling, wear long sleeves and close-weave cotton gloves with tight-fitting wristlets. If dusty conditions prevail, use of an approved NIOSH-MSHA dust is recommended. When purging into container of flammable liquid, ground both containers electrically to prevent static spark. Will release heat when absorbing water. If a large quantity of zeolites quickly absorbs the equilibrium amount of water, the zeolite can become hot enough to cause thermal burns of the skin. Avoid contact under these conditions.

Source: Zeoline Engis

Remark: Le dossier technique (points 2 à 5) est présenté par la société UOP MS Spa.

Source: CECA SA Paris-La Defence 2

Remark: Polución de las aguas: Clase 1, debido a la alta alcalinidad que tienen en suspensión acuosa.

Source: FMC FORET SA BARCELONA

Remark: Water Pollution:

Classified by : other: (provisionally) Grace GmbH (DE)
Labelled by : other: (provisionally) Grace GmbH (DE)
Class of danger: other: 1 (slightly water polluting)

(DE-WGK-Rating)

Source: Grace G.m.b.H Worms

Source: Süd-Chemie AG München

1.16 Last Literature Search

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1.17 Reviews

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1.18 Listings e.g. Chemical Inventories

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2.1 Melting Point

Value: > 1200 degree C
Remark: Detergent Zeolite NaA transforms itself into different types of non fibrous solid sodium aluminum silicate at temperatures above approx. 700 C.
Source: Degussa AG Frankfurt am Main (8)

Value:
Remark: no data
Source: Zeoline Engis

Value:
Remark: No data available.
Source: UOP MS. S.p.A. Assago MI

2.2 Boiling Point

Value:
Remark: no data
Source: Zeoline Engis

Value:
Remark: Not Applicable.
Source: UOP MS. S.p.A. Assago MI

Value:
Remark: not applicable
Source: Degussa AG Frankfurt am Main

2.3 Density

Type: density
Value: ca. 2.1 g/cm³ at 20 degree C
Source: Degussa AG Frankfurt am Main (9)

Type: density
Value: ca. 2.1 g/cm³ at 25 degree C
Method: other
Year: 1975
Remark: The density value is a calculated crystalline density.
Source: UOP MS. S.p.A. Assago MI

Type: density
Value: 2.1 - 2.1 g/cm³
Method: other: no data
GLP: no data
Source: Zeoline Engis

Type: bulk density
Value: 300 - 900 kg/m³
Method: other: no data
GLP: no data
Source: Zeoline Engis

Type: bulk density
Value: ca. 450 kg/m³
Method: other: DIN 53491
Remark: Bulk density means tapped density, i.e. the density of the stored material in silos.
Source: Degussa AG Frankfurt am Main

(10)

2.3.1 Granulometry

-

2.4 Vapour Pressure

Value:
Remark: no data
Source: Zeoline Engis

Value:
Remark: Not Applicable.
Source: UOP MS. S.p.A. Assago MI

Value:
Remark: not applicable
Source: Degussa AG Frankfurt am Main

2.5 Partition Coefficient

log Pow:
Method:
Year:
Remark: no data
Source: Zeoline Engis

log Pow:
Method:
Year:
Remark: No data available.
Source: UOP MS. S.p.A. Assago MI

log Pow:
Method:
Year:
Remark: not applicable (inorganic, inert substance).
Source: Degussa AG Frankfurt am Main

2.6.1 Water Solubility

Value: < 1 - 1 g/l at 20 degree C
pH: ca. 10 - 10 at 50 g/l and 20 degree C
Method: other: no data
GLP: no data
Source: Zeoline Engis
Test condition: PH: 5% slurry

Value: < 1 g/l at 20 degree C
Qualitative: slightly soluble
pH: ca. 11 at 50 g/l and 20 degree C
Remark: Similar results were obtained by Enichem Augusta (I),
personal communication from Mr. Clerici (1994)
Source: Degussa AG Frankfurt am Main

(11)

Value: ca. 0
Remark: insoluble
pH depends on the composition of the Y zeolite it can be
from 9-11 to 3-5
Source: Zeolyst C.V. Delfzijl
Remark: pH of a 5% zeolite-water solution is 8-11.
Practically insoluble.
Source: UOP MS. S.p.A. Assago MI

2.6.2 Surface Tension

-

2.7 Flash Point

Value:
Type:
Method:
Year:
Remark: no data
Source: Zeoline Engis

Value:
Type:
Method:
Year:
Remark: Not Applicable.
Source: UOP MS. S.p.A. Assago MI

Value:
Type:
Method:
Year:
Remark: not applicable (inorganic, inert substance).
Source: Degussa AG Frankfurt am Main

2.8 Auto Flammability

Value:**Remark:** non flammable**Source:** Zeoline Engis**Value:****Remark:** Not Applicable.**Source:** UOP MS. S.p.A. Assago MI**Value:****Remark:** not applicable (inorganic, inert substance).**Source:** Degussa AG Frankfurt am Main

2.9 Flammability

Result: non flammable**Method:** other: no data**GLP:** no data**Source:** Zeoline Engis**Result:****Remark:** Not Applicable.**Source:** UOP MS. S.p.A. Assago MI**Result:****Remark:** not applicable (inorganic, inert substance).**Source:** Degussa AG Frankfurt am Main

2.10 Explosive Properties

Result: not explosive**Method:** other: no data**GLP:** no data**Source:** Zeoline Engis**Result:** not explosive**Source:** Degussa AG Frankfurt am Main**Result:****Remark:** Not Applicable.**Source:** UOP MS. S.p.A. Assago MI

2.11 Oxidizing Properties

Result: no oxidizing properties**Method:** other: no data**GLP:** no data**Source:** Zeoline Engis**Result:** no oxidizing properties**Source:** Degussa AG Frankfurt am Main

Result:
Remark: Not Applicable.
Source: UOP MS. S.p.A. Assago MI

2.12 Additional Remarks

Remark: Physical and chemical properties:
Physical state: Solid
Form: Powder
Colour: White
Odour: None
Density: ca. 2,000 kg/m³ at 20 C
300 - 350 kg/m³ at 20 C (compacted bulk)
Solubility in water: Insoluble

Source: Zeolyst C.V. Delfzijl

Remark: no additional remarks
Source: Zeoline Engis

3.1.1 Photodegradation

Type:
Method:
Year: GLP:
Test substance:
Remark: no data
Source: Zeoline Engis

Type:
Method:
Year: GLP:
Test substance:
Remark: Not Applicable.
Source: UOP MS. S.p.A. Assago MI

Type:
Method:
Year: GLP:
Test substance:
Remark: not relevant
Source: Degussa AG Frankfurt am Main

3.1.2 Stability in Water

Type: abiotic
Method:
Year: GLP: no data
Test substance: other TS: Zeolite A
Result: An average loss of 44% of a 10 mg/L concentration of zeolite A in several raw wastewaters occurred over 55 days; losses from individual samples ranged up to 88%. This suggests that the half-life of the intact zeolite structure is likely only a few days to a few months in natural waters.
Source: UOP MS. S.p.A. Assago MI
Test condition: 10 mg/L zeolite A was incubated in several raw wastewaters for 55 days and the remaining concentration of intact zeolite determined by "apparent zeolite SiO₂ method" (photometric measurement of molybdate-reactive silica released from the material by selective dissolution in dilute acid). All sample pH values > 7.2 (most in the range of 8.0-8.6).

(12)

Type: abiotic
Method:
Year: **GLP:**
Test substance: other TS: Zeolite A
Result: The data indicate that the hydrolysis behavior was incongruent: initially the cations in the lattice were replaced by protons; then, the samples progressively lost Si and Al. The resulting end product had properties similar to those of naturally occurring gibbsite ($\text{Al}_2\text{O}_3 \times 3 \text{H}_2\text{O}$) and halloysite ($\text{Al}_2 \text{Si}_2 \text{O}_5 (\text{OH})_4$). In a zeolite A slurry the crystals became totally amorphous to x-rays within minutes to hours, depending on pH. The IR spectra of the solids were quite distinct from those of intact zeolite. These features were found to be independent of the pH at which spectra were taken. X-ray emission-energy shift studies of hydrolysed zeolite A showed characteristics of common, naturally occurring minerals. These findings were confirmed in an analysis of zeolite solids from sewage obtained from households using a detergent product containing zeolite A.

Source: UOP MS. S.p.A. Assago MI
Test condition: The hydrolysis of Na-zeolite A and Ca-zeolite A in the pH range 3 - 9 was studied in distilled water, model environmental systems and sewage media.

(13)

Type: abiotic
Method:
Year: **GLP:**
Test substance: other TS: Zeolite A
Result: No changes could be observed during the entire test period of 60 days.

Source: UOP MS. S.p.A. Assago MI
Test condition: Suspensions of 2 g SASIL in 250 ml water were filled into dialysis tubing and immersed into a river (Elsenz) at a weir (the constant turbulence kept the test material in suspension). The pH of river water was 7.4 at certain time intervals (0.5-60 days) a tubing was removed and analysed for weight, $\text{SiO}_2/\text{Al}_2\text{O}_3$ -ratio and crystallinity (x-ray diffraction).

(14)

Type: abiotic
t1/2 pH 8.2 : ca. 2 month
Method: other: See Freetext Test Condition
Year: 1983 **GLP:** no data
Test substance: other TS: Zeolite A, calcium-form
Source: UOP MS. S.p.A. Assago MI
Test condition: A 1 mg/L suspension of Ca-zeolite A in synthetic water (pH 8.2, 42 mg/L CaCO₃) was studied for hydrolysis as indicated by loss of both particulate aluminum and particulate silicon. The equilibration period was overall 30 weeks with samples taken after 8 hours, 3 days and 2, 3, 8, 12, 16 and 30 weeks. Samples were continuously shaken in polyethylene bottles (40 cycles/min). Particulate phases of samples were obtained by filtration and solubilized with 0.18 M HNO₃. Only constituents solubilized by this procedure are classified as particulate (degraded, amorphous zeolite A is not solubilized). Analysis of aluminum was by atomic adsorption spectrometry, silica was analyzed by an automated colorimetric method based on formation of the reduced silicomolybdate complex.

(15)

Type: abiotic
Method: other: See freetest condition
Year: 1983 **GLP:** no data
Test substance: other TS: Zeolite A, Calcium-form
Result: Hydrolysis was strongly dependant on pH:

pH	degradation rate
8.2	44%
7.1	59%
6.3	72%

Source: UOP MS. S.p.A. Assago MI
Test condition: A 1 mg/L suspension of Ca-zeolite A in synthetic water was studied for hydrolysis as indicated by loss of both particulate aluminum and particulate silicon. The equilibration period was 3 days. Samples were maintained at pH values of 6.3, 7.1 and 8.2 in glass containers. Mixing was achieved by bubbling a CO₂/N₂-mixture through the samples. Particulate phases of samples were obtained by filtration and solubilized with 0.18 M HNO₃. Only constituents solubilized by this procedure are classified as particulate (degraded, amorphous zeolite A is not solubilized). Analysis of aluminum was by atomic adsorption spectrometry, silica was analysed by an automated colorimetric method based on formation of the reduced silicomolybdate complex.

(15)

Type: abiotic
Method: other: See Freetext Condition
Year: 1983 **GLP:** no data
Test substance: other TS: Zeolite A, Calcium-form
Result: The following approximate half-times were determined:

Source	Parameter	Half-time
Lake Michigan	pH 8.4, 109 mg/L CaCO ₃	1-2 months
Miami River	pH 8.3, 263 mg/L CaCO ₃	5 months
Town River	pH 6.5, 16 mg/L CaCO ₃	complete removal within a few days
Racoon Creek	pH 4.3, 255 mg/L CaCO ₃	complete, immediate removal already after 1 day

Source: UOP MS. S.p.A. Assago MI
Test condition: A 1 mg/L suspension of Ca-zeolite A in various natural lake and river waters was studied for hydrolysis as indicated by loss of both particulate aluminum and particulate silicon. The equilibration period was overall 12 weeks with samples taken after 1 and 3 days and 2, 4, 8 and 12 weeks. Samples were continuously shaken in polyethylene bottles (40 cycles/min). Particulate phases of samples were obtained by filtration and solubilized with 0.18 M HNO₃. Only constituents solubilized by this procedure are classified as particulate (degraded, amorphous zeolite A is not solubilized). Analysis of aluminum was by atomic adsorption spectrometry, silica was analysed by an automated colorimetric method based on formation of the reduced silicomolybdate complex.

(15)

Type: abiotic
Method:
Year: **GLP:** no data
Test substance:
Result: An average loss of 44% of a 10 mg/l concentration of zeolite A in several raw wastewaters occurred after 55 days; losses for individual samples ranged up to 88%. This suggests that the half-life of the intact Zeolite structure is in the range of a few days to a few months in natural waters.

Source: Degussa AG Frankfurt am Main
Test condition: 10 mg/l zeolite A was incubated in several raw wastewaters for 55 days and the remaining concentration of intact zeolite determined by "apparent zeolite SiO₂ method" (photometric measurement of molybdate-reactive silica released from the material by selective dissolution in dilute acid). All sample pH values > 7.2 (most in the range 8.0 - 8.6).

(16)

Type: abiotic
Method:
Year: **GLP:** no data
Test substance:
Result: The data indicate that the hydrolysis behaviour was incongruent: initially the cations in the lattice were replaced by protons; then, the samples progressively lost Si and Al. The resulting end product had properties similar to those of naturally occurring gibbsite [Al₂ O₃ x 3 H₂O] and halloysite [Al₂ Si₂ O₅ (OH)₄]. In a zeolite A slurry the crystals became totally amorphous to x-rays within minutes to hours, depending on pH. The IR spectra of the solids were quite distinct from those of intact zeolite. These features were found to be independent of the pH at which spectra were taken. X-ray emission-energy shift studies of hydrolysed zeolite A showed characteristics of common, naturally occurring minerals. These findings were confirmed in an analysis of zeolite solids from sewage obtained from households using a detergent product containing zeolite A.

Source: Degussa AG Frankfurt am Main
Test condition: The hydrolysis of Na-zeolite A and Ca-zeolite A in the pH range 3 - 9 was studied in distilled water, model environmental systems and sewage media.

(17)

Type: abiotic
Method:
Year: **GLP:**
Test substance:
Result: No changes could be observed during the entire test period of 60 days.

Source: Degussa AG Frankfurt am Main
Test condition: Suspensions of 2 g zeolite A in 250 ml water were filled into dialysis tubing and immersed into a river (Elsenz) at a weir (the constant turbulence kept the test material in suspension). The pH of river water was 7.4 At certain time intervalls (0.5 - 60 days) a tubing was removed and analysed for weight, SiO₂/Al₂O₃-ratio and crystallinity (x-ray diffraction).

(18)

Type: abiotic
t1/2 pH 8.2 : ca. 2 month
Method: other: see Freetext Test Condition
Year: 1983 **GLP:** no data
Test substance: other TS: Zeolite A, calcium-form
Source: Degussa AG Frankfurt am Main
Test condition: A 1 mg/l suspension of Ca-zeolite A in synthetic water (pH 8.2, 42 mg/l CaCO₃) was studied for hydrolysis as indicated by loss of both particulate aluminum and particulate silicon. The total equilibration period was 30 weeks with samples taken after 8 hours, 3 days and 2, 3, 8, 12, 16 and 30 weeks. Samples were continuously shaken in polyethylene bottles (40 cycles/min). Particulate phases of samples were obtained by filtration and solubilized with 0.18 M HNO₃. Only constituents solubilized by this procedure are classified as particulate (degraded, amorphous zeolite A is not solubilized). Analysis of aluminum was by atomic adsorption spectrometry, silica was analysed by an automated colorimetric method based on formation of the reduced silicomolybdate complex.

(15)

Type: abiotic
Method: other: see Freetext Test Condition
Year: 1983 **GLP:** no data
Test substance: other TS: Zeolite A, calcium-form
Result: Hydrolysis was strongly dependent on pH and increased with decreasing pH:

pH	% hydrolysed
8.2	44%
7.1	59%
6.3	72%

Source: Degussa AG Frankfurt am Main
Test condition: A 1 mg/l suspension of Ca-zeolite A in synthetic water was studied for hydrolysis as indicated by loss of both particulate aluminum and particulate silicon. The equilibration period was 3 days. Samples were maintained at pH values of 6.3, 7.1 and 8.2 in glass containers. Mixing was achieved by bubbling a CO₂/N₂-mixture through the samples. Particulate phases of samples were obtained by filtration and solubilized with 0.18 M HNO₃. Only constituents solubilized by this procedure are classified as particulate (degraded, amorphous zeolite A is not solubilized). Analysis of aluminum was by atomic adsorption spectrometry, silica was analysed by an automated colourimetric method based on formation of the reduced silicomolybdate complex.

(15)

Type: abiotic
Method: other: see Freetext Test Condition
Year: 1983 **GLP:** no data
Test substance: other TS: Zeolite A, calcium-form
Result: The following approximate half-times were determined:

source	parameter	half-time
Lake Michigan	pH 8.4, 109 mg/l CaCO ₃	1-2 months
Miami River	pH 8.3, 263 mg/l CaCO ₃	5 months
Town River	pH 6.5, 16 mg/l CaCO ₃	complete removal within a few days
Racoon Creek	pH 4.3, 255 mg/l CaCO ₃	complete, immediate removal already after 1 day

Zeolite A is hydrolysed quickly (T 1/2 approx. 7 days) in weakly acidic rivers but slower in waters having pH >8 and with high concentration of calcium (>70 mg/l) and silicon (>6 mg/l as SiO₂).

Source: Degussa AG Frankfurt am Main
Test condition: A 1 mg/l suspension of Ca-zeolite A in various natural lake and river waters was studied for hydrolysis as indicated by loss of both particulate aluminum and particulate silicon. The equilibration period was overall 12 weeks with samples taken after 1 and 3 days and 2, 4, 8 and 12 weeks. Samples were continuously shaken in polyethylene bottles (40 cycles/min).
 Particulate phases of samples were obtained by filtration and solubilized with 0.18 M HNO₃. Only constituents solubilized by this procedure are classified as particulate (degraded, amorphous zeolite A is not solubilized). Analysis of aluminum was by atomic adsorption spectrometry, silica was analysed by an automated colorimetric method based on formation of the reduced silicomolybdate complex.

(15)

Type:
Method:
Year: **GLP:**
Test substance:
Remark: product is stable
Source: Zeoline Engis

3.1.3 Stability in Soil

Type: Radiolabel:
Concentration:
Cation exch.
capac.
Microbial
biomass:
Method:
Year: GLP:
Test substance:
Remark: no data
Source: Zeoline Engis

Type: Radiolabel:
Concentration:
Cation exch.
capac.
Microbial
biomass:
Method:
Year: GLP:
Test substance:
Remark: No data available.
Source: UOP MS. S.p.A. Assago MI

3.2 Monitoring Data (Environment)

Type of
measurement:
Medium:
Remark: no data
Source: Zeoline Engis

Type of
measurement:
Medium:
Remark: No data available.
Source: UOP MS. S.p.A. Assago MI

3.3.1 Transport between Environmental Compartments

Type:
Media:
Method:
Year:
Remark: No data
Source: Zeoline Engis

Type:
Media:
Method:
Year:
Remark: No data available.
Source: UOP MS. S.p.A. Assago MI

Type:
Media:
Method:
Year:
Remark: See "additional remarks"
Source: Degussa AG Frankfurt am Main

3.3.2 Distribution

Media:
Method:
Year:
Remark: No data
Source: Zeoline Engis

Media:
Method:
Year:
Remark: No data available.
Source: UOP MS. S.p.A. Assago MI

Media:
Method:
Year:
Remark: See "additional remarks"
Source: Degussa AG Frankfurt am Main

3.4 Mode of Degradation in Actual Use

Remark: No data
Source: Zeoline Engis

Remark: No degradation of material during actual use.
Source: UOP MS. S.p.A. Assago MI

Remark: See chapter 3.1.2 "Stability in Water"
Source: Degussa AG Frankfurt am Main

3.5 Biodegradation

Type:
Inoculum:
Method:
Year: **GLP:**
Test substance:
Remark: No data
Source: Zeoline Engis

Type:
Inoculum:
Method:
Year: **GLP:**
Test substance:
Remark: Studies on biodegradation are not applicable (inorganic substance).
Source: UOP MS. S.p.A. Assago MI

Type:
Inoculum:
Method:
Year: **GLP:**
Test substance:
Remark: Studies on biodegradation are not applicable (inorganic substance).
Source: Degussa AG Frankfurt am Main

3.6 BOD5, COD or BOD5/COD Ratio

Remark: No data
Source: Zeoline Engis

Remark: No data available.
Source: UOP MS. S.p.A. Assago MI

3.7 Bioaccumulation

Species: Carassius sp. (Fish, fresh water)
Exposure period: 214 day
Concentration:
BCF:
Elimination: yes
Method: other: See Freetext Test Condition
Year: 1979 **GLP:** no data
Test substance: other TS: Sodium Aluminum Silicate (SASIL) doted with Indium
Source: UOP MS. S.p.A. Assago MI
Test condition: Method: Biocenotic investigation of different ponds and streams.

I) Pond without water in- or outflow
220 kg SASIL were evenly ditributed on the pond surface
(2000 square meter; pond volume: 600-700 cubic meter;

mean depth: 0.3 m).

II) Flow-through pond

Overall 220 kg SASIL were dosed continuously during the test period (May-November 1976). Flow rate was 0.77 l/sec; mean retention time: 10 days.

Effect:

Since the added test substance was Indium-doted (incorporation of Indium into crystal lattice), the bioaccumulation could be studied. At the end of the 7-month test fish were caught and investigated: Indium was detected in the intestine and intestinal epithelium. After 4 weeks in SASIL-free water no Indium was found in bones or whole fish.

Indium-doted SASIL was also detected on and in waterplants and in traces in snails.

(19)

Species: Carassius sp. (Fish, fresh water)
Exposure period: 214 day
Concentration:
BCF:
Elimination: yes
Method: other: see Freetext Test Condition
Year: 1979 **GLP:** no data
Test substance: other TS: sodium aluminum silicate (SASIL) doted with Indium
Source: Degussa AG Frankfurt am Main
Test condition: Method: biocenotic investigation of different ponds and streams.

I) pond without water in- or outflow

220 kg SASIL were evenly distributed on the pond surface (2000 square meter; pond volume: 600 - 700 cubic meter; mean depth: 0.3 m).

II) Flow-through pond

Overall 220 kg SASIL were dosed continuously during the test period (May - November 1976). Flow rate was 0.77 l/sec; mean retention time: 10 days.

Effect:

Since the added test substance was Indium-doted (incorporation of Indium into crystal lattice), the bioaccumulation could be studied. At the end of the 7-month test fish were caught and investigated: Indium was detected in the intestine and intestinal epithelium. After 4 weeks in SASIL-free water no Indium was found in bones or whole fish.

Indium-doted SASIL was also detected on and in waterplants and in traces in snails.

(20)

Species: other: Unio tumidus (freshwater clam)
Exposure period: 28 day
Concentration: 250 mg/l
BCF:
Elimination:
Method: other: See Freetext Test Condition
Year: 1977 **GLP:** no data
Test substance: other TS: SASIL doted with Indium
Remark: Neutron activation analysis revealed no enhanced level of SASIL in tissue as compared to surrounding water.
Source: UOP MS. S.p.A. Assago MI
Test condition: Clams were incubated in tap water to which 250 mg/L SASIL (Indium-doted) was added; slight magnetic stirring to keep test material in suspension.

(21)

Species: other: Tubifex sp. (freshwater worm)
Exposure period: 28 day
Concentration:
BCF:
Elimination:
Method: other: See Freetext Test Condition
Year: 1977 **GLP:** no data
Test substance: other TS: SASIL doted with Indium
Remark: Neutron activation analysis revealed no enhanced level of SASIL in tissue as compared to surrounding water.
Source: UOP MS. S.p.A. Assago MI
Test condition: River sediment was mixed with SASIL (Indium-doted) at 250 mg/kg; Tubifex were added and incubated for 4 weeks (3-5 cm water layer, 10 cm sediment depth).
Test substance: SASIL was doted by incorporation of Indium into the crystal lattice.

(22) (23)

Species: other: Tubifex sp. (freshwater worm)
Exposure period: 28 day
Concentration:
BCF:
Elimination:
Method: other: see Freetext Test Condition
Year: 1977 **GLP:** no data
Test substance: other TS: SASIL doted with Indium
Remark: Neutron activation analysis revealed no enhanced level of SASIL in tissue as compared to surrounding water.
Source: Degussa AG Frankfurt am Main
Test condition: River sediment was mixed with SASIL (Indium-doted) at 250 mg/kg; Tubifex were added and incubated for 4 weeks (3 - 5 cm water layer, 10 cm sediment depth).
Test substance: Zeolite A was doted by incorporation of Indium into the crystal lattice.

(24) (25)

Species: other: Unio tumidus (freshwater clam)
Exposure period: 28 day
Concentration: 250 mg/l
BCF:
Elimination:
Method: other: see Freetext Test Condition
Year: 1977 **GLP:** no data
Test substance: other TS: SASIL doted with Indium
Remark: Neutron activation analysis revealed no enhanced level of SASIL in tissue as compared to surrounding water.
Source: Degussa AG Frankfurt am Main
Test condition: Clams were incubated in tap water to which 250 mg/l SASIL (Indium-doted) was added; slight magnetic stirring to keep test material in suspension.

(24) (25)

Species:
Exposure period:
Concentration:
BCF:
Elimination:
Method:
Year: **GLP:**
Test substance:
Remark: No data
Source: Zeoline Engis

3.8 Additional Remarks

Remark: Can't find information in literature
 Except for:
STABILITY/REACTIVITY:
 Stability: Stable, Hygroscopic
 Conditions to avoid: Exposure to water
 Materials to avoid: Strong acids, strong bases
 Hazardous decompositions products: None known
Source: Zeolyst C.V. Delfzijl

Remark: no additional remarks
Source: Zeoline Engis

Remark: Settling tests:
 In a field study a wastewater treatment plant (trickling filter system) serving ca. 5300 people at Nevada, Iowa (USA) was fed with zeolite A (Na-form) at about 10 mg/L for a period of 7 months. Zeolite A was analysed by "SiO₂-method": filtration; treatment with dilute acid to selectively dissolve intact zeolite; colorimetric measurement of SiO₂ after treatment with molybdate.

Results:
 Removal of zeolite averaged 30% at primary clarifier, 74% after passing trickling filter and secondary clarifier.
 Overall elimination rateç 81%
 The presence of zeolite in the wastewater did not adversely affect the treatment performance of the plant or the

- production of gas by the anaerobic digester. Zeolite did not increase the concentration of trace metals in secondary effluent or the wet sludge of the digester.
- Source:** UOP MS. S.p.A. Assago MI
Test substance: Zeolite A, Sodium-form. (26)
- Remark:** Settling Test:
The settling behaviour of raw sewage in the presence of 30 mg/L zeolite A was studied in sedimentation columns (2.7 m high; 150 mm diameter). Zeolite A concentrations were determined by analysis of aluminum using flameless atomic adsorption spectrophotometry.
- Source:** UOP MS. S.p.A. Assago MI
Test substance: Zeolite A (27)
- Remark:** Result:
The suspended solids removal in the presence of zeolite A was marginally less compared to sewage without zeolite.
- Source:** UOP MS. S.p.A. Assago MI
Test substance: Zeolite A (28)
- Remark:** To test whether zeolite A applied to land via digester sludge can penetrate the soil layers in the form of particles and end up in ground water, columns containing standardized soils and Cr51-labeled Ca-zeolite a (mean diameter 3.7 um) were percolated with tap water for 24 days at 10 ml/h.
- Source:** UOP MS. S.p.A. Assago MI
Test substance: Zeolite A, Ca-exchanged. (28)
- Remark:** Result:
No radioactivity above background radiation was found in the eluates.
- Source:** UOP MS. S.p.A. Assago MI
Test substance: Zeolite A, Ca-exchanged. (28)
- Remark:** Activated sludge tests:
An activated sludge pilot plant was fed with settled wastewater from a sewage plant containing Ca-exchanged zeolite A (15 & 30 mg/L). Acclimation for 9 days prior to sampling of effluents; 5 day sampling period; nominal hydraulic retention times were 2.5 h and 4 h.
- Source:** UOP MS. S.p.A. Assago MI
Test substance: Zeolite A, Ca-exchanged. (29)
- Remark:** Result:
2 - 4 mg/L zeolite was found in effluent (measured by aluminum analysis via atomic adsorption spectrophotometry). This corresponds to 73 - 93% elimination rate of initial 15 - 30 mg/L in the influent.
- Source:** UOP MS. S.p.A. Assago MI
Test substance: Zeolite A, Ca-exchanged. (29)
- Remark:** Static settling test:
Columns were filled with raw sewage containing 30 mg/L zeolite A. Samples were taken at different time intervals from sampling ports positioned at different heights of the columns; suspended solids and zeolite concentration (via aluminum analysis by atomic adsorption spectrometry) were

determined.

Result:

Only marginally lower removal of zeolite A compared to other suspended solids. Removal rates were 35% and 53% at retention times of 1 and 2 h respectively.

Source: UOP MS. S.p.A. Assago MI

Test substance: Zeolite A

(30)

Remark:

Static settling test:

The settling of zeolite A in primary clarifiers was modeled in static settling tests: vertical columns were filled with raw municipal wastewater containing 100 mg/L zeolite A (sodium-form). Sampling ports were located at different heights of the column; samples were taken at different time intervals and analysed for aluminum (atomic adsorption spectrometry) and suspended solids.

Result:

Data suggest that removal of zeolite by primary treatment is similar to that of other suspended solids.

Dynamic settling test:

The settleability of zeolite was studied in a continuous flow apparatus. Coarse-filtered raw wastewater containing 20 mg/L zeolite A (sodium-form) was pumped through a 6 L tank (retention time 2 h); samples of influent and effluent were analysed for suspended solids and aluminum.

Result:

Removal of zeolite, calculated from the aluminum data, was 77%; suspended solids were removed by 41%.

Continuous activated sludge treatment:

A 60 day continuous flow test was performed with a test unit fed with raw municipal wastewater at a rate of 1 L/h containing 20 mg/L zeolite A (sodium-form).

Result:

Removal of zeolite as measured by aluminum analysis averaged at least 77%.

Trickling filter treatment:

Cylinders filled with crushed rock were run with raw municipal wastewater at a rate of 540 mL/h containing 20 mg/L zeolite A (sodium-form).

Result:

Removal of zeolite as measured by aluminum analysis averaged 89%.

Semi-continuous activated sludge test:

In a 10-day semicontinuous activated sludge test (SCAS-test) involving a fill and draw operation with a daily cycle of 23 h aeration and 0.5 h settling 98% of zeolite A (sodium-form) added at 20 mg/L was eliminated from the effluent. In a

72-day study in the same test 80% of 20 mg/L zeolite was removed (as measured by aluminum analysis).
Source: UOP MS. S.p.A. Assago MI
Test substance: Zeolite A, Sodium-form. (31)

Remark: Activated sludge test:
The performance of an activated sludge plant serving 60 households supplied with zeolite A containing laundry detergent was studied over a period of 9 weeks.

Result:
No adverse effects were observed as compared to the 5 week baseline period prior to the actual test. At influent concentrations averaging between 7.6 and 17.1 mg/L zeolite A removal from influent was 80 - 90 %.
Source: UOP MS. S.p.A. Assago MI (32)

Remark: Dynamic settling test:
Zeolite A and suspended solids removal was tested in a continuous primary sedimentation pilot plant fed with sewage to which 30 and 60 mg/L zeolite was added. the plant was operated with continuous flow rates or under variable flow conditions (zeolite dosage changed according to the flow variations to produce a constant concentration in the influent). Test period: 3 days.

Result:
Suspended solids removal (50 - 60%) was not enhanced in the presence of zeolite A.
Zeolite A removal (analysis of Al by atomic adsorption spectrometry) was 66% at a retention time of 0.76 h and 76% at variable flow conditions.
Source: UOP MS. S.p.A. Assago MI (33)

Remark: Sedimentation in a sewage plant:
In a municipal activated sludge plant whose influent was spiked with Indium-doped zeolite A removal was already 50% in the sand trap and reached 85% removal after passing the mechanical stage of the sewage plant.

Anaerobic treatment:
Addition of zeolite A to digester sludge in concentrations up to 130% of the dry sludge residue had no effect on gas production in a model digester.
Source: UOP MS. S.p.A. Assago MI (34)

Remark: In technical trickling filter fed with municipal sewage containing 60 g/L Zeolite A (Ca-form), 81% was removed in the primary settler.
In a technical scale activated sludge treatment plant no adverse effects as compared to untreated control were observed when Ca-zeolite at 40 mg/L was added to the raw sewage. Parameters tested: BOD5, TOC, COD, N- &

P-elimination, elination of Fe, Zn, Cu and Pb from effluents and sludge.

Source: UOP MS. S.p.A. Assago MI
Test substance: Zeolite A, calcium-form.

(35) (36)

Remark: In a 13-month field trial in the village of Buesnau (Germany) comprising more than 3000 people, a 63% removal of zeolite A was observed after mechanical treatment of the raw wastewater in the local sewage plant (21% removal in sand trap; 42% in primary settler). Overall elimination rate after passage of sewage plant was 96%, of which 33 % was eliminated in the biological stage.

Source: UOP MS. S.p.A. Assago MI
(37)

Remark: Anaerobic sludge digestion:
Units were seeded with digester sludge from municipal plant and fed with synthetic sewage containing 78 or 780 mg/L zeolite A (sodium-form). During the 20-week test period no differences were observed concerning gas production, pH or supernatant metals (Cd, Cu, Fe, Zn) as compared to untreated control. Mixed digester and supernatant suspended solids as well as supernatant Al was higher in zeolite-treated units due to high amount of zeolite added.

Individual home treatment systems:
Field study test groups were supplied with zeolite-containing laundry detergent (control group with similar product containing no zeolite). Test group using septic tanks or home aerobics had elimination rates of 81% and 88%, respectively at influent concentrations of 26 and 23 mg/L, respectively.

Anaerobic treatment:
In a model septic tank representing individual anaerobic wastewater home treatment systems > 97% of zeolite A added to the wastewater at 40 - 55 mg/L was removed from the effluent (110-day study period, hydraulic retention time: 3 days).

Source: UOP MS. S.p.A. Assago MI
Test substance: Zeolite A, Sodium-form.

(38)

Remark: Settling tests:
In a field study a wastewater treatment plant (trickling filter system) serving ca. 5300 people at Nevada, Iowa (USA) was fed with zeolite A (Na-form) at about 10 mg/l for a period of 7 months. Zeolite A was analysed by "SiO₂-method": filtration; treatment with dilute acid to selectively dissolve intact zeolite; colorimetric measurement of SiO₂ after treatment with molybdate.

Results:
Removal of zeolite averaged 30% at primary clarifier, 74% after passing through trickling filter and secondary clarifier. Overall elimination rate: 81%.
The presence of zeolite in the wastewater did not adversely

affect the treatment performance of the plant or the production of gas by the anaerobic digester. Zeolite did not increase the concentration of trace metals in secondary effluent or the wet sludge of the digester.

Source: Degussa AG Frankfurt am Main

Test substance: Zeolite A, sodium-form.

(39)

Remark: Settling test:

The settling behaviour of raw sewage in the presence of 30 mg/l zeolite A was studied in sedimentation columns (2.7 m high; 150 mm diameter). Zeolite A concentrations were determined by analysis of aluminum using flameless atomic adsorption spectrophotometry.

Result:

The suspended solids removal in the presence of zeolite A was marginally less compared to sewage without zeolite.

Source: Degussa AG Frankfurt am Main

Test substance: Zeolite A

(40)

Remark:

To test whether zeolite A applied to land via digester sludge can penetrate the soil layers in the form of particles and end up in ground water, columns containing standardized soils and Cr51-labelled Ca-zeolite A (mean diameter 3.7 μm) were percolated with tap water for 24 days at 10 ml/h.

Result:

No radioactivity above background radiation was found in the eluates.

Source: Degussa AG Frankfurt am Main

Test substance: Zeolite A, calcium-exchanged

(41)

Remark:

Activated sludge tests:

An activated sludge pilot plant was fed with settled wastewater from a sewage plant containing Ca-exchanged zeolite A (15 & 30 mg/l). Acclimation for 9 days prior to sampling of effluents; 5 day sampling period; nominal hydraulic retention times were 2.5 h and 4 h.

Result:

2 - 4 mg/l zeolite was found in effluent (measured by aluminum analysis via atomic adsorption spectrophotometry). This corresponds to to 73 - 93% elimination rate of initial 15 - 30 mg/l in the influent.

Source: Degussa AG Frankfurt am Main

Test substance: Zeolite A, calcium-exchanged

(42)

Remark: Static settling test:
Columns were filled with raw sewage containing 30 mg/l zeolite A. Samples were taken at different time intervals from sampling ports positioned at different heights of the columns; suspended solids and zeolite concentration (via aluminum analysis by atomic adsorption spectrometry) were determined.

Result:
Only marginally lower removal of zeolite A compared to other suspended solids. Removal rates were 38% and 53% at retention times of 1 and 2 h respectively.

Continuous activated sludge tests:
Test unit was fed with settled sewage from a sewage treatment plant, zeolite A added at nominal concentration of 30 mg/l; retention time was 2.4 and 4 hours; 6 weeks operation.

Result:
Zeolite A removal (analysis of aluminum by atomic adsorption spectrometry) was 88% (average for 6 weeks).

Source: Degussa AG Frankfurt am Main
Test substance: Zeolite A

(43)

Remark: Static settling test:
The settling of zeolite A in primary clarifiers was modeled in static settling tests: vertical columns were filled with raw municipal wastewater containing 100 mg/l zeolite A (sodium-form). Sampling ports were located at different heights of the column; samples were taken at different time intervals and analysed for aluminum (atomic adsorption spectrometry) and suspended solids.

Result:
Data suggest that removal of zeolite by primary treatment is similar to that of other suspended solids.

Dynamic settling test:
The settleability of zeolite was studied in a continuous flow apparatus. Coarse-filtered raw wastewater containing 20 mg/l zeolite A (Sodium-form) was pumped through a 6 l tank (retention time 0.5-2 h); samples of influent and effluent were analysed for suspended solids and aluminum.

Result:
Removal of zeolite, calculated from the aluminum data, was 77%, suspended solids were removed by 41%.

Continuous activated sludge treatment:
A 60 day continuous flow test using sewage dosed with 20 mg/l zeolite (sodium form). Mixed liquor suspended solids (MLSS) were maintained at approx. 2500 mg/l and routine plant performance was monitored together with trace metal removal and zeolite removal (aluminum analysis).

Result:

Average removal of zeolite was 87% and the aluminum concentration of sludge was equivalent to 130 mg/l zeolite or 5% of the MLSS. Zeolite had no effect on treatment efficiency or concentrations of trace metals in effluent.

Trickling filter treatment:

Cylinders filled with crushed rock were run with raw municipal wastewater at a rate of 540 ml/h containing 20 mg/l zeolite A (sodium-form).

Result:

Removal of zeolite as measured by aluminum analysis averaged 89%.

Semi-continuous activated sludge test:

In a 10-day semicontinuous activated sludge test (SCAS-test) involving a fill and draw operation with a daily cycle of 23 h aeration and 0.5 h settling 98% of zeolite A (sodium-form) added at 20 mg/l was eliminated from the effluent.

Semi-continuous activated sludge test:

A 72-day study to assess the effect of zeolite on treatability of LAS using a synthetic sewage various combinations of zeolite and/or LAS and a 23 h aeration cycle. Mixed liquor suspended solids (MLSS) were maintained at approx. 3000 mg/l and zeolite removal was determined by aluminum analysis and LAS removal by MBAS method.

Results:

Removal of zeolite was approx. 80% and the aluminum content of the sludge solids was equivalent to 200-300 mg/l of zeolite or 7-11% of the MLSS. No effect on sludge settlement, overall treatment efficiency (TOC removal) or LAS removal.

Transport in sewers:

Theoretical calculations of potential for deposition in sewers based on the minimum flow velocity for particle transport and the Manning equation. Calculations based on a circular sewer flowing full with a minimum recommended slope of 0.0022 and zeolite with a specific gravity of 2, a particle diameter of 4 μ m, particle characteristic coefficient of 0.17 and a coefficient of roughness of 0.015.

Results:

According to Manning equation the flow velocity in the sewer would be 0.55 m/s and flow velocity necessary to transport the zeolite is 0.037 m/s. The usual design practice for sanitary sewers requires a minimum velocity of 0.61 m/s. Based on these calculations zeolite is predicted not to collect in municipal sewers.

Transport in sewers:

Field study of sewers in a Belgian village where 75 of 109 households used a laundry detergent containing approx. 20% zeolite A. After 4 months of product usage sewer lines were

inspected for accumulation of sediments and samples of the top layer of sediment analysed for apparent zeolite SiO₂. Initial inspection was at the end of a relatively dry summer period followed by inspection after light rain and then 8 days later after heavy rain.

Results:

In general the sediment decreased in width and depth after rainfall but did not wash out completely. The concentration of zeolite in the upper sediment layer decreased from an average of 6.7% initially to 0.9% after heavy rain. No substantial long-term accumulation is expected and flow should not be impaired.

Source: Degussa AG Frankfurt am Main
Test substance: Zeolite A, sodium-form.

(16)

Remark: Activated sludge test:
The performance of an activated sludge plant serving 60 households supplied with zeolite A containing laundry detergent was studied over a period of 9 weeks.

Result:

No adverse effects were observed as compared to the 5 week baseline period prior to the actual test.

At influent concentrations averaging between 7.6 and 17.1 mg/l zeolite A removal from influent to effluent was 80 - 90%.

Source: Degussa AG Frankfurt am Main

(44)

Remark: Dynamic settling test:
Zeolite A and suspended solids removal was tested in a continuous primary sedimentation pilot plant fed with sewage to which 30 and 60 mg/l zeolite was added. The plant was operated with continuous flow rates or under variable flow conditions (zeolite dosage changed according to the flow variations to produce a constant concentration in the influent). Test period: 3 days.

Result:

Suspended solids removal (50 - 60%) was not enhanced in the presence of zeolite A.

Zeolite A removal (analysis of Al by atomic adsorption spectrometry) was 66% at a retention time of 0.76 h and 76% at variable flow conditions.

Source: Degussa AG Frankfurt am Main

(45)

Remark: Sedimentation in sewage plant:
In a municipal activated sludge plant whose influent was spiked with Indium-doped zeolite A removal was already 50% in the sand trap and reached 85% removal after passing the mechanical stage of the sewage plant.

Anaerobic treatment:

Addition of zeolite A to digester sludge in concentrations

up to 130% of the dry sludge residue had no effect on gas production in a model digester.

Source: Degussa AG Frankfurt am Main (46)

Remark: In a technical trickling filter pilot plant fed with municipal sewage containing 40 g/m³ Zeolite A (Ca-form), 81% was removed in the primary settler. In a technical scale activated sludge treatment plant no adverse effects as compared to untreated control were observed when Ca-zeolite at 40 mg/l was added to the raw sewage. Parameters tested: BOD₅, TOC, COD, N- & P-elimination, elimination of Fe, ZN, Cu and Pb from effluents and sludge.

Source: Degussa AG Frankfurt am Main
Test substance: Zeolite A, calcium-form. (47) (48)

Remark: In a 13-month field trial in the village of Buesnau (Germany) comprising more than 3000 people, a 63% removal of zeolite A was observed after mechanical treatment of the raw wastewater in the local sewage plant (21% removal in sand trap; 42% in primary settler). Overall elimination rate after passage of sewage plant was 96%, of which 33% was eliminated in the biological stage.

Source: Degussa AG Frankfurt am Main (49)

Remark: Anaerobic sludge digestion:
Laboratory units were seeded with digester sludge from municipal plant and fed with synthetic sewage containing 78 or 780 mg/l zeolite A (sodium-form). During the 20-week test period no differences were observed concerning gas production, pH or supernatant metals (Cd, Cu, Fe, Zn) as compared to untreated control. Mixed digester and supernatant suspended solids as well as supernatant Al were higher in zeolite-treated units due to high amount of zeolite added.

Source: Degussa AG Frankfurt am Main
Test substance: Zeolite A, sodium-form. (50)

Remark: Individual home treatment systems:
In a field study (7 months) test groups were supplied with zeolite-containing laundry detergent (control group with similar product containing no zeolite). Test group using septic tanks or home aerobics had elimination rates of 81% and 88%, respectively at influent concentrations of 26 and 23 mg/l, respectively. Assessed overall performance and observed no effect on treatment efficiency or effluent concentration of trace metals.

Source: Degussa AG Frankfurt am Main
Test substance: Zeolite A, sodium-form. (50)

- Remark:** Anaerobic treatment:
In a model septic tank representing individual anaerobic wastewater home treatment systems >97% of zeolite A added to the wastewater at 40 - 55 mg/l was removed from the effluent (110-day study period, hydraulic retention time: 3 days).
- Source:** Degussa AG Frankfurt am Main
- Test substance:** Zeolite A, sodium-form. (50)
- Remark:** Gravitational sludge thickening/settling:
Studies performed in slow stirred columns of mixed liquor with calcium-exchanged zeolite at concentrations up to 20% of total suspended solids. Analysis involved measurement of sludge settling velocity.
- Results:**
The sludge containing 20% zeolite had a settling velocity about twice that of the control. At 10% of total suspended solids the limiting solids flux was increased 17 - 22%.
- Source:** Degussa AG Frankfurt am Main
- Test substance:** Zeolite A, calcium-exchanged (50)
- Remark:** Sludge de-watering:
Studies to assess the effect of zeolite on de-watering of activated sludge and anaerobic sludge by vacuum filtration and capillary suction time.
- Results:**
Increased filterability was observed with increasing concentrations of zeolite (up to 389 mg/l) in activated sludge. In anaerobic sludge with zeolite content of 2.5 and 19.6% of total solids no significant difference in filterability was observed.
- Source:** Degussa AG Frankfurt am Main
- Test substance:** Zeolite A, sodium-form. (50)
- Remark:** Laboratory-scale septic tank:
Laboratory-scale septic tanks consisting of 2 l rectangular tanks with gravity effluent flow to a seepage bed consisting of 64 cm filtered sand and 20 cm pea gravel. Raw wastewater was dosed at a rate of 660 ml/d (hydraulic retention time approx. 3 days) with zeolite at 0, 40 and 55 mg/l for 110 days. Tanks were assessed for performance and apparent zeolite SiO₂.
- Results:**
No effect on plant performance and zeolite removal was >97%.
- Source:** Degussa AG Frankfurt am Main
- Test substance:** Zeolite A, sodium-form. (50)
- Source:** Degussa AG Frankfurt am Main

AQUATIC ORGANISMS**4.1 Acute/Prolonged Toxicity to Fish**

Type: semistatic
Species: Brachydanio rerio (Fish, fresh water)
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** no
LC0: > 1000
Method: ISO 7346/1-3
Year: **GLP:** no
Test substance: other TS: Zeolite A, calcium-form
Remark: 1000 mg/l was highest concentration tested.
Source: Degussa AG Frankfurt am Main

(51)

Type: semistatic
Species: Brachydanio rerio (Fish, fresh water)
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** no
LC0: 1000
LC50: 1800
LC100: 3200
Method: OECD Guide-line 203 "Fish, Acute Toxicity Test"
Year: 1984 **GLP:** yes
Test substance: other TS: Zeolite A
Remark: 95% confidence limits for LC50 (96h): 1718 - 2346 mg/l.
Source: Degussa AG Frankfurt am Main
Test condition: To achieve the desired concentrations, the test substance was directly weighed in and gently stirred for one hour at 25 degr. C prior to test. Replacement of test suspensions every 24 h; suspensions were turbid and undissolved material was observed on the bottom of the test vessels. Slight aeration during test. pH varied from 8.0 to 10.4

(52)

Type: semistatic
Species: Oryzias latipes (Fish, fresh water)
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** no
LC50: 3200 - 5600
Method: other: See Freetext Condition
Year: 1980 **GLP:** no data
Test substance: other TS: Zeolite Type 4A (AKZO)
Source: UOP MS. S.p.A. Assago MI
Test condition: Test performed "in analogy to rules of Dutch Standard Organization (1980)"; semistatic test (renewal 3X per week); 23 + -2 degr. C.

(53)

Type: semistatic
Species: Oryzias latipes (Fish, fresh water)
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** no
LC50: 3200 - 5600
Method: other: see Test Condition
Year: 1980 **GLP:** no data
Test substance: other TS: Zeolite type 4A
Source: Degussa AG Frankfurt am Main
Test condition: Test performed "in analogy to rules of Dutch Standard Organization (1980)"; semistatic test (renewal 3x per week); 23 +- 2 degr. C

(54)

Type: semistatic
Species: Poecilia reticulata (Fish, fresh water)
Exposure period: 28 day
Unit: mg/l **Analytical monitoring:** no
LC50: 1800 - 3200
Method: other: See Freetext Test Condition
Year: 1980 **GLP:** no data
Test substance: other TS: Zeolite Type 4A (AKZO)
Source: UOP MS. S.p.A. Assago MI
Test condition: Test performed "in analogy to rules of Dutch Standard Organization (1980)"; semistatic test (renewal 3x per week); 23 + -2 degr. C.

(53)

Type: semistatic
Species: Poecilia reticulata (Fish, fresh water)
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** no
LC50: 1800 - 3200
Method: other: See Freetext Test Condition
Year: 1980 **GLP:** no data
Test substance: other TS: Zeolite Type 4A (AKZO)
Source: UOP MS. S.p.A. Assago MI
Test condition: Test performed "in analogy to rules of Dutch Standard Organization(1980)" ; semistatic test (renewal 1x per day); 23 + -2 degr. C.

(53)

Type: semistatic
Species: Poecilia reticulata (Fish, fresh water)
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** no
LC50: 1800 - 3200
Method: other: see Test Condition
Year: 1980 **GLP:** no data
Test substance: other TS: Zeolite type 4A
Source: Degussa AG Frankfurt am Main
Test condition: Test performed "in analogy to rules of Dutch Standard Organization (1980)"; semistatic test (renewal 1x per day); 23 +- 2 degr. C

(54)

Type: static
Species: Ictalurus punctatus (Fish, fresh water)
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** yes
NOEC: > 680
Method: other: U.S. Environm. Prot. Agency "Methods for Acute toxicity Tests with Fish, Macroinvertebrates, and Amphibians", Ecological Res. Ser., EPA-660/3-75-009
Year: 1975 **GLP:** no data
Test substance: other TS: Zeolite A pre-exchanged with Ca²⁺, Mg²⁺, Na⁺ and K⁺ ions
Source: UOP MS. S.p.A. Assago MI
Test condition: No feeding 48 h prior to and during test; gentle continuous stirring to keep test substance in suspension; 21 + -1 degr. C; pH 7.1.
Test substance: Analysis by atomic adsorption revealed zeolite A to be present at 90% as Ca-form and 10% as Mg-, Na- and K- form.

(55)

Type: static
Species: Ictalurus punctatus (Fish, fresh water)
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** yes
NOEC: > 680
Method: other: U.S. Environm. Prot. Agency "Methods for Acute Toxicity Tests with Fish, Macroinvertebrates, and Amphibians", Ecological Res. Ser., EPA-660/3-75-009
Year: 1975 **GLP:** no data
Test substance: other TS: Zeolite A pre-exchanged with Ca²⁺, Mg²⁺, Na⁺ and K⁺ ions
Remark: Highest concentration tested was 680 mg/l.
Source: Degussa AG Frankfurt am Main
Test condition: No feeding 48 h prior to and during test; gentle continuous stirring to keep test substance in suspension; 21 +- 1 degr. C; pH 7.1
Test substance: Analysis by atomic adsorption revealed zeolite A to be present at 90% as Ca-form and 10% as Mg-, Na- and K-form.

(56)

Type: static
Species: Lagodon rhomboides (Fish, estuary, marine)
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** yes
NOEC: > 780
Method: other: U.S. Environm. Prot. Agency. "Methods for Acute Toxicity Tests with Fish, Macroinvertebrates, and Amphibians", Ecological Res. Ser., EPA-660/3-75-009
Year: 1975 **GLP:** no data
Test substance: other TS: Unexchanged sodium form of zeolite A.
Source: UOP MS. S.p.A. Assago MI
Test condition: Test in natural seawater (salinityç 24 ppt, pH 8.0 + -0.5); no feeding during test; continuous stirring to keep test substance in suspension;

(57)

Type: static
Species: Lagodon rhomboides (Fish, estuary, marine)
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** yes
NOEC: > 780
Method: other: U.S. Environm. Prot. Agency "Methods for Acute Toxicity Tests with Fish, Macroinvertebrates, and Amphibians", Ecological Res. Ser., EPA-660/3-75-009
Year: 1975 **GLP:** no data
Test substance: other TS: unexchanged sodium form of zeolite A
Remark: Highest concentration tested was 780 mg/l.
Source: Degussa AG Frankfurt am Main
Test condition: Test in natural seawater (salinity: 24 ppt, pH 8.0 +- 0.5); no feeding during test; continuous stirring to keep test substance in suspension;

(56)

Type: static
Species: Lepomis macrochirus (Fish, fresh water)
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** yes
NOEC: > 680
Method: other: U.S. Environm. Prot. Agency "Methods for Acute Toxicity Tests with Fish, Macroinvertebrates, and Amphibians", Ecological Res. Ser., EPA-660/3-75-009
Year: 1975 **GLP:** no data
Test substance: other TS: Zeolite A pre-exchanged with Ca²⁺, Mg²⁺, Na⁺ and K⁺ ions.
Source: UOP MS. S.p.A. Assago MI
Test condition: No feeding 48 h prior to and during test; gentle continuous stirring to keep test substance in suspension; 21 + -1 degr. C; pH 7.1.

(57)

Type: static
Species: Lepomis macrochirus (Fish, fresh water)
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** yes
NOEC: > 680
Method: other: U.S. Environm. Prot. Agency "Methods for Acute Toxicity Tests with Fish, Macroinvertebrates, and Amphibians", Ecological Res. Ser., EPA-660/3-75-009
Year: 1975 **GLP:** no data
Test substance: other TS: Zeolite A pre-exchanged with Ca²⁺, Mg²⁺, Na⁺ and K⁺ ions
Remark: Highest concentration tested was 680 mg/l.
Source: Degussa AG Frankfurt am Main
Test condition: No feeding 48 h prior to and during test; gentle continuous stirring to keep test substance in suspension; 21 +- 1 degr. C; pH 7.1
Test substance: Analysis by atomic adsorption revealed zeolite A to be present at 90% as Ca-form and 10% as Mg-, Na- and K-form.

(56)

Type: static
Species: Leuciscus idus (Fish, fresh water)
Exposure period: 48 hour(s)
Unit: mg/l **Analytical monitoring:** no data
NOEC: > 500
Method: other: DIN 38412, Teil 15 (modified)
Year: 1977 **GLP:** no data
Test substance: other TS: SASIL
Remark: 500 mg/L was highest concentration tested.
Source: UOP MS. S.p.A. Assago MI
Test condition: Fish were kept in 2 L beaker (2 fish/beaker); test material was kept in suspension by continuous magnetic stirring and aeration with an airstone.

(58) (59)

Type: static
Species: Leuciscus idus (Fish, fresh water)
Exposure period: 48 hour(s)
Unit: mg/l **Analytical monitoring:** no data
NOEC: > 500
Method: other: DIN 38412, Teil 15 (modified)
Year: 1977 **GLP:** no data
Test substance: other TS: Zeolite A
Remark: 500 mg/l was highest concentration tested.
Source: Degussa AG Frankfurt am Main
Test condition: Fish were kept in 2 L beakers (2 fish/beaker); test material was kept in suspension by continuous magnetic stirring and aeration with an airstone.

(24) (25)

Type: static
Species: Pimephales promelas (Fish, fresh water)
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** yes
NOEC: > 680
Method: other: U.S. Environm. Prot. Agency "Methods for Acute Toxicity Tests with Fish, Macroinvertebrates, and Amphibians", Ecological Res. Ser., EPA-660/3-75-009
Year: 1975 **GLP:** no data
Test substance: other TS: Zeolite A pre-exchanged with Ca²⁺, Mg²⁺, Na⁺ and K⁺ ions.
Source: UOP MS. S.p.A. Assago MI
Test condition: No feeding 48 h prior to and during test; gentle continuous stirring to keep test substance in suspension; 21 + -1 degr. C; pH 7.1.
Test substance: Analysis by atomic adsorption revealed zeolite A to be present at 90% as Ca-form and 10% as Mg-, Na- and K- form.

(57)

Type: static
Species: Pimephales promelas (Fish, fresh water)
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** yes
NOEC: > 680
Method: other: U.S. Environm. Prot. Agency "Methods for Acute Toxicity Tests with Fish, Macroinvertebrates, and Amphibians", Ecological Res. Ser., EPA-660/3-75-009
Year: 1975 **GLP:** no data
Test substance: other TS: Zeolite A pre-exchanged with Ca²⁺, Mg²⁺, Na⁺ and K⁺ ions
Remark: Highest concentration tested was 680 mg/l.
Source: Degussa AG Frankfurt am Main
Test condition: No feeding 48 h prior to and during test; gentle continuous stirring to keep test substance in suspension; 21 +/- 1 degr. C; pH 7.1
Test substance: Analysis by atomic adsorption revealed zeolite A to be present at 90% as Ca-form and 10% as Mg-, Na- and K-form. (56)

Type: static
Species: Salmo gairdneri (Fish, estuary, fresh water)
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** yes
NOEC: > 680
Method: other: U.S. Environm. Prot. Agency "Methods for Acute Toxicity Tests with Fish, Macroinvertebrates, and Amphibians", Ecological Res. Ser., EPA-660/3-75-009
Year: 1975 **GLP:** no data
Test substance: other TS: Zeolite A pre-exchanged with Ca²⁺, Mg²⁺, Na⁺ and K⁺ ions
Remark: Highest concentration tested was 680 mg/l.
Source: Degussa AG Frankfurt am Main
Test condition: No feeding 48 h prior to and during test; gentle continuous stirring to keep test substance in suspension; 21 +/- 1 degr. C; pH 7.1
Test substance: Analysis by atomic adsorption revealed zeolite A to be present at 90% as Ca-form and 10% as Mg-, Na- and K-form. (56)

Type: static
Species: Salmo gairdneri (Fish, estuary, fresh water)
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** yes
NOEC: > 680
Method: other: U.S. Environm. Prot. Agency "Methods for Acute Toxicity Tests with Fish, Macroinvertebrates, and Amphibians", Ecological Res. Ser., EPA-660/3-75-009
Year: 1975 **GLP:** no data
Test substance: other TS: Zeolite A pre-exchanged with Ca²⁺, Mg²⁺, Na⁺ and K⁺ ions.
Source: UOP MS. S.p.A. Assago MI
Test condition: No feeding 48 h prior to and during test; gentle continuous stirring to keep test substance in suspension; 21 + -1 degr. C; pH 7.1.
Test substance: Analysis by atomic adsorption revealed zeolite A to be present at 90% as Ca- form and 10% as Mg-, Na- and K- form.

(60)

Type:
Species:
Exposure period:
Unit: **Analytical monitoring:**
Method:
Year: **GLP:**
Test substance:
Remark: No data
Source: Zeoline Engis

4.2 Acute Toxicity to Aquatic Invertebrates

Species: Daphnia magna (Crustacea)
Exposure period: 24 hour(s)
Unit: mg/l **Analytical monitoring:** no
NOEC: 1000
EC0: 1800
EC50: 2808
EC100: 5600
Method: OECD Guide-line 202, part 1 "Daphnia sp., Acute Immobilisation Test"
Year: 1984 **GLP:** yes
Test substance: other TS: Zeolite A
Remark: Data given are for filtered test solutions, since daphnias were physically hampered by undissolved material in unfiltered suspensions.
Source: Degussa AG Frankfurt am Main
Test condition: To achieve the desired concentrations, the test substance was directly weighed in and gently stirred for one hour at 20 degr. C prior to test. Test was performed with unfiltered suspension and after filtration of insoluble particles through a paper filter. After 24 h the aqueous phases were mostly clear, but precipitates were observed on the bottom of the test vessels. Even after filtration, aqueous phases were not completely clear and undissolved material was observed on the bottom of test vessels after 24 h.
 pH 7.9 - 10.3 (unfiltered); pH 8.0 - 10.5 (filtered)

(61)

Species: Daphnia magna (Crustacea)
Exposure period: 24 hour(s)
Unit: mg/l **Analytical monitoring:** no data
NOEC: > 500
Method: other: DIN 38412 Teil 11 (modified)
Year: 1977 **GLP:** no data
Test substance: other TS: SASIL
Remark: Prolonged incubation led to offspring at the same time as in control, i.e. after 18 days.
500 mg/L was highest concentration tested.
Source: UOP MS. S.p.A. Assago MI
Test condition: Test material was kept in suspension by continuous slow rotation of test vessels.

(62) (59)

Species: Daphnia magna (Crustacea)
Exposure period: 48 hour(s)
Unit: mg/l **Analytical monitoring:** no
EC50: 1000 - 1800
Method: other: See Freetext Test Condition
Year: 1980 **GLP:** no data
Test substance: other TS: Zeolite Type 4A (AKZO).
Source: UOP MS. S.p.A. Assago MI
Test condition: Test performed "in analogy to rules of Dutch Standard Organization (1980)"; static test; 19 + -1 degr. C.

(53)

Species: Daphnia magna (Crustacea)
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** yes
EC50: 377.2
Method: other: See Freetext Test Condition
Year: 1978 **GLP:** no data
Test substance: other TS: Zeolite A pre-exchanged with Ca²⁺, Mg²⁺, Na⁺ and K⁺ ions
Remark: 95% confidence limits: 315.3 - 464.8 mg/L.
Source: UOP MS. S.p.A. Assago MI
Test condition: Continuous rotation of test flasks to keep substance in suspension; overall duration of test: 21 days; replacement of individuals in fresh dilutions of test material every week; 24 + -12 h old Daphnia used, pH 7.3 + -0.4.
Test substance: Analysis by atomic adsorption revealed zeolite A to be present at 90% as Ca-form and 10% as Mg-, Na- and K- form.

(57)

Species: Daphnia magna (Crustacea)
Exposure period: 24 hour(s)
Unit: mg/l **Analytical monitoring:** no data
NOEC: > 500
Method: other: DIN 38412, Teil 11 (modified)
Year: 1977 **GLP:** no data
Test substance: other TS: Zeolite A
Remark: 500 mg/l was highest concentration tested.
 Prolonged incubation led to offspring at the same time as in control, i.e. after 18 days.
Source: Degussa AG Frankfurt am Main
Test condition: Test material was kept in suspension by continuous slow rotation of test vessels.

(24) (25)

Species: Daphnia magna (Crustacea)
Exposure period: 48 hour(s)
Unit: mg/l **Analytical monitoring:** no
EC50: 1000 - 1800
Method: other: see Test Condition
Year: 1980 **GLP:** no data
Test substance: other TS: Zeolite type 4A
Source: Degussa AG Frankfurt am Main
Test condition: Test performed "in analogy to rules of Dutch Standard Organization (1980)"; static test; 19 +- 1 degr. C;

(54)

Species: Daphnia magna (Crustacea)
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** yes
EC50: 377.2
Method: other: see Test Condition
Year: 1978 **GLP:** no data
Test substance: other TS: Zeolite A pre-exchanged with Ca²⁺, Mg²⁺, Na⁺ and K⁺ ions
Remark: 95% confidence limits: 315.3 - 464.8 mg/l.
Source: Degussa AG Frankfurt am Main
Test condition: Continuous rotation of test flasks to keep substance in suspension; 24 +- 12 h old Daphnia used; pH 7.3 +- 0.4
Test substance: Analysis by atomic adsorption revealed zeolite A to be present at 90% as Ca-form and 10% as Mg-, Na- and K-form.

(56) (63)

Species: other aquatic arthropod: Aedes aegypti
Exposure period: 48 hour(s)
Unit: mg/l **Analytical monitoring:** no
EC50: 10000 - 18000
Method: other: See Freetext Test Condition
Year: 1980 **GLP:** no data
Test substance: other TS: Zeolite Type 4A (AKZO)
Source: UOP MS. S.p.A. Assago MI
Test condition: Test performed "in analogy to rules of Dutch Standard Organization (1980)"; static test; 23 + -2 degr. C; 3 - 4 day old larvae were used for test.

(53)

Species: other aquatic arthropod: Aedes aegypti (larvae)
Exposure period: 48 hour(s)
Unit: mg/l **Analytical monitoring:** no
EC50: 10000 - 18000
Method: other: see Test Condition
Year: 1980 **GLP:** no data
Test substance: other TS: Zeolite type 4A
Source: Degussa AG Frankfurt am Main
Test condition: Test performed "in analogy to rules of Dutch Standard Organization (1980)"; static test; 23 +- 2 degr. C; 3 - 4 day old larvae were used for test.

(54)

Species: other aquatic arthropod: Penaeus duorarum
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** yes
NOEC: > 780
Method: other: U.S. Environm. Prot. Agency "Methods for Acute Toxicity Tests with Fish, Macroinvertebrates, and Amphibians", Ecological Res. Ser., EPA-660/3-75-009
Year: 1975 **GLP:** no data
Test substance: other TS: Unexchanged sodium form of zeolite A
Source: UOP MS. S.p.A. Assago MI
Test condition: Test in natural seawater (salinity: 24 ppt, pH 8.0 +- 0.5); no feeding during test; continuous stirring to keep test substance in suspension.

(64)

Species: other aquatic arthropod: Penaeus duorarum (pink shrimp)
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** yes
NOEC: > 780
Method: other: U.S. Environm. Prot. Agency "Methods for Acute Toxicity Tests with Fish, Macroinvertebrates, and Amphibians", Ecological Res. Ser., EPA-660/3-75-009
Year: 1975 **GLP:** no data
Test substance: other TS: unexchanged sodium form of zeolite A
Source: Degussa AG Frankfurt am Main
Test condition: Test in natural seawater (salinity: 24 ppt, pH 8.0 +- 0.5); no feeding during test; continuous stirring to keep test substance in suspension;

(56)

Species: other aquatic mollusc: *Crassostrea virginica*
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** yes
NOEC: > 780
Method: other: According to Butler, P.A. et al., Proc. Natl. Shellfish Assoc. 51, 23-32 (1960) / Butler, P.A. "Reaction of some Estuarine Molluscs to Environmental Factors", Public Health Service Publ. No. 999-WP-24, 92-104, USHEW (1965)
Year: 1975 **GLP:** no data
Test substance: other TS: Unexchanged sodium form of zeolite A
Source: UOP MS. S.p.A. Assago MI
Test condition: Flow-through test in seawater (flow rate: 30 L/h); no agitation (zeolite settled at aquaria bottoms); Oysters were placed on platforms 3 cm above the bottoms to avoid being covered by settling test material; parameter: reduction in shell growth.

(65)

Species: other aquatic mollusc: *Unio tumidus*
Exposure period: 28 day
Unit: mg/l **Analytical monitoring:** no data
NOEC: > 250
Method: other: Static test in tap water
Year: 1977 **GLP:** no data
Test substance: other TS: SASIL doted with Indium at 600 mg/kg.
Remark: No observable effect at 250 mg/L. Neutron activation analysis revealed no enhanced level of SASIL in tissue as compared to surrounding water. 250 mg/L was highest concentration tested.
Source: UOP MS. S.p.A. Assago MI
Test condition: Clams were incubated in tap water to which 250 mg/L SASIL (Indium-doted) was added; slight manetic stirring to keep test material in suspension.

(58) (59)

Species: other aquatic mollusc: *Crassostrea virginica* (eastern oyster)
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** yes
NOEC: > 780
Method: other: according to Butler, P.A. et al., Proc. Natl. Shellfish Assoc. 51, 23-32 (1960) / Butler, P.A. "Reaction of some Estuarine Molluscs to Environmental Factors", Public Health Service Publ. No. 999-WP-24, 92-104, USHEW (1965)
Year: 1975 **GLP:** no data
Test substance: other TS: unexchanged sodium form of zeolite A
Remark: Highest concentration tested was 780 mg/l.
Source: Degussa AG Frankfurt am Main
Test condition: Flow-through test in seawater (flow rate: 30 L/h); no agitation (zeolite settled at aquaria bottoms); oysters were placed on platforms 3 cm above the bottoms to avoid being covered by settling test material; parameter: reduction in shell growth

(56)

Species: other aquatic mollusc: Unio tumidus (freshwater clam)
Exposure period: 28 day
Unit: mg/l **Analytical monitoring:** no data
NOEC: > 250
Method: other: static test in tap water
Year: 1977 **GLP:** no data
Test substance: other TS: Zeolite A doted with Indium at 600 mg/kg
Remark: 250 mg/l was highest concentration tested.
No observable effect at 250 mg/l. Neutron activation analysis revealed no enhanced level of SASIL in tissue as compared to surrounding water.
Source: Degussa AG Frankfurt am Main
Test condition: Clams were incubated in tap water to which 250 mg/l SASIL (Indium-doted) was added; slight magnetic stirring to keep test material in suspension.
(24) (25)

Species: other aquatic worm: Tubifex sp.
Exposure period: 28 day
Unit: mg/kg soil dw **Analytical monitoring:** no data
NOEC: > 250
Method: other: Static test with river sediment.
Year: 1977 **GLP:** no data
Test substance: other TS: SASIL doted with Indium at 600 mg/kg
Remark: No loss of weight observable at 250 mg/L. Neutron activation analysis revealed no enhanced level of SASIL in tissue as compared to surrounding water.
250 mg/L was highest concentration used.
Source: UOP MS. S.p.A. Assago MI
Test condition: River sediment was mixed with SASIL (Indium-doted) at 250 mg/kg; Tubifex were added and incubated for 4 weeks (3 - 5 cm water layer, 10 cm sediment depth); parameter: weight.
(66) (59)

Species: other aquatic worm: Tubifex sp. (freshwater worm)
Exposure period: 28 day
Unit: mg/kg soil dw **Analytical monitoring:** no data
NOEC: > 250
Method: other: static test with river sediment
Year: 1977 **GLP:** no data
Test substance: other TS: Zeolite A doted with Indium at 600 mg/kg
Remark: 250 mg/l was highest concentration tested.
No loss of weight observable at 250 mg/l. Neutron activation analysis revealed no enhanced level of SASIL in tissue as compared to surrounding water.
Source: Degussa AG Frankfurt am Main
Test condition: River sediment was mixed with SASIL (Indium-doted) at 250 mg/kg; Tubifex were added and incubated for 4 weeks (3 - 5 cm water layer, 10 cm sediment depth); parameter: weight.
(24) (25)

Species:
Exposure period:
Unit: **Analytical monitoring:**
Method:
Year: **GLP:**
Test substance:
Remark: No data
Source: Zeoline Engis

4.3 Toxicity to Aquatic Plants e.g. Algae

Species: Anabaena flos-aquae (Algae)
Endpoint: growth rate
Exposure period:
Unit: mg/l **Analytical monitoring:** no data
LOEC: .1
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon.
Year: 1971 **GLP:** no data
Test substance: other TS: Zeolite A, no further characterization
Remark: Effect is due to binding of nutrients by zeolite A; addition of minimal salts reverses the effect of zeolite.
Source: UOP MS. S.p.A. Assago MI

(67)

Species: Anabaena flos-aquae (Algae)
Endpoint: growth rate
Exposure period:
Unit: mg/l **Analytical monitoring:** no data
LOEC: .1
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon
Year: 1971 **GLP:** no data
Test substance: other TS: Zeolite A, no further characterization
Remark: Effect is due to binding of nutrients by zeolite A; addition of minimal salts reverses the effect of zeolite.
Source: Degussa AG Frankfurt am Main

(68)

Species: Chlorella vulgaris (Algae)
Endpoint: biomass
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** no
EC50: 560 - 1000
Method: other: See Freetext Test Condition
Year: 1980 **GLP:** no data
Test substance: other TS: Zeolite Type 4A (AKZO)
Source: UOP MS. S.p.A. Assago MI
Test condition: Test performed "in analogy to rules of Dutch Standard Organization (1980)"; static test; 22+- 2 degr. -C.

(53)

Species: Chlorella vulgaris (Algae)
Endpoint: biomass
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** no
EC50: 560 - 1000
Method: other: see Test Condition
Year: 1980 **GLP:** no data
Test substance: other TS: Zeolite type 4A
Source: Degussa AG Frankfurt am Main
Test condition: Test performed "in analogy to rules of Dutch Standard Organization (1980)"; static test; 22 +- 2 degr. C;

(54)

Species: Chlorella vulgaris (Algae)
Endpoint: growth rate
Exposure period: 18 day
Unit: mg/l **Analytical monitoring:** no data
NOEC: 1
LOEC: 10
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon
Year: 1971 **GLP:** no data
Test substance: other TS: SASIL
Remark: Growth was reduced due to adsorption of micro-nutrients by test substance.
Source: UOP MS. S.p.A. Assago MI
Test condition: Culture was continuously shaken.

(69) (59)

Species: Chlorella vulgaris (Algae)
Endpoint: growth rate
Exposure period: 18 day
Unit: mg/l **Analytical monitoring:** no data
NOEC: 1
LOEC: 10
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon
Year: 1971 **GLP:** no data
Test substance: other TS: Zeolite A
Remark: Growth was reduced due to adsorption of micro-nutrients by test substance.
Source: Degussa AG Frankfurt am Main
Test condition: Culture was continuously shaken.

(24) (25)

Species: Microcystis aeruginosa (Algae, blue, cyanobacteria)
Endpoint: biomass
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** no
EC50: 180 - 320
Method: other: See Freetext Test Condition
Year: 1980 **GLP:** no data
Test substance: other TS: Zeolite Type 4A (AKZO)
Source: UOP MS. S.p.A. Assago MI
Test condition: Test performed "in analogy to rules of Dutch Standard Organization (1980)"; static test; 23 +- 2 degr. C.

(53)

Species: Microcystis aeruginosa (Algae, blue, cyanobacteria)
Endpoint: biomass
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** no
EC50: 180 - 320
Method: other: see Test Condition
Year: 1980 **GLP:** no data
Test substance: other TS: Zeolite type 4A
Source: Degussa AG Frankfurt am Main
Test condition: Test performed "in analogy to rules of Dutch Standard Organization (1980)"; static test; 23 +- 2 degr. C;

(54)

Species: Microcystis aeruginosa (Algae, blue, cyanobacteria)
Endpoint: growth rate
Exposure period: 5 day
Unit: mmol/l **Analytical monitoring:** yes
LOEC: 50
Method: other: Algal Assay Procedure (AAP): Bottle test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon.
Year: 1971 **GLP:** no data
Test substance: other TS: Zeolite A pre-exchanged with Ca²⁺, Mg²⁺, Na⁺ and K⁺ ions.
Remark: Exposure of M. aeruginosa to various concentrations between 0.5 and 50 mg/L for 14 days showed no effect on cell numbers as compared to control.
 LOEC is lowest concentration which allowed no growth of algae, but did not kill them.
Source: UOP MS. S.p.A. Assago MI
Test substance: Analysis by atomic adsorption revealed zeolite A to be present at 90% as Ca-form and 10% as Mg-, Na- and K- form.

(57)

Species: Microcystis aeruginosa (Algae, blue, cyanobacteria)
Endpoint: growth rate
Exposure period: 5 day
Unit: mg/l **Analytical monitoring:** yes
EC100 : 50 - 100
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon
Year: 1971 **GLP:** no data
Test substance: other TS: Zeolite A pre-exchanged with Ca²⁺, Mg²⁺, Na⁺ and K⁺ ions
Source: Degussa AG Frankfurt am Main
Test substance: Analysis by atomic adsorption revealed zeolite A to be present at 90% as Ca-form and 10% as Mg-, Na- and K-form. (56)

Species: Navicula pelliculosa (Algae)
Endpoint: growth rate
Exposure period:
Unit: mg/l **Analytical monitoring:** no data
LOEC: 10
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon.
Year: 1971 **GLP:** no data
Test substance: other TS: Zeolite A, no further characterization
Remark: Effect is due to binding of nutrients by zeolite A; addition of minimal salts reverses the effect of zeolite.
Source: UOP MS. S.p.A. Assago MI (67)

Species: Navicula pelliculosa (Algae)
Endpoint: growth rate
Exposure period:
Unit: mg/l **Analytical monitoring:** no data
LOEC: 10
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon
Year: 1971 **GLP:** no data
Test substance: other TS: Zeolite A, no further characterization
Remark: Effect is due to binding of nutrients by zeolite A; addition of minimal salts reverses the effect of zeolite.
Source: Degussa AG Frankfurt am Main (68)

Species: Navicula seminulum (Algae)
Endpoint: growth rate
Exposure period: 5 day
Unit: mg/l **Analytical monitoring:** yes
LOEC: 50
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon.
Year: 1971 **GLP:** no data
Test substance: other TS: Zeolite A pre-exchanged with Ca²⁺, Mg²⁺, Na⁺ and K⁺ ions.
Remark: LOEC is lowest concentration which allowed no growth of algae, but did not kill them.
Source: UOP MS. S.p.A. Assago MI
Test substance: Analysis by atomic adsorption revealed zeolite A to be present at 90% as Ca-form and 10% as Mg-, Na- and K- form. (70)

Species: Navicula seminulum (Algae)
Endpoint: growth rate
Exposure period: 5 day
Unit: mg/l **Analytical monitoring:** yes
EC100 : 50 - 100
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon
Year: 1971 **GLP:** no data
Test substance: other TS: Zeolite A pre-exchanged with Ca²⁺, Mg²⁺, Na⁺ and K⁺ ions
Source: Degussa AG Frankfurt am Main
Test substance: Analysis by atomic adsorption revealed zeolite A to be present at 90% as Ca-form and 10% as Mg-, Na- and K-form. (56)

Species: Scenedesmus subspicatus (Algae)
Endpoint: growth rate
Exposure period: 4 day
Unit: mg/l **Analytical monitoring:** no
EC10: 4.9
EC50: 18
EC90 : 66
Method: other: OECD Guide-line 201 (modified)
Year: 1984 **GLP:** yes
Test substance: other TS: Zeolite A
Remark: Data given relate to unfiltered suspension; effect measured: growth yield measured by particle counting.

Summary of different evaluations (data in brackets: 95% confidence limits):

I) Unfiltered suspension; particle counting

	growth yield	area under growth curve
EC10	4.9	5.7
EC50	18 (10-32)	34
EC90	66	130

II) Unfiltered suspension; fluorescence measurement

	growth yield	area under growth curve
EC10	11	12
EC50	34 (22-52)	45
EC90	84	200

III) Filtered suspension, particle counting

	growth rate	area under growth curve
EC10	>328	77
EC50	>328	>328
EC90	>328	>328

Source: Degussa AG Frankfurt am Main

Test condition: To adjust the desired concentrations, test material was directly weighed in and stirred for one hour prior to test. To achieve a better buffering capacity 150 mg/l NaHCO₃ instead of 50 mg/l was used in culture media. Initial pH was 8.9, it increased with algal density to 8.6 - 10.6 after 4 days. Algal growth was determined by electronic particle counting; unfiltered suspensions were also checked by chlorophyll fluorescence determinations. Test was run with unfiltered suspension and after filtration of insoluble test material.

(71)

Species: Selenastrum capricornutum (Algae)

Endpoint: growth rate

Exposure period:

Unit: mg/l **Analytical monitoring:** no data

LOEC: .1

Method: other: Algal Assay Procedure (AAP) : Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon.

Year: 1971 **GLP:** no data

Test substance: other TS: Zeolite A, no further characterization

Remark: Effect is due to binding of nutrients by zeolite A; addition of minimal salts reverses the effect of zeolite.

Source: UOP MS. S.p.A. Assago MI

(67)

Species: Selenastrum capricornutum (Algae)
Endpoint: growth rate
Exposure period:
Unit: mg/l **Analytical monitoring:** no data
NOEC: > 10
Method: other: Algal Assay Procedure (AAP) : Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon.
Year: 1971 **GLP:** no data
Test substance: other TS: Zeolite A, Na₁₂(AlO₂)₁₂(SiO₂)₁₂x27H₂O
Remark: No effect up to highest concentration used (10 mg/L) was observed.
Source: UOP MS. S.p.A. Assago MI
Test condition: Water from oligotrophic Burntside Lake was used; 10 mg/L was highest concentration tested.

(72)

Species: Selenastrum capricornutum (Algae)
Endpoint: growth rate
Exposure period: 5 day
Unit: mg/l **Analytical monitoring:** yes
LOEC: 100
Method: other: Algal Assay Procedure (AAP) : Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon.
Year: 1971 **GLP:** no data
Test substance: other TS: Zeolite A pre-exchanged with Ca²⁺, Mg²⁺, Na⁺ and K⁺ ions.
Remark: LOEC is lowest concentration which allowed no growth of algae, but did not kill them.
Source: UOP MS. S.p.A. Assago MI
Test substance: Analysis by atomic adsorption revealed zeolite A to be present at 90% as Ca-form and 10% as Mg-, Na- and K-form.

(57)

Species: Selenastrum capricornutum (Algae)
Endpoint: growth rate
Exposure period: 5 day
Unit: mg/l **Analytical monitoring:** yes
EC100 : 100 - 1000
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon
Year: 1971 **GLP:** no data
Test substance: other TS: Zeolite A pre-exchanged with Ca²⁺, Mg²⁺, Na⁺ and K⁺ ions
Source: Degussa AG Frankfurt am Main
Test substance: Analysis by atomic adsorption revealed zeolite A to be present at 90% as Ca-form and 10% as Mg-, Na- and K-form.

(56)

Species: Selenastrum capricornutum (Algae)
Endpoint: growth rate
Exposure period:
Unit: mg/l **Analytical monitoring:** no data
LOEC: .1
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon
Year: 1971 **GLP:** no data
Test substance: other TS: Zeolite A, no further characterization
Remark: Effect is due to binding of nutrients by zeolite A; addition of minimal salts reverses the effect of zeolite.
Source: Degussa AG Frankfurt am Main

(68)

Species: Selenastrum capricornutum (Algae)
Endpoint: growth rate
Exposure period:
Unit: mg/l **Analytical monitoring:** no data
NOEC: > 10
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon
Year: 1971 **GLP:** no data
Test substance: other TS: Zeolite A
Remark: No effect up to highest concentration used (10 mg/l) was observed.
Source: Degussa AG Frankfurt am Main
Test condition: Water from oligotrophic Burntside Lake was used; 10 mg/l was highest concentration tested

(73)

Species: other algae: Chlorella Kessleri
Endpoint: growth rate
Exposure period:
Unit: mg/l **Analytical monitoring:** no
LOEC: .1
Method: other: Algal Assay Procedure (AAP) : Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon.
Year: 1971 **GLP:** no data
Test substance: other TS: Zeolite A, no further characterization
Remark: Effect is due to binding of nutrients by zeolite A; addition of minimal salts reverses the effect of zeolite.
Source: UOP MS. S.p.A. Assago MI

(67)

Species: other algae: *Fragilaria Crotonensis*
Endpoint: growth rate
Exposure period:
Unit: mg/l **Analytical monitoring:** no data
LOEC: 10
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis Oregon.
Year: 1971 **GLP:** no data
Test substance: other TS: Ca-exchanged sodium aluminum silicate
Remark: In water from Olef-dam, growth was significantly (by factor 7) reduced at 10 mg/L. In all other waters no significant impairment of growth was observed. Stream water (Walmbach) was richest in nutrients; water from Olef-dam was poorest in nutrients. 10 mg/L was highest concentration tested.
Source: UOP MS. S.p.A. Assago MI
Test condition: Cultures were shaken once per day, by hand, to keep test material in suspension; 18 degr. C; illumination: 2500 Lux; cell growth was measured by counting cell numbers under the microscope after cultures had reached stationary phase; culture medium: natural waters from 2 different dams (Olef- and Walmbach-dam) and a stream (Walmbach).

(74)

Species: other algae: *Melosira Granulata Angustissima*
Endpoint: growth rate
Exposure period:
Unit: mg/l **Analytical monitoring:** no data
LOEC: 10
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon.
Year: 1971 **GLP:** no data
Test substance: other TS: Ca-exchanged sodium aluminum silicate
Remark: In waters from Olef- and Walmbach-dam, growth was significantly (by factor 7 and 15, respectively) reduced at 10 mg/L. In stream water (Walmbach) no significant impairment of growth was found. Stream water (Walmbach) was richest in nutrients; water from Olef-dam was poorest in nutrients. 10 mg/L was highest concentration tested.
Source: UOP MS. S.p.A. Assago MI
Test condition: Cultures were shaken once per day, by hand, to keep test material in suspension; 18 degr. C; illumination: 2500 Lux; cell growth was measured by counting cell numbers under the microscope after cultures had reached stationary phase; culture medium: natural waters from 2 different dams (Olef- and Walmbach-dam) and a stream (Walmbach).

(75)

Species: other algae: Pseudanabaena Galeata
Endpoint: growth rate
Exposure period:
Unit: mg/l **Analytical monitoring:** no data
LOEC: 10
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon.
Year: 1971 **GLP:** no data
Test substance: other TS: Ca-exchanged sodium aluminum silicate
Remark: Reduced growth rate was found in Olef-dam water at 10 mg/L (by factor 2.6). No impairment of growth in stream water and Walmbach-dam water. Stream water (Walmbach) was richest in nutrients; water from Olef-dam was poorest in nutrients. 10 mg/L was highest concentration tested.
Source: UOP MS. S.p.A. Assago MI
Test condition: Cultures were shaken once per day by hand to keep test material in suspension; 18 degr. C; illumination: 2500 Lux; cell growth was measured by counting cell numbers under the microscope after cultures had reached stationary phase; culture medium: natural waters from 2 different dams (Olef- and Walmbach-dam) and a stream (Walmbach).

(76)

Species: other algae: Scenedesmus Abundans
Endpoint: growth rate
Exposure period:
Unit: mg/l **Analytical monitoring:** no data
NOEC: > 10
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon.
Year: 1971 **GLP:** no data
Test substance: other TS: Ca-exchanged sodium aluminum silicate
Remark: No effect up to the highest concentration tested (10mg/L) was found in any of the tested waters. Stream water (Walmbach) was richest in nutrients; water from Olef-dam was poorest in nutrients.
Source: UOP MS. S.p.A. Assago MI
Test condition: Cultures were shaken once per day, by hand, to keep test material in suspension; 18 degr. C; illumination: 2500 Lux; cell growth was measured by counting cell numbers under the microscope after cultures had reached stationary phase; culture medium: natural waters from 2 different dams (Olef- and Walmbach-dam) and a stream (Walmbach).

(75)

Species: other algae: *Synechocystis* sp.
Endpoint: growth rate
Exposure period:
Unit: mg/l **Analytical monitoring:** no data
LOEC: 10
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon.
Year: 1971 **GLP:** no data
Test substance: other TS: Ca-exchanged sodium aluminum silicate
Remark: Reduced growth rate was found in Olef-dam water (by factor 4) at 10 mg/L. No impairment of growth in stream water and Walmbach-dam water. Stream water (Walmbach) was richest in nutrients; water from Olef-dam was poorest in nutrients. 10 mg/l was highest concentration tested.
Source: UOP MS. S.p.A. Assago MI
Test condition: Cultures were shaken once per day, by hand, to keep test material in suspension; 18 degr. C; illumination: 2500 Lux; cell growth was measured by counting cell numbers under the microscope after cultures had reached stationary phase; culture medium: natural waters from 2 different dams (Olef- and Walmbach-dam) and a stream (Walmbach).

(75)

Species: other algae: *Chlorella kessleri*
Endpoint: growth rate
Exposure period:
Unit: mg/l **Analytical monitoring:** no
LOEC: .1
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon
Year: 1971 **GLP:** no data
Test substance: other TS: Zeolite A, no further characterization
Remark: Effect is due to binding of nutrients by zeolite A; addition of minimal salts reverses the effect of zeolite.
Source: Degussa AG Frankfurt am Main

(68)

Species: other algae: Coelastrum Microporum
Endpoint: growth rate
Exposure period:
Unit: mg/l **Analytical monitoring:** no data
NOEC: > 10
Method: other: Algal Assay Procedure (AAP) : Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon.
Year: 1971 **GLP:** no data
Test substance: other TS: Ca-exchanged sodium aluminum silicate
Remark: No effect up to the highest concentration tested (10 mg/L) was found in any of the tested waters. Stream water (Walmbach) was richest in nutrients; water from Olef-dam was poorest in nutrients.
Source: UOP MS. S.p.A. Assago MI
Test condition: Cultures were shaken once per day by hand to keep test material in suspension; 18 degr. C; illumination: 2500 Lux; cell growth was measured by counting cell numbers under the microscope after cultures had reached stationary phase; culture medium: natural waters from 2 different dams (Olef- and Walmbach-dam) and a stream (Walmbach).

(77)

Species: other algae: Coelastrum microporum (green algae)
Endpoint: growth rate
Exposure period:
Unit: mg/l **Analytical monitoring:** no data
NOEC: > 10
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon
Year: 1971 **GLP:** no data
Test substance: other TS: Ca-exchanged zeolite A
Remark: No effect up to the highest concentration tested (10 mg/l) was found in any of the tested waters. Stream water (Walmbach) was richest in nutrients; water from Olef-dam was poorest in nutrients.
Source: Degussa AG Frankfurt am Main
Test condition: Cultures were shaken once per day by hand to keep test material in suspension; 18 degr. C; illumination: 2500 Lux; cell growth was measured by counting cell numbers under the microscope after cultures had reached stationary phase; culture medium: natural waters from 2 different dams (Olef- and Walmbach-dam) and a stream (Walmbach).

(78)

Species: other algae: *Fragilaria crotonensis* (diatom)
Endpoint: growth rate
Exposure period:
Unit: mg/l **Analytical monitoring:** no data
LOEC: 10
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon
Year: 1971 **GLP:** no data
Test substance: other TS: Ca-exchanged zeolite A
Remark: 10 mg/l was highest concentration tested.
In water from Olef-dam growth was significantly (by factor 7) reduced at 10 mg/l. In all other waters no significant impairment of growth was observed.
Stream water (Walmbach) was richest in nutrients; water from Olef-dam was poorest in nutrients.
Source: Degussa AG Frankfurt am Main
Test condition: Cultures were shaken once per day by hand to keep test material in suspension; 18 degr. C; illumination: 2500 Lux; cell growth was measured by counting cell numbers under the microscope after cultures had reached stationary phase; culture medium: natural waters from 2 different dams (Olef- and Walmbach-dam) and a stream (Walmbach).

(78)

Species: other algae: *Melosira granulata angustissima* (diatom)
Endpoint: growth rate
Exposure period:
Unit: mg/l **Analytical monitoring:** no data
LOEC: 10
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon
Year: 1971 **GLP:** no data
Test substance: other TS: Ca-exchanged zeolite A
Remark: 10 mg/l was highest concentration tested.
In waters from Olef- and Walmbach-dam growth was significantly (by factor 7 and 15, respectively) reduced at 10 mg/l. In stream water (Walmbach) no significant impairment of growth was found.
Stream water (Walmbach) was richest in nutrients; water from Olef-dam was poorest in nutrients.
Source: Degussa AG Frankfurt am Main
Test condition: Cultures were shaken once per day by hand to keep test material in suspension; 18 degr. C; illumination: 2500 Lux; cell growth was measured by counting cell numbers under the microscope after cultures had reached stationary phase; culture medium: natural waters from 2 different dams (Olef- and Walmbach-dam) and a stream (Walmbach).

(78)

Species: other algae: Pseudanabaena galeata (blue-green algae)
Endpoint: growth rate
Exposure period:
Unit: mg/l **Analytical monitoring:** no data
LOEC: 10
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon
Year: 1971 **GLP:** no data
Test substance: other TS: Ca-exchanged zeolite A
Remark: 10 mg/l was highest concentration tested.
Reduced growth rate was found in Olef-dam water at 10 mg/l (by factor 2.6). No impairment of growth in stream water and Walmbach-dam water.
Stream water (Walmbach) was richest in nutrients; water from Olef-dam was poorest in nutrients.
Source: Degussa AG Frankfurt am Main
Test condition: Cultures were shaken once per day by hand to keep test material in suspension; 18 degr. C; illumination: 2500 Lux; cell growth was measured by counting cell numbers under the microscope after cultures had reached stationary phase; culture medium: natural waters from 2 different dams (Olef- and Walmbach-dam) and a stream (Walmbach).

(78)

Species: other algae: Scenedesmus abundans
Endpoint: growth rate
Exposure period:
Unit: mg/l **Analytical monitoring:** no data
NOEC: > 10
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon
Year: 1971 **GLP:** no data
Test substance: other TS: Ca-exchanged zeolite A
Remark: 10 mg/l was highest concentration tested.
No effect up to the highest concentration tested (10 mg/l) was found in any of the tested waters.
Stream water (Walmbach) was richest in nutrients; water from Olef-dam was poorest in nutrients.
Source: Degussa AG Frankfurt am Main
Test condition: Cultures were shaken once per day by hand to keep test material in suspension; 18 degr. C; illumination: 2500 Lux; cell growth was measured by counting cell numbers under the microscope after cultures had reached stationary phase; culture medium: natural waters from 2 different dams (Olef- and Walmbach-dam) and a stream (Walmbach).

(78)

Species: other algae: Synechocystis sp. (blue-green algae)
Endpoint: growth rate
Exposure period:
Unit: mg/l **Analytical monitoring:** no data
LOEC: 10
Method: other: Algal Assay Procedure (AAP): Bottle Test; U.S. Environm. Prot. Agency, Pacific Northwest Water Lab., Corvallis, Oregon
Year: 1971 **GLP:** no data
Test substance: other TS: Ca-exchanged zeolite A
Remark: 10 mg/l was highest concentration tested.
 Reduced growth rate was found in Olef-dam water at 10 mg/l (by factor 4). No impairment of growth in stream water and Walmbach-dam water.
 Stream water (Walmbach) was richest in nutrients; water from Olef-dam was poorest in nutrients.
Source: Degussa AG Frankfurt am Main
Test condition: Cultures were shaken once per day by hand to keep test material in suspension; 18 degr. C; illumination: 2500 Lux; cell growth was measured by counting cell numbers under the microscope after cultures had reached stationary phase; culture medium: natural waters from 2 different dams (Olef- and Walmbach-dam) and a stream (Walmbach).

(78)

Species:
Endpoint:
Exposure period:
Unit: **Analytical monitoring:**
Method:
Year: **GLP:**
Test substance:
Remark: No data
Source: Zeoline Engis

4.4 Toxicity to Microorganisms e.g. Bacteria

Type: aquatic
Species: Aspergillus niger (Fungi)
Exposure period: 32 hour(s)
Unit: mg/l **Analytical monitoring:** no data
NOEC : > 25
Method: other: Static test in tap water
Year: 1977 **GLP:** no data
Test substance: other TS: SASIL
Source: UOP MS. S.p.A. Assago MI
Test condition: Incubation of 10 exp 5 germs/ml in tap water containing 25 mg/l SASIL for 32 hr at 20 degr. C under slight agitation; at various time intervals, aliquots were plated on nutrient agar, incubated for 5 days at 30 degr. C and resulting colonies counted.

(79) (80)

Type: aquatic
Species: Aspergillus niger (Fungi)
Exposure period: 32 hour(s)
Unit: mg/l **Analytical monitoring:** no data
NOEC : > 25
Method: other: static test in tap water
Year: 1977 **GLP:** no data
Test substance: other TS: Zeolite A
Remark: 25 mg/l was highest concentration tested.
Source: Degussa AG Frankfurt am Main
Test condition: Incubation of 10 exp 5 organisms/ml in tap water containing 25 mg/l zeolite A for 32 h at 20 degr. C under slight agitation; at various time intervals aliquots were plated on nutrient agar, incubated for 3 days at 30 degr. C and resulting colonies counted.
(24) (25)

Type: aquatic
Species: Candida albicans (Fungi)
Exposure period: 32 hour(s)
Unit: mg/l **Analytical monitoring:** no data
NOEC : > 25
Method: other: Static test in tap water
Year: 1977 **GLP:** no data
Test substance: other TS: SASIL
Remark: 25 mg/l was highest concentration tested.
Source: UOP MS. S.p.A. Assago MI
Test condition: Incubation of 10 exp 5 germs/ml in tap water containing 25 mg/l SASIL for 32 h at 20 degr. C under slight agitation; at various time intervals, aliquots were plated on nutrient agar, incubated for 5 days at 30 degr. C and resulting colonies counted.
(81) (82)

Type: aquatic
Species: Candida albicans (Fungi)
Exposure period: 32 hour(s)
Unit: mg/l **Analytical monitoring:** no data
NOEC : > 25
Method: other: static test in tap water
Year: 1977 **GLP:** no data
Test substance: other TS: Zeolite A
Remark: 25 mg/l was highest concentration tested.
Source: Degussa AG Frankfurt am Main
Test condition: Incubation of 10 exp 5 organisms/ml in tap water containing 25 mg/l zeolite A for 32 h at 20 degr. C under slight agitation; at various time intervals aliquots were plated on nutrient agar, incubated for 3 days at 30 degr. C and resulting colonies counted.
(24) (25)

Type: aquatic
Species: Pseudomonas aeruginosa (Bacteria)
Exposure period: 8 hour(s)
Unit: mg/l **Analytical monitoring:** no
EC50: 3200 - 5600
Method: other: See Freetext Test Condition
Year: 1980 **GLP:** no data
Test substance: other TS: Zeolite Type A
Source: UOP MS. S.p.A. Assago MI
Test condition: Test performed " in analogy to rules of Dutch Standard Organization (1980)"; static test; 22 +-2 degr.C; parameter: specific growth rate.

(83)

Type: aquatic
Species: Pseudomonas fluorescens (Bacteria)
Exposure period: 32 hour(s)
Unit: mg/l **Analytical monitoring:** no data
NOEC : > 25
Method: other: Static test in tap water
Year: 1977 **GLP:** no data
Test substance: other TS: SASIL
Remark: 25 mg/l was the highest concentration tested
Source: UOP MS. S.p.A. Assago MI
Test condition: Incubation of 10 exp 5 germs/ml in tap water containing 25 mg/l SASIL for 32 h at 20 degr. C under slight agitation; at various time intervals, aliquots were plated on nutrient agar, incubated for 3 days at 30 degr. C and resulting colonies counted.

(84) (80)

Type: aquatic
Species: Pseudomonas fluorescens (Bacteria)
Exposure period: 8 hour(s)
Unit: mg/l **Analytical monitoring:** no
EC50: 3200 - 5600
Method: other: see Test Condition
Year: 1980 **GLP:** no data
Test substance: other TS: Zeolite type 4A
Source: Degussa AG Frankfurt am Main
Test condition: Test performed "in analogy to rules of Dutch Standard Organization (1980)"; static test; 22 +- 2 degr. C; parameter: specific growth rate

(54)

Type: aquatic
Species: Pseudomonas fluorescens (Bacteria)
Exposure period: 32 hour(s)
Unit: mg/l **Analytical monitoring:** no data
NOEC : > 25
Method: other: static test in tap water
Year: 1977 **GLP:** no data
Test substance: other TS: Zeolite A
Remark: 25 mg/l was highest concentration tested.
Source: Degussa AG Frankfurt am Main
Test condition: Incubation of 10 exp 5 organisms/ml in tap water containing 25 mg/l zeolite A for 32 h at 20 degr. C under slight agitation; at various time intervals aliquots were plated on nutrient agar, incubated for 3 days at 30 degr. C and resulting colonies counted.

(24) (25)

Type: aquatic
Species: Pseudomonas putida (Bacteria)
Exposure period: 16 hour(s)
Unit: mg/l **Analytical monitoring:** no
EC10: 330
EC50: 1550
Method: other: DIN 38412, Teil 8
Year: 1991 **GLP:** yes
Test substance: other TS: Zeolite A
Remark: Data given refer to alkaline solution (95% confidence limits for EC50: 530 - 4544 mg/l).
Data for neutralized solutions: EC10 330 mg/l; EC50 950 mg/l (95 % confidence limits: 570 -1590 mg/l).
Source: Degussa AG Frankfurt am Main
Test condition: To adjust the desired concentrations, test material was directly weighed in and stirred for one hour prior to test. Test was performed with centrifuged solutions (removal of undissolved material) which were used as such or were neutralized to pH 7. pH of test solutions was between 7.6 and 10.2

(85)

Type:
Species:
Exposure period:
Unit: **Analytical monitoring:**
Method:
Year: **GLP:**
Test substance:
Remark: No data
Source: Zeoline Engis

4.5 Chronic Toxicity to Aquatic Organisms**4.5.1 Chronic Toxicity to Fish**

Species: Pimephales promelas (Fish, fresh water)
Endpoint: other: Reproduction rate, survival of eggs and length and weight of young fish
Exposure period: 30 day
Unit: mg/l **Analytical monitoring:** yes
NOEC: > 86.7
Method: other: US Environm. Prot. Agency "Proposed Recommended Bioassay Procedures for Egg and Fry Stages of Freshwater Fish", Duluth, Minn. (modified; see Freetext Test Condition)
Year: 1972 **GLP:** no data
Test substance: other TS: Ca-exchanged Zeolite A
Source: UOP MS. S.p.A. Assago MI
Test condition: Continuous flow (ca. 6 tank volumes/24 h); pH 7.6 +-0.3; dissolved oxygen always > 86% saturation; test started within 48 h after fertilization of eggs; daily counting and removal of dead eggs until hatch was completed (after 3-5 days); fry was transferred to fresh cups and exposed to test substance for 30 days; modification: circulation with airstone to keep test material in suspension. Parameter: percentage hatch, mean total length and weight of fry, survival of eggs.
Test substance: Analysis by atomic adsorption revealed Zeolite A to be present at 90% as Ca-form and 10% as Mg-, Na- and K-form. (65)

Species: Pimephales promelas (Fish, fresh water)
Endpoint: other: reproduction rate, survival of eggs and length and weight of young fish
Exposure period: 30 day
Unit: mg/l **Analytical monitoring:** yes
NOEC: > 86.7
Method: other: U.S. Environm. Prot. Agency "Proposed Recommended Bioassay Procedures for Egg and Fry Stages of Freshwater Fish", Duluth, Minn. (modified; see Freetext Test Condition)
Year: 1972 **GLP:** no data
Test substance: other TS: Ca-exchanged zeolite A
Result: No adverse effects on hatchability and survival of eggs, mean total length and average weight of fry upon exposure to 86.7 mg/l.
Source: Degussa AG Frankfurt am Main
Test condition: Continuous flow (ca. 6 tank volumes/24 h); pH 7.6 +- 0.3; dissolved oxygen always > 86% saturation; test started within 48 h after fertilization of eggs; daily counting and removal of dead eggs until hatch was completed (after 3-5 days); fry was transferred to fresh cups and exposed to test substance for 30 days; modification: circulation with airstone to keep test material in suspension. Parameter: percentage hatch, mean total length and weight of fry, survival of eggs.
Test substance: Analysis by atomic adsorption revealed zeolite A to be present at 90% as Ca-form and 10% as Mg-, Na- and K-form. (56) (63)

Species:
Endpoint:
Exposure period:
Unit: **Analytical monitoring:**
Method:
Year: **GLP:**
Test substance:
Remark: No data
Source: Zeoline Engis

4.5.2 Chronic Toxicity to Aquatic Invertebrates

Species: Daphnia magna (Crustacea)
Endpoint: other: Mortality and reproduction rate
Exposure period: 21 day
Unit: mg/l **Analytical monitoring:** yes
EC50: 214.6
Method: other: See Freetext Test Condition
Year: 1978 **GLP:** no data
Test substance: other TS: Zeolite A pre-exchanged with Ca²⁺, Mg²⁺, Na⁺ and K⁺ ions
Result:

Parameter	Effect Conc. (mg/L)	95% Confidence Limits
21 day EC50	214.6	174.3-256.2
Total Young Production	211.3	177.9-255.7
Mean Brood Size	340.9	281.8-412.6

Source: UOP MS. S.p.A. Assago MI
Test condition: Continuous rotation of test flasks to keep substance in suspension; replacement of individuals in fresh dilutions of test material every week; 24 +- 12 h old Daphnia used; pH 7.3 +-0.4.
Test substance: Analysis by atomic adsorption revealed zeolite A to be present at 90% as Ca-form and 10% as Mg-, Na- and K-form.

(86)

Species: Daphnia magna (Crustacea)
Endpoint: other: mortality and reproduction rate
Exposure period: 21 day
Unit: mg/l **Analytical monitoring:** yes
EC50: 214.6
Method: other: see Test Condition
Year: 1978 **GLP:** no data
Test substance: other TS: Zeolite A pre-exchanged with Ca²⁺, Mg²⁺, Na⁺ and K⁺ ions
Result:

parameter	effect conc. [mg/l]	95% confidence limits
21 day EC50	214.6	174.3 - 256.2
Total young production	211.3	177.9 - 255.7
Mean brood size	340.9	281.8 - 412.6

Source: Degussa AG Frankfurt am Main
Test condition: Continuous rotation of test flasks to keep substance in suspension; replacement of individuals in fresh dilutions of test material every week; 24 +- 12 h old Daphnia used; pH 7.3 +- 0.4
Test substance: Analysis by atomic adsorption revealed zeolite A to be present at 90% as Ca-form and 10% as Mg-, Na- and K-form. (56) (63)

Species: Daphnia magna (Crustacea)
Endpoint: reproduction rate
Exposure period: 21 day
Unit: mg/l **Analytical monitoring:** no
NOEC: 10
Method: other: See Freetext Test Condition
Year: 1980 **GLP:** no data
Test substance: other TS: Zeolite Type 4A (AKZO)
Source: UOP MS. S.p.A. Assago MI
Test condition: Test performed "in analogy to rules of Dutch Standard Organization (1980)"; semistatic test (renewal 3 times/week); 19 +- 1 degr. C; feeding with Chlorella; 1 day old Daphnia were used for test. (83)

Species: Daphnia magna (Crustacea)
Endpoint: reproduction rate
Exposure period: 21 day
Unit: mg/l **Analytical monitoring:** no
NOEC: 320
Method: other: See Freetext Test Condition
Year: 1980 **GLP:** no
Test substance: other TS: Zeolite Type NaA (Henkel)
Source: UOP MS. S.p.A. Assago MI
Test condition: Test performed "in analogy to rules of Dutch Standard Organization (1980)"; semistatic test (renewal 3 times/week); 19 +- 1 degr. C; feeding with Chlorella; 1 day old Daphnia were used for test. (83)

Species: other aquatic arthropod: Paratanytarsus Parthenogenica
Endpoint: reproduction rate
Exposure period:
Unit: mg/l **Analytical monitoring:** yes
NOEC: 100 - 200
Method: other: Static test with eggs
Year: 1978 **GLP:** no data
Test substance: other TS: Ca-exchanged zeolite A
Result: Parameter EC50 (mg/L) 95% Confidence Limits

F0 hatchability	551.8	370.9-1175.4
F0 pupation	298.1	287.1-308.8
F0 adult emergence	274.1	264.9-283.9
F1 egg production	364.9	311.6-455.8

Source: UOP MS. S.p.A. Assago MI
Test condition: Test chambers were filled with 30 ml of zeolite suspension allowed to settle for 4 h and inoculated with midge eggs; daily feeding of emerging larvae; pH 7.6 +- 0.2; parameter: F0 hatchability, F0 pupation, F0 adult emergence and F1 egg production.
Test substance: Analysis by atomic adsorption revealed zeolite A to be present at 90% as Ca-form and 10% as Mg-, Na- and K-form.

(87)

Species: Daphnia magna (Crustacea)
Endpoint: reproduction rate
Exposure period: 21 day
Unit: mg/l **Analytical monitoring:** no
NOEC: 10
Method: other: see Test Condition
Year: 1980 **GLP:** no data
Test substance: other TS: Zeolite type 4A
Source: Degussa AG Frankfurt am Main
Test condition: Test performed "in analogy to rules of Dutch Standard Organization (1980)"; semistatic test (renewal 3 times/week); 19 +- 1 degr. C; feeding with Chlorella; 1 day old Daphnia were used for test.

(54)

Species: Daphnia magna (Crustacea)
Endpoint: reproduction rate
Exposure period: 21 day
Unit: mg/l **Analytical monitoring:** no
NOEC: 320
Method: other: see Test Condition
Year: 1980 **GLP:** no data
Test substance: other TS: Zeolite type NaA
Source: Degussa AG Frankfurt am Main
Test condition: Test performed "in analogy to rules of Dutch Standard Organization (1980)"; semistatic test (renewal 3 times/week); 19 +- 1 degr. C; feeding with Chlorella; 1 day old Daphnia were used for test.

(54)

Species: other aquatic arthropod: Paratanytarsus parthenogenica
 (midge, diptera)
Endpoint: reproduction rate
Exposure period:
Unit: mg/l **Analytical monitoring:** yes
NOEC: 100 - 200
Method: other: static test with eggs
Year: 1978 **GLP:** no data
Test substance: other TS: Ca-exchanged zeolite A
Result: parameter EC50 [mg/l] 95% confidence limits
 F0 hatchability 551.8 370.9 - 1175.4
 F0 pupation 298.1 287.1 - 308.8
 F0 adult emergence 274.1 264.9 - 283.9
 F1 egg production 364.9 311.6 - 455.8
Source: Degussa AG Frankfurt am Main
Test condition: Test chambers were filled with 30 ml of zeolite suspension
 allowed to settle for 4 h and inoculated with midge eggs;
 daily feeding of emerging larvae; ph 7.6 +- 0.2; parameter:
 F0 hatchability, F0 pupation, F0 adult emergence and F1 egg
 production.
Test substance: Analysis by atomic adsorption revealed zeolite A to be
 present at 90% as Ca-form and 10% as Mg-, Na- and K-form.

(56)

Species:
Endpoint:
Exposure period:
Unit: **Analytical monitoring:**
Method:
Year: **GLP:**
Test substance:
Remark: No data
Source: Zeoline Engis

TERRESTRIAL ORGANISMS

4.6.1 Toxicity to Soil Dwelling Organisms

Type:
Species:
Endpoint:
Exposure period:
Unit:
Method:
Year: **GLP:**
Test substance:
Remark: No data
Source: Zeoline Engis

Type:
Species:
Endpoint:
Exposure period:
Unit:
Method:
Year: **GLP:**
Test substance:
Remark: No data available.
Source: UOP MS. S.p.A. Assago MI

4.6.2 Toxicity to Terrestrial Plants

Species: Avena sativa (Monocotyledon)
Endpoint: growth
Expos. period: 21 day
Unit: mg/kg soil dw
NOEC: > 1000
Method: other: EEC Directive 79/831, Annex V; EEC Ring Test
C(L1)3: Higher Plant
Year: 1986 **GLP:** no data
Test substance: other TS: Zeolite A, calcium-form
Remark: 1000 mg/kg was highest concentration tested.
Source: Degussa AG Frankfurt am Main

(51)

Species: Brassica rapa (Dicotyledon)
Endpoint: growth
Expos. period: 21 day
Unit: mg/kg soil dw
NOEC: > 1000
Method: other: EEC Directive 79/831, Annex V; EEC Ring Test
C(L1)3: Higher Plant
Year: 1986 **GLP:** no data
Test substance: other TS: Zeolite A, calcium-form
Remark: 1000 mg/kg was highest concentration tested.
Source: Degussa AG Frankfurt am Main

(51)

Species: other terrestrial plant: Lycopersicum esculentum (tomatoe)
Endpoint: growth
Expos. period: 21 day
Unit: mg/kg soil dw
NOEC: > 1000
Method: other: EEC Directive 79/831, Annex V; EEC Ring Test
C(L1)3: Higher Plant
Year: 1986 **GLP:** no data
Test substance: other TS: Zeolite A, calcium-form
Remark: 1000 mg/kg was highest concentration tested.
Source: Degussa AG Frankfurt am Main

(51)

Species: other terrestrial plant: 2:1 mixture of Lolium perenne and Lolium italicum
Endpoint: other: Biomass
Expos. period:
Unit:
Method: other: See Freetext Test Condition
Year: 1979 **GLP:** no data
Test substance: other TS: SASIL
Remark: No negative effect of SASIL was observed. On the contrary, there was a growth enhancing effect under certain fertilizing conditions.
Source: UOP MS. S.p.A. Assago MI
Test condition: Seeds of a 2:1 mixture of Lolium perenne and Lolium italicum were sown in 21 pots containing 1 kg of 4 different types of soil to which SASIL was added at 0, 2 and 4 g/kg soil. In a one-year study, the grass was cut altogether 7 times and each time the dry weight of the biomass was determined. (88)

Species: other terrestrial plant: 2:1 mixture of Lolium perenne and Lolium italicum
Endpoint: other: biomass
Expos. period:
Unit:
Method: other: see Test Condition
Year: 1979 **GLP:** no data
Test substance: other TS: Zeolite A
Remark: No negative effect of zeolite A was observed. On the contrary, there was a growth enhancing effect under certain fertilizing conditions.
Source: Degussa AG Frankfurt am Main
Test condition: Seeds of a 2:1 mixture of Lolium perenne and Lolium italicum were sown in 21 pots containing 1 kg of 4 different types of soil to which SASIL was added at 0, 2 and 4 g/kg soil. In a one-year study the grass was cut altogether 7 times and each time the dry weight of the biomass was determined. (89)

Species:
Endpoint:
Expos. period:
Unit:
Method:
Year: **GLP:**
Test substance:
Remark: No data
Source: Zeoline Engis

4.6.3 Toxicity to other Non-Mamm. Terrestrial Species

Species:
Endpoint:
Expos. period:
Unit:
Method:
Year: GLP:
Test substance:
Remark: No data
Source: Zeoline Engis

Species:
Endpoint:
Expos. period:
Unit:
Method:
Year: GLP:
Test substance:
Remark: No data available.
Source: UOP MS. S.p.A. Assago MI

4.7 Biological Effects Monitoring

Remark: No data
Source: Zeoline Engis
Remark: No data available.
Source: UOP MS. S.p.A. Assago MI

4.8 Biotransformation and Kinetics

Type:
Remark: No data
Source: Zeoline Engis
Type:
Remark: No data available.
Source: UOP MS. S.p.A. Assago MI

4.9 Additional Remarks

Remark: can't find information in the literature
Source: Zeolyst C.V. Delfzijl
Remark: No Additional remarks
Source: Zeoline Engis
Remark: Test organism: *Xenopus laevis* (frog).
Test Condition: Semistatic test (renewal 1x per day); 96 h;
21 +/- 2 degr. C ; parameter: mortality.
Effect: LC50 1800 - 3200 mg/L

Source: UOP MS. S.p.A. Assago MI
Test substance: Zeolite Type 4A (AKZO)

(83)

Remark: Method: Biocenotic investigation of different ponds and streams.

- I) Pond without water in- or outflow
220 kg SASIL were evenly distributed on the pond surface (2000 square meter; pond volume: 600 - 700 cubic meter; mean depth: 0.3 m).
- II) Flow-through pond
Overall 220 kg SASIL were dosed continuously during the test period (May - November 1976). Flow rate was 0.77 L/sec; mean retention time: 10 days.

Effects in I and II:

There were no qualitative or quantitative differences between SASIL-treated and control ponds of both types concerning the phytoplankton (4 species studied). The Shannon-index for phytoplankton (diversity index) did not differ from the untreated controls. However, species diversity was greater in the static ponds. Development of macrophytes was strongest in the SASIL-treated flow-through pond, whereas weight gain of fish (carp) was slightly less compared to control or static ponds. No differences concerning macrophytes or fish were found in treated and control static ponds.

- III) Stream
5 mg/L SASIL were continuously dosed into a stream (1 km long; flow rate: 30 L/sec) fed 5% mechanically treated sewage.
In a second test run, the stream was fed exclusively with biologically-treated sewage effluent (3 - 4 L/sec) containing 13.5 mg/L SASIL.
Effects were compared with SASIL-free control streams.

Effects:

No significant differences concerning degradation of organic substances (measured as BOD, COD or organic C) and the biocenoses between SASIL-treated and untreated stream was found. There was a slight increase in the saprobity index of the SASIL-treated stream.

In the test with sewage-effluent, also, no significant differences between treated and untreated streams could be observed concerning degradation of organics and biocenotic changes (esp. zoobenthos was quantitatively studied).

Source: UOP MS. S.p.A. Assago MI
Test substance: Sodium aluminum silicate (SASIL) doted with Indium.

(90)

Remark: Test organism: *Xenopus laevis* (frog).
Test condition: semistatic test (renewal 1x per day); 96 h;
21 +/- 2 degr. C; parameter: mortality.
Effect: LC50 1800 - 3200 mg/l

Source: Degussa AG Frankfurt am Main

Test substance: Zeolite type 4A

(54)

Remark: Method: biocenotic investigation of different ponds and streams.

I) pond without water in- or outflow
220 kg SASIL were evenly distributed on the pond surface (2000 square meter; pond volume: 600 - 700 cubic meter; mean depth: 0.3 m).

II) Flow-through pond
Overall 220 kg SASIL were dosed continuously during the test period (May - November 1976). Flow rate was 0.77 l/sec; mean retention time: 10 days.

Effects in I and II:
There were no qualitative or quantitative differences between SASIL-treated and control ponds of both types concerning the phytoplankton (4 species studied). The Shannon-index for phytoplankton (diversity index) did not differ from the untreated controls. However, species diversity was greater in the static ponds. Development of macrophytes was strongest in the SASIL-treated flow-through pond, whereas weight gain of fish (carp) was slightly less compared to control or static ponds. No differences concerning macrophytes or fish were found in treated and control static ponds.

III) stream
5 mg/l SASIL were continuously dosed into a stream (1 km long; flow rate: 30 l/sec) fed with 5% mechanically treated sewage.
In a second test run the stream was fed exclusively with biologically-treated sewage effluent (3 - 4 l/sec) containing 13.5 mg/l SASIL.
Effects were compared with SASIL-free control streams.

Effects:
No significant differences concerning degradation of organic substances (measured as BOD, COD or organic C) and the biocenoses between SASIL-treated and untreated stream was found. There was a slight increase in the saprobity index of the SASIL-treated stream.

In the test with sewage-effluent also no significant differences between treated and untreated streams could be observed concerning degradation of organics and biocenotic changes (esp. zoobenthos was quantitatively studied).

Source: Degussa AG Frankfurt am Main

Test substance: Zeolite A was doted by incorporation of Indium into the crystal lattice.

4. Ecotoxicity

date: 18-FEB-2000
Substance ID: 1318-02-1

(20)

5.1 Acute Toxicity**5.1.1 Acute Oral Toxicity**

Type: LD50
Species: rat
Sex:
Number of Animals:
Vehicle:
Value: > 31600 - 31600 mg/kg bw
Method: other: no data
Year: **GLP:** no data
Test substance: no data
Source: Zeoline Engis

(91)

Type: LD50
Species: rat
Sex:
Number of Animals:
Vehicle:
Value: > 32000 mg/kg bw
Method: other
Year: 1977 **GLP:** no data
Test substance: other TS: Zeolite Type A, X, Y
Remark: Interpretation: EXTREMELY LOW ORDER OF TOXICITY
Single Stomach Intubation
Source: UOP MS. S.p.A. Assago MI

(92)

Type: LD50
Species: rat
Sex:
Number of Animals:
Vehicle:
Value: > 27000 mg/kg bw
Method: other: Not specified "Acute Oral Toxicity"
Year: **GLP:** no data
Test substance: other TS: Zeolite Type A
Remark: NO MORTALITY WAS OBSERVED AT THIS DOSE.
Source: UOP MS. S.p.A. Assago MI

(93)

Type: LD50
Species: rat
Sex:
Number of Animals:
Vehicle:
Value: > 31600 mg/kg bw
Method: other: "Huntingdon Research Center Acute Toxicity Study"
Year: 1976 **GLP:** no data
Test substance: other TS: Zeolite Type A
Source: UOP MS. S.p.A. Assago MI

(94)

Type: LD50
Species: rat
Sex:
Number of Animals:
Vehicle:
Value: > 31600 mg/kg bw
Method: other: "Huntingdon Research Center Acute Toxicity Study"
Year: 1976 **GLP:** no data
Test substance: other TS: Zeolite Type Y exchanged with circa 10% rare earths
Source: UOP MS. S.p.A. Assago MI

(95)

Type: LD50
Species: rat
Sex:
Number of Animals:
Vehicle:
Value: > 10000 mg/kg bw
Method: other: Henkel-method "Limit Test: Acute oral toxicity"
Year: **GLP:** no
Test substance: as prescribed by 1.1 - 1.4
Remark: Ten male rats were given an aqueous suspension of 10 g Zeolithe A/kg by gavage. The animals were observed over a period of 8 days.
Source: Degussa AG Frankfurt am Main

(96)

Type: LD50
Species: rat
Sex:
Number of Animals:
Vehicle:
Value: > 16520 mg/kg bw
Method: other: Procter & Gamble Standard Procedure # 1 "Acute Oral Toxicity"
Year: 1973 **GLP:** no
Test substance: as prescribed by 1.1 - 1.4
Remark: The test substance was applied as a 40% w/w aqueous suspension.
Source: Degussa AG Frankfurt am Main
Test substance: Test substance was AC-Base (Sodium Aluminosilicate)

Analysis: Total Na : 12.2%
Total Al : 11.9%
Total SiO2 : 26.4%
Total H2O : 33.8%

(97)

Type: LD50
Species: rat
Sex:
Number of Animals:
Vehicle:
Value: > 27000 mg/kg bw
Method: other: not specified "Acute oral toxicity"
Year: **GLP:** no data
Test substance: as prescribed by 1.1 - 1.4
Remark: No mortality was observed at this dose.
Source: Degussa AG Frankfurt am Main

(98)

Type: LD50
Species: rat
Sex:
Number of Animals:
Vehicle:
Value: > 5110 mg/kg bw
Method: OECD Guide-line 401 "Acute Oral Toxicity"
Year: 1987 **GLP:** no
Test substance: other TS
Remark: Limit test. 21.5 ml/kg of a 0.5% slurry were given. No signs of toxic effects were observed. All animals survived up to 14 days; at this time point the animals were killed and their body cavities and organs were investigated macroscopically. No clinical symptoms or other findings were recorded.
Source: Degussa AG Frankfurt am Main
Test substance: The substance Wessalith P was tested.

(99)

Type: LD50
Species: rat
Sex:
Number of Animals:
Vehicle:
Value: 5000 mg/kg bw
Method: other: method not specified
Year: **GLP:** no data
Test substance: as prescribed by 1.1 - 1.4
Remark: Result: There were no adverse reactions or death noted during the 14 day observation period.
Source: Degussa AG Frankfurt am Main
Test substance: Test substance was the experimental compound CH-216-110-1, an aluminosilicate similar to Zeolith A.

(100)

Type: LD50
Species: rat
Sex:
Number of Animals:
Vehicle:
Value: > 27400 mg/kg bw
Method: other: Scientific Associates, Inc. "Acute Oral Toxicity"
Year: 1974 **GLP:** no data
Test substance: as prescribed by 1.1 - 1.4
Remark: Result: Doses of 7.1, 14.0, and 27.4 g/kg of 40% w/w aqueous dilution of AC-base (test compound UDL-821) were administered orally. At the higher dose levels the animals exhibited a decrease in motor activity. No animal succumbed at any dose level tested. Gross necropsy of the animals sacrificed at termination showed moderate to severe congestion of the liver, kidneys and adrenal glands. Otherwies, the tissues were not remarkable.
Source: Degussa AG Frankfurt am Main
Test substance: Test substance was the experimental compound UDL-821, an aluminosilicate similar to Zeolith A.

(101)

Type: LD50
Species: rat
Sex:
Number of Animals:
Vehicle:
Value: > 5110 mg/kg bw
Method: OECD Guide-line 401 "Acute Oral Toxicity"
Year: 1987 **GLP:** yes
Test substance: other TS
Remark: No clinical symptoms or other findings.
Source: Degussa AG Frankfurt am Main
Test substance: The substance Wessalith AP 300 was tested.

(102)

Type: LD50
Species: rat
Sex:
Number of Animals:
Vehicle:
Value: > 5110 mg/kg bw
Method: OECD Guide-line 401 "Acute Oral Toxicity"
Year: 1987 **GLP:** yes
Test substance: other TS
Remark: No clinical symptoms or other findings.
Source: Degussa AG Frankfurt am Main
Test substance: The substance Wessalith AP 400 was tested.

(103)

Type: LD50
Species: rat
Sex:
Number of Animals:
Vehicle:
Value: > 31800 mg/kg bw
Method: other: not specified
Year: **GLP:** no
Test substance: other TS
Remark: 1. Maximal attainable concentration in a 0.8% aqueous hydroxy-propyl-methylcellulose suspension. Observation period: 4 weeks.
2. Result: No clinical symptoms or other findings.
Source: Degussa AG Frankfurt am Main
Test substance: The substance Sipernat 44 was tested.

(104)

Type: LD50
Species: mouse
Sex:
Number of Animals:
Vehicle:
Value: > 10000 mg/kg bw
Method: other: Henkel-method "Limit Test: Acute Oral Toxicity"
Year: **GLP:** no
Test substance: as prescribed by 1.1 - 1.4
Remark: Volume applied was 40 ml/kg. No signs of toxic effects were observed.
Source: Degussa AG Frankfurt am Main

(105)

Type: LD50
Species: dog
Sex:
Number of Animals:
Vehicle:
Value: > 1000 mg/kg bw
Method: other: Procter & Gamble Standard Procedure # 1
Year: 1973 **GLP:** no
Test substance: as prescribed by 1.1 - 1.4
Remark: Limit-test. A single dose of 1.000 mg/kg was tested. The test substance was applied as a 40% w/w aqueous suspension.
Source: Degussa AG Frankfurt am Main
Test substance: Test substance was AC-Base:

Analysis: Sodium : 13.4 %
Aluminum : 15.0 %
Silicon : 11.5 %
Free Na2O : 12.9 %
H2O : 19.0 %

(106)

5.1.2 Acute Inhalation Toxicity

Type: LC0
Species: rat
Sex:
Number of Animals:
Vehicle:
Exposure time: 4 hour(s)
Value: >= .14 mg/l
Method: other: Huntingdon Research Center "Acute Inhalation Toxicity"
Year: **GLP:** no
Test substance: as prescribed by 1.1 - 1.4
Remark: Test conditions: animals were for four hours whole-body exposed to aerosol concentrations of 0.08 mg/l and 0.14 mg/l, respectively.

Result: There were no exposure-related effects evident in pharmacotoxic signs, body weights, ophthalmic examinations, gross pathology, or organ weights. Therefore, only a LC0-value could be given.

Source: Degussa AG Frankfurt am Main
Test substance: Test substance was the experimental compound UDL-738, an aluminosilicate similar to Zeolith A. Particle size was so, that 71% of the compound were respirable aerosol, i.e. it could reach the tracheal-bronchial and alveolar regions of the respiratory tract.

(107)

Type: LC50
Species: rat
Sex:
Number of Animals:
Vehicle:
Exposure time: 1 hour(s)
Value: 2.4 - 18.3 mg/l
Method: other
Year: 1980 **GLP:** no data
Test substance: other TS: Zeolite Type A
Remark: Interpretation: NO OBSERVABLE TOXIC EFFECTS.
Single 1-hour exposure.
Source: UOP MS. S.p.A. Assago MI

(108)

Type: LC50
Species: rat
Sex:
Number of Animals:
Vehicle:
Exposure time: 4 hour(s)
Value: > 5.3 mg/l
Method: other: Method not specified
Year: **GLP:** no data
Test substance: other TS: Zeolite Type Y
Remark: Sodium Zeolite Type Y exposure (4 hours) as an airborne dust at a mean concentration of 4.92 mg/L produced no overt toxicity in rats. The LC50 appears to be greater than 5.3 mg/L.
Source: UOP MS. S.p.A. Assago MI

(109)

Type: LC50
Species: rat
Sex:
Number of Animals:
Vehicle:
Exposure time: 1 hour(s)
Value: > 2 mg/l
Method: other: "Huntingdon Research Center Acute Inhalation Toxicity"
Year: 1977 **GLP:** no data
Test substance: other TS: Zeolite Type A
Remark: Results:

No signs of toxicity during the exposure period. During the exposure signs of irritation and dyspnea were apparent in most animals. Data obtained from the experiments would indicate that the one (1) hour LC50 with either a forty-eight (48) hour or fourteen (14) day observation period, is significantly greater than 2 mg/L

Source: UOP MS. S.p.A. Assago MI

(110)

Type: LC50
Species: rat
Sex:
Number of Animals:
Vehicle:
Exposure time: 1 hour(s)
Value: > 2 mg/l
Method: other: "Huntingdon Research Center Acute Inhalation Toxicity"
Year: 1977 **GLP:** no data
Test substance: other TS: Zeolite Type Y, exchanged with circa 10% rare earths
Remark: Results:

No signs of toxicity during the exposure period. During the exposure signs of irritation and dyspnea were apparent in most animals. Data obtained from the experiments would

indicate that the one (1) hour LC50 with either a forty-eight (48) hour or fourteen (14) day observation period, is significantly greater than 2 mg/L

Source: UOP MS. S.p.A. Assago MI (110)

Type: LC50
Species: rat
Sex:
Number of Animals:
Vehicle:
Exposure time: 1 hour(s)
Value: > 18.3 mg/l
Method: other: Huntingdon Research Center "Acute Inhalation Toxicity"
Year: **GLP:** no

Test substance: as prescribed by 1.1 - 1.4
Remark: Result: There were no adverse effects evident in pharmacotoxic signs, body weights, or gross pathology resulting from a one-hour exposure to the test compound. Thus the substance would be classified as non-toxic according to the definitions of Part 191, Chapter 1, Title 21 of the CFR, when administered via the inhalation route as an aerosol.

Source: Degussa AG Frankfurt am Main
Test substance: Test substance was the experimental compound CH-216-110-1, an aluminosilicate similar to Zeolith A. (111)

Type: LC50
Species: rabbit
Sex:
Number of Animals:
Vehicle:
Exposure time: 20 hour(s)
Value: > 1000 mg/l
Method: other
Year: 1981 **GLP:** no

Test substance: other TS: Zeolite Type X
Remark: Interpretation: NON-TOXIC.
Positive Control Used: Silica
RAM = Cytotoxicity to Rabbit Alveolar Macrophage cells in vitro.

Source: UOP MS. S.p.A. Assago MI (112)

Type: LC50
Species: rabbit
Sex:
Number of Animals:
Vehicle:
Exposure time: 20 hour(s)
Value: > 1000 mg/l
Method: other
Year: 1981 **GLP:** yes
Test substance: other TS: Zeolite Type Y
Remark: Interpretation: NON-TOXIC.
RAM = Cytotoxicity to Rabbit Alveolar Macrophage cells in vitro.
Source: UOP MS. S.p.A. Assago MI

(113)

Type:
Species:
Sex:
Number of Animals:
Vehicle:
Exposure time:
Value:
Method:
Year: **GLP:**
Test substance:
Remark: No data
Source: Zeoline Engis

5.1.3 Acute Dermal Toxicity

Type: LD50
Species: rabbit
Sex:
Number of Animals:
Vehicle:
Value: > 2000 - 2000 mg/kg bw
Method:
Year: **GLP:**
Test substance:
Source: Zeoline Engis

(91)

Type: LD50
Species: rabbit
Sex:
Number of Animals:
Vehicle:
Value: > 2000 mg/kg bw
Method: other: Henkel-method "Acute dermal toxicity"
Year: **GLP:** no
Test substance: other TS: Zeolite Type A
Remark: Result:
 Rabbits tolerated a single dermal administration of 2 g/kg without any signs of local or systemic effects.
Source: UOP MS. S.p.A. Assago MI (114)

Type: LD50
Species: rabbit
Sex:
Number of Animals:
Vehicle:
Value: > 2000 mg/kg bw
Method: other: "Huntingdon Research Center Acute Toxicity Studies"
Year: 1976 **GLP:** no data
Test substance: other TS: Zeolite Type A
Source: UOP MS. S.p.A. Assago MI (115)

Type: LD50
Species: rabbit
Sex:
Number of Animals:
Vehicle:
Value: > 2000 mg/kg bw
Method: other: "Huntingdon Research Center Acute Toxicity Studies"
Year: 1976 **GLP:** no data
Test substance: other TS: Zeolite Type Y, exchanged with 10% rare earths
Source: UOP MS. S.p.A. Assago MI (116)

Type: LD50
Species: rabbit
Sex:
Number of Animals:
Vehicle:
Value: > 2000 mg/kg bw
Method: other: Henkel-method "Acute dermal toxicity"
Year: **GLP:** no
Test substance: as prescribed by 1.1 - 1.4
Remark: Result: Rabbits tolerated a single dermal administration of 2 g/kg without any signs of local or systemic effects.
Source: Degussa AG Frankfurt am Main (96)

Type: LD50
Species: rabbit
Sex:
Number of Animals:
Vehicle:
Value: > 2000 mg/kg bw
Method: other: Procter & Gamble Standard Procedure # 10 "Acute Rabbit Percutaneous Toxicity"
Year: 1973 **GLP:** no data
Test substance: as prescribed by 1.1 - 1.4
Remark: Rabbits showed only mild erythema on both, abraded and intact skin.
Source: Degussa AG Frankfurt am Main
Test substance: Test substance was AC-Base (Aluminosilicate)

Analysis:

Total Na : 12.2
 Total Al : 11.9
 Total SiO₂: 26.4
 Total H₂O : 33.8

(117)

Type: other
Species: rabbit
Sex:
Number of Animals:
Vehicle:
Value: = 2000 mg/kg bw
Method: other
Year: 1980 **GLP:** no data
Test substance: other TS: Zeolite Type A
Remark: A single amount was applied.
 At a 2000 mg/kg dose there were NO DEATHS and only MILD ERYTHEMA.
Source: UOP MS. S.p.A. Assago MI

(118)

5.1.4 Acute Toxicity, other Routes

Type: LC50
Species: rat
Sex:
Number of Animals:
Vehicle:
Route of admin.: other: intratracheal
Exposure time: 336 hour(s)
Value: ca. 12 - 40 mg/kg bw
Method: other: Huntingdon Reaseach Center "Project No. 747-147B"
Year: 1975 **GLP:** no data
Test substance: as prescribed by 1.1 - 1.4
Remark: The test substance (P&G code UDL-739) was applied as aqueous suspension at concentrations of 3 mg/ml, 10 mg/ml, 25 mg/ml,

50 mg/ml, and 100 mg/ml by intratracheal injection of 1 ml. All of the animals dosed with 3 mg/ml survived (10/10); only one (1/10) exhibited incidence of lung gross abnormalities. Weight gain in this group was normal compared to untreated controls. In the group dosed with 10 mg/ml (9/10) died within the 14 days. At the higher doses all (10/10) animals died during the experiment. LD50-values were calculated from the applied doses using a body weight of 250 g, i.e. the doses expressed in mg/kg are by a factor of 4 higher than the doses given as mg/ml per animal.

Source: Degussa AG Frankfurt am Main

(119)

Type:

Species:

Sex:

Number of

Animals:

Vehicle:

Route of admin.:

Value:

Method:

Year:

GLP:

Test substance:

Remark: No data

Source: Zeoline Engis

Type:

Species:

Sex:

Number of

Animals:

Vehicle:

Route of admin.:

Value:

Method:

Year:

GLP:

Test substance:

Remark: No data available.

Source: UOP MS. S.p.A. Assago MI

5.2 Corrosiveness and Irritation

5.2.1 Skin Irritation

Species: rabbit
Concentration:

Exposure:
Exposure Time:
Number of Animals:
PDII:
Result: not irritating
EC classificat.: not irritating
Method: other: Method not specified
Year: **GLP:** no data
Test substance: other TS: Zeolite Type A
Remark: Na/Al-Silicate powder was tested.
Source: UOP MS. S.p.A. Assago MI

(120)

Species: rabbit
Concentration:

Exposure:
Exposure Time:
Number of Animals:
PDII:
Result: not irritating
EC classificat.:
Method: other: method not specified
Year: **GLP:** no data
Test substance: as prescribed by 1.1 - 1.4
Remark: Na/Al-Silicate powder was tested.
Source: Degussa AG Frankfurt am Main

(121)

Species: rabbit
Concentration:

Exposure:
Exposure Time:
Number of Animals:
PDII:
Result: moderately irritating
EC classificat.:
Method: other: Procter & Gamble Standard Procedure # 9 "Rabbit Skin Irritation"
Year: 1973 **GLP:** no data
Test substance: as prescribed by 1.1 - 1.4
Remark: Under test conditions the test substance elicited mild primary irritation.
Source: Degussa AG Frankfurt am Main
Test substance: Test substance was 20% aq. solution of AC-Base (Aluminosilicate)

Analysis:

Total Na : 12.2
Total Al : 11.9
Total SiO2: 26.4
Total H2O : 33.8

(122)

Species: rabbit
Concentration:

Exposure:
Exposure Time:
Number of
Animals:

PDII:

Result: not irritating

EC classificat.:

Method: Directive 84/449/EEC, B.4 "Acute toxicity (skin irritation)"

Year: 1984 **GLP:** no

Test substance: other TS

Remark: Patch test. A skin irritation index of 0 was recorded (according to Gilman et al. 1983). No systemic-toxic effects were observed.

Source: Degussa AG Frankfurt am Main

Test substance: A slurry of 0.5 g Wessalith P in 0.25 ml aqua demin.

(123)

Species: rabbit
Concentration:

Exposure:
Exposure Time:
Number of
Animals:

PDII:

Result: not irritating

EC classificat.:

Method: OECD Guide-line 404 "Acute Dermal Irritation/Corrosion"

Year: 1981 **GLP:** yes

Test substance: other TS

Source: Degussa AG Frankfurt am Main

Test substance: The substance Wessalith AP 300 was tested.

(124)

Species: rabbit
Concentration:

Exposure:
Exposure Time:
Number of
Animals:

PDII:

Result: not irritating

EC classificat.:

Method: OECD Guide-line 404 "Acute Dermal Irritation/Corrosion"

Year: 1981 **GLP:** yes

Test substance: other TS

Remark: Very slight erythema was observed (1/3 animals).

Source: Degussa AG Frankfurt am Main
Test substance: The substance Wessalith AP 400 was tested. (125)

Species: human
Concentration:

Exposure:
Exposure Time:
**Number of
Animals:**

PDII:
Result: not irritating
EC classificat.: not irritating
Method: Draize Test
Year: 1980 **GLP:** no data

Test substance: other TS: Zeolite Type A
Source: UOP MS. S.p.A. Assago MI (126)

Species: human
Concentration:

Exposure:
Exposure Time:
**Number of
Animals:**

PDII:
Result: not irritating
EC classificat.: not irritating
Method: Draize Test
Year: **GLP:** no data

Test substance: other TS: Zeolite Type Y
Source: UOP MS. S.p.A. Assago MI (127)

Species: human
Concentration:

Exposure:
Exposure Time:
**Number of
Animals:**

PDII:
Result: not irritating
EC classificat.: not irritating
Method: other
Year: **GLP:** no data

Test substance: other TS: Zeolite Type A
Remark: Cotton- or polyester-patches were washed several times with a Zeolite A-containing detergent. Bound Zeolite A was analyzed. It was found that cotton accumulated 2-6 times more Zeolite A (approximately 25.000 ppm) than polyester. The zeolite A-contaminated patches were applied for 48 h by Finn-Chambers onto the backs of 40 healthy volunteers (20 seborrheic type, 20 sebostatic type) to test for skin irritation. Scores were recorded 20 min, 24 h, and 48 h

after removal of the patches. Result: All subjects tolerated the washed patches without any skin reaction.

In a second experiment, a wear-test was conducted in 15 children, age between 7 month and 6 years. Similar washed cotton T-shirts (ca. 8.000 ppm Zeolite A bound) were worn by the children for up to 11 days. Skin reaction was not seen, nor did the children complain of any unpleasant skin sensations.

This experiment leads to the conclusion, that any remaining amounts of zeolite on cloths do not pose a risk for skin irritation for consumers, even to babies.

Source: UOP MS. S.p.A. Assago MI

(128)

Species: human

Concentration:

Exposure:

Exposure Time:

**Number of
Animals:**

PDII:

Result: not irritating

EC classificat.:

Method: other: Burckhardt-Test

Year: 1970

GLP: no data

Test substance: as prescribed by 1.1 - 1.4

Remark: No signs of skin irritation were observed.

Source: Degussa AG Frankfurt am Main

Test substance: Zeolith A was applied for 24 h at a concentration of 1%.

(96)

Species: human

Concentration:

Exposure:

Exposure Time:

**Number of
Animals:**

PDII:

Result: not irritating

EC classificat.:

Method: other: method not specified

Year:

GLP: no data

Test substance: as prescribed by 1.1 - 1.4

Remark: The skin irritation of AC-base (sodium aluminosilicate) was evaluated by means of a single application patch test on the backs of 8 panelists. The test concentration was 50%. AC-base was innocuous for primary irritation under the conditions of this test.

Source: Degussa AG Frankfurt am Main

Test substance: Test substance was AC-Base (sodium aluminosilicate)

Analysis: Total Na : 12.2%
Total Al : 11.9%

Total SiO2 : 26.4%
Total H2O : 33.8%

(129)

Species:
Concentration:

Exposure:
Exposure Time:
Number of
Animals:
PDII:
Result:
EC classificat.:
Method:

Year:
Test substance:
Remark:

GLP:

When activated, molecular sieve powders (zeolites) act as a desiccant and can cause a drying irritation of the mucous membranes and skin in cases of severe exposure. There is no knowledge of medical conditions abnormally aggravated by exposure to this product.

Source: Zeoline Engis

(91)

5.2.2 Eye Irritation

Species: rabbit

Concentration:

Dose:

Exposure Time:

Comment:

Number of
Animals:

Result: not irritating

EC classificat.: not irritating

Method: other: Federal Hazardous Substances Act (FHSA) Regulations 16 CFR Part 1500.42, Federal Test Protocol

Year: 1988 GLP: yes

Test substance: other TS: Zeolite Types A, X, Y

Source: UOP MS. S.p.A. Assago MI

(130)

Species: rabbit

Concentration:

Dose:

Exposure Time:

Comment:

Number of
Animals:

Result: not irritating

EC classificat.: not irritating

Method: Draize Test

Year: 1976 GLP: no data

Test substance: other TS: Zeolite Type A

Source: UOP MS. S.p.A. Assago MI

(115)

Species: rabbit
Concentration:
Dose:
Exposure Time:
Comment:
Number of Animals:
Result: not irritating
EC classificat.: not irritating
Method: Draize Test
Year: 1976 **GLP:** no data
Test substance: other TS: Zeolite Type Y exchange with circa 10% rare earths
Source: UOP MS. S.p.A. Assago MI

(116)

Species: rabbit
Concentration:
Dose:
Exposure Time:
Comment:
Number of Animals:
Result: slightly irritating
EC classificat.:
Method: Draize Test
Year: 1944 **GLP:** no
Test substance: as prescribed by 1.1 - 1.4
Remark: Instillation of 10 mg Na/Al-silicate in the rabbit eye caused a foreign-body reaction due to the mechanical action of the substance.
Source: Degussa AG Frankfurt am Main

(96)

Species: rabbit
Concentration:
Dose:
Exposure Time:
Comment:
Number of Animals:
Result: slightly irritating
EC classificat.:
Method: other: Procter & Gamble Standard Procedure # 2 "Rabbit Eye Irritation"
Year: 1973 **GLP:** no data
Test substance: as prescribed by 1.1 - 1.4
Remark: Three milligrams test substance were very mild producing no grossly observable abnormalities in the rabbit eye at 1 hour.
Source: Degussa AG Frankfurt am Main
Test substance: Test substance was AC-Base: Na₁₂(AlO₂xSiO₂)₁₂ . 27 H₂O

Analysis: Sodium : 13.4 %
 Aluminum : 15.0 %
 Silicon : 11.5 %

Free Na2O : 12.9 %
H2O : 19.0 %

(131)

Species: rabbit
Concentration:
Dose:
Exposure Time:
Comment:
Number of Animals:
Result: slightly irritating
EC classificat.:
Method: Directive 84/449/EEC, B.5 "Acute toxicity (eye irritation)"
Year: 1984 **GLP:** no
Test substance: as prescribed by 1.1 - 1.4
Remark: Instillation of 100 mg dry substance (no-rinse application) caused marked secretion, which is a typical foreign-body reaction.
Source: Degussa AG Frankfurt am Main
Test substance: The substance Wessalith P was tested.

(132)

Species: rabbit
Concentration:
Dose:
Exposure Time:
Comment:
Number of Animals:
Result: not irritating
EC classificat.:
Method: other: method not specified
Year: **GLP:** no data
Test substance: as prescribed by 1.1 - 1.4
Remark: 3 mg or 10% sodium aluminosilicate in 0.1 ml aqueous solution, with and without rinsing.
Source: Degussa AG Frankfurt am Main

(98)

Species: rabbit
Concentration:
Dose:
Exposure Time:
Comment:
Number of Animals:
Result: not irritating
EC classificat.:
Method: OECD Guide-line 405 "Acute Eye Irritation/Corrosion"
Year: 1987 **GLP:** yes
Test substance: other TS
Remark: No alternations in cornea and iris. The conjunctiva showed slight hypermia up to 24 hours.
Source: Degussa AG Frankfurt am Main
Test substance: The substance Wessalith AP 300 was tested.

(133)

Species: rabbit
Concentration:
Dose:
Exposure Time:
Comment:
Number of Animals:
Result: not irritating
EC classificat.:
Method: OECD Guide-line 405 "Acute Eye Irritation/Corrosion"
Year: 1987 **GLP:** yes
Test substance: other TS
Remark: No alternations in cornea and iris. The conjunctiva showed slight hypermia up to 24 hours.
Source: Degussa AG Frankfurt am Main
Test substance: The substance Wessalith AP 400 was tested.

(134)

Species: monkey
Concentration:
Dose:
Exposure Time:
Comment:
Number of Animals:
Result: slightly irritating
EC classificat.:
Method: Draize Test
Year: 1959 **GLP:** no data
Test substance: as prescribed by 1.1 - 1.4
Remark: 35 mg sodium aluminosilicate were instilled in the eyes of monkeys. From this test the substance is considered slightly irritating to the monkey eye.
Source: Degussa AG Frankfurt am Main
Test substance: Test substance was Sodium-Aluminosilicate (UDL 812)

Analysis:

Sodium : 13.4 %
Aluminum : 15.0
Silicon : 11.5
Free Na₂O : 12.9
H₂O : 19.0

(135)

Species:
Concentration:
Dose:
Exposure Time:
Comment:
Number of Animals:
Result:
EC classificat.: not irritating
Method:
Year: **GLP:**
Test substance:

Source: Zeoline Engis

(91)

5.3 Sensitization

Type: Buehler Test

Species: guinea pig

**Number of
Animals:**

Vehicle:

Result: not sensitizing

Classification:

Method: other: Hill Top Research, Inc. "Buehler Test"

Year: 1966 **GLP:** no data

Test substance: as prescribed by 1.1 - 1.4

Remark: No signs of hypersensitivity were observed.

Source: Degussa AG Frankfurt am Main

Test substance: Test substance was Sodium-Aluminosilicate (UDL 435).

(136)

Type: Buehler Test

Species: human

**Number of
Animals:**

Vehicle:

Result: not sensitizing

Classification:

Method: other: method described in reference: Stotts (1973)

Year: 1973 **GLP:** no data

Test substance: as prescribed by 1.1 - 1.4

Remark: A panel of 71 human subjects was exposed to 5.0% aqueous AC-base in a standard test for skin sensitization. No evidence of sensitization was seen in any subject. AC-base was very mild under patching conditions.

Source: Degussa AG Frankfurt am Main

Test substance: Test substance was AC-Base: Na₁₂(AlO₂xSiO₂)₁₂ . 27 H₂O

Analysis:

Sodium	:	13.4 %
Aluminum	:	15.0 %
Silicon	:	11.5 %
Free Na ₂ O	:	12.9 %
H ₂ O	:	19.0 %

(137)

Type: Guinea pig maximization test
Species: guinea pig
Number of Animals:
Vehicle:
Result: not sensitizing
Classification:
Method: other: Henkel-method "Magnusson & Kligman Test", modified
Year: 1968 **GLP:** no
Test substance: other TS: Zeolite Type A
Remark: Sensitization induction was tested in 20 male guinea-pigs by administration of ten successive injections of a 10% suspension of Zeolite A with Freund's adjuvant over a period of 14 days. After an interval of 14 days, another treatment was started with three epicutaneous injections of a 50% suspension. The guinea-pig maximization tests yielded no evidence of skin-sensitizing properties.
Source: UOP MS. S.p.A. Assago MI (114)

Type: Guinea pig maximization test
Species: guinea pig
Number of Animals:
Vehicle:
Result: not sensitizing
Classification:
Method: other: Henkel-method "Magnusson & Klingman test", modified
Year: 1968 **GLP:** no
Test substance: as prescribed by 1.1 - 1.4
Remark: Sensitization induction was tested in 20 male guinea-pigs by administration of ten successive injections of a 10% suspension of Zeolithe A with Freund's adjuvant over a period of 14 days. After an interval of 14 days, another treatment was started with three epicutaneous injections of a 50% suspension. The guinea-pig maximization tests yielded no evidence of skin-sensitizing properties.
Source: Degussa AG Frankfurt am Main (96)

Type: no data
Species: human
Number of Animals:
Vehicle:
Result: not sensitizing
Classification: not sensitizing
Method: other
Year: 1980 **GLP:** no data
Test substance: other TS: Zeolite Type A
Remark: 5% aqueous slurry; 9 weekly applications and challenge.
Source: UOP MS. S.p.A. Assago MI (126)

Type:
Species:
Number of
Animals:
Vehicle:
Result:
Classification:
Method:
Year: GLP:
Test substance:
Remark: no data
Source: Zeoline Engis

5.4 Repeated Dose Toxicity

Species: rat Sex: male
Strain: no data
Route of admin.: inhalation
Exposure period: 11 weeks
Frequency of
treatment: 5 hr/day on 5 days/week
Post. obs.
period: None. The animals were killed immediately after the exposure
period.
Doses: 2 +/- 1 mg/L
Control Group: yes
LOAEL: <= 2 mg/l
Method: other: Henkel-method "Subchronic inhalation toxicity"
Year: GLP: no
Test substance: other TS: Zeolite Type A
Result: All test animals suffered a respiratory infection and three
animals out of 30 died. At both gross and histological
examinations all animals showed signs of pneumonitis, but
there was no indication of any fibrotic reaction. Silicon
determinations on the lungs of treated and control animals
showed higher concentrations in the treated animals.
Source: UOP MS. S.p.A. Assago MI

(114)

Species: rat **Sex:** male
Strain: no data
Route of admin.: inhalation
Exposure period: 11 weeks
Frequency of treatment: 5 hr/day on 5 days/week
Post. obs. period: No. The animals were killed immediately after the exposure period.
Doses: 2 +/-1 mg/l
Control Group: yes
Method: other: Henkel-method "Subchronic inhalation toxicity"
Year: **GLP:** no
Test substance: as prescribed by 1.1 - 1.4
Result: All test animals suffered a respiratory infection and three animals out of 30 died. At both gross and histological examinations all animals showed signs of pneumonitis, but there was no indication of any fibrotic reaction. Silicon determinations on the lungs of treated and control animals showed higher concentrations in the treated animals.
Source: Degussa AG Frankfurt am Main

(96)

Species: rat **Sex:** male
Strain: Wistar
Route of admin.: inhalation
Exposure period: 21 days
Frequency of treatment: 5 hours on three days per week for three consecutive weeks
Post. obs. period: No. All animals were killed at the end of the exposure period.
Doses: 0.02 mg/l
Control Group: yes
NOAEL: > .02 mg/l
Method: other: Henkel KGaA "Inhalation of Sasil, Report No. 770093"
Year: 1977 **GLP:** no
Test substance: as prescribed by 1.1 - 1.4
Result: Result: Although a significant increase in silica content of the lungs occurred by the treatment (242 ppm vs. 142 ppm), no treatment-related toxic effects were noted. The weight gain of the animals was normal and no macroscopic changes were found on the inner organs.
Source: Degussa AG Frankfurt am Main

(138)

Species: rat **Sex:** male/female
Strain: Wistar
Route of admin.: oral feed
Exposure period: One Month
Frequency of treatment: Ad Libitum
Post. obs. period: None
Doses: Male/Female: 10%, 3%, 1% Molecular Sieve Type A
Control Group: other
NOAEL: ca. .5
LOAEL: ca. 1
Method: other
Year: 1974 **GLP:** no
Test substance: other TS: Zeolite Type A
Remark: A similar test was done on dogs at the same time and yielded the same results.
Basic diet of Purina Formula B Chow 5008 in which 10%, 3%, 1% was Molecular Sieve. Body weight gains were statistically compared throughout the study. Water and diet consumption were measured as were hematologic, biochemical and urinalysis criteria. Organ weights; liver, kidney, heart, spleen, adrenals and testes or ovaries and microscopic examination of tissues were performed at the termination of the one month doses.
Two control groups were used; one contained 10% of a non-nutritive material (ALPHACEL) and 4.72% NaHCO₃ and the other was a no treatment (NTL) group.

Source: UOP MS. S.p.A. Assago MI

(139)

Species: rat **Sex:** male/female
Strain: Wistar
Route of admin.: oral feed
Exposure period: 7 days
Frequency of treatment: Ad Libitum
Post. obs. period: None
Doses: Male: 5900, 2300, 910 mg/kg Female: 8000, 3300, 124 mg/kg
Control Group: yes, concurrent vehicle
NOAEL: > 5000 mg/kg
Method: other
Year: 1977 **GLP:** yes
Test substance: other TS: Zeolite Type Y
Remark: Interpretation: NON-TOXIC
Source: UOP MS. S.p.A. Assago MI

(140)

5. Toxicity

date: 18-FEB-2000
Substance ID: 1318-02-1

Species: rat **Sex:** male/female
Strain: Wistar
Route of admin.: oral feed
Exposure period: 90 days
Frequency of treatment: continuous
Post. obs. period: No. The animals were killed immediately after the exposure period.
Doses: 1000, 5000 and 10000 ppm
Control Group: yes
NOAEL: = 5000 ppm
LOAEL: <= 10000 ppm
Method: other: Henkel-method "Subchronic oral toxicity"
Year: **GLP:** no
Test substance: as prescribed by 1.1 - 1.4
Result: All test animals survived the subchronic oral test. The only differences between test and control groups were found in the group fed the highest dose of the test substance. This group showed diminished urine secretion, haematuria, and ketone bodies in the urine and in 12 of the 20 male animals urinary calculi of varying number and size were observed in the bladder.
Source: Degussa AG Frankfurt am Main (96) (141)

Species: rat **Sex:** male/female
Strain: Sprague-Dawley
Route of admin.: oral feed
Exposure period: 91 days
Frequency of treatment: continuous
Post. obs. period: 5 days
Doses: 0.0, 0.05, 0.1, 0.2, and 0.4 % in diet
Control Group: yes
Method: other: Bio/dynamics "Subchronic Rat Feeding Study"
Year: 1977 **GLP:** no data
Test substance: as prescribed by 1.1 - 1.4
Remark: Unfortunately, the results of the described study were not included in the Supplementary Information A10, and thus are not available for the EG-dataset.
Source: Degussa AG Frankfurt am Main (142)

Species: guinea pig **Sex:** no data
Strain: no data
Route of admin.: inhalation
Exposure period: 11 weeks
Frequency of treatment: 5 hr/day on 5 days/week
Post. obs. period: None. The animals were killed immediately after the exposure period.
Doses: 2 +/- 1 mg/L
Control Group: yes
LOAEL: <= 2 mg/l
Method: other: Henkel-method "Subchronic inhalation toxicity"
Year: **GLP:** no
Test substance: other TS: Zeolite Type A
Result: All test animals suffered a respiratory infection; no animal out of 5 died. At both gross and histological examinations all animals showed signs of pneumonitis, but there was no indication of any fibrotic reaction. Silicon determinations on the lungs of treated and control animals showed higher concentrations in the treated animals.
Source: UOP MS. S.p.A. Assago MI

(143)

Species: guinea pig **Sex:** no data
Strain: no data
Route of admin.: inhalation
Exposure period: 11 weeks
Frequency of treatment: 5 hr/day on 5 days/week
Post. obs. period: No. The animals were killed immediately after the exposure period.
Doses: 2 +/-1 mg/l
Control Group: yes
LOAEL: <= 2 mg/l
Method: other: Henkel-method "Subchronic inhalation toxicity"
Year: **GLP:** no
Test substance: as prescribed by 1.1 - 1.4
Result: All test animals suffered a respiratory infection but all animals (5/5) survived the treatment. At both gross and histological examinations all animals showed signs of pneumonitis, but there was no indication of any fibrotic reaction. Silicon determinations on the lungs of treated and control animals showed higher concentrations in the treated animals.
Source: Degussa AG Frankfurt am Main

(96)

Species: **Sex:**
Strain:
Route of admin.:
Exposure period:
Frequency of treatment:
Post. obs. period:
Doses:
Control Group:
Method:
Year: **GLP:**
Test substance:
Remark: no data
Source: Zeoline Engis

5.5 Genetic Toxicity 'in Vitro'

Type: Ames test
System of testing: Salmonella typhimurium reverse mutation rates
Concentration: Five half-log doses up to a dose that elicited toxicity
Metabolic activation: with and without
Result: negative
Method: other: OECD guide-line 471, modified according to Haworth et al. (1983)
Year: **GLP:** no data
Test substance: other TS: Zeolite Type A
Source: UOP MS. S.p.A. Assago MI

(144)

Type: Ames test
System of testing: Salmonella typhimurium reverse mutation rates
Concentration: Five half-log doses up to a dose that elicited toxicity
Metabolic activation: with and without
Result: negative
Method: other: OECD guide-line 471, modified according to Haworth et al. (1983)
Year: **GLP:** no data
Test substance: as prescribed by 1.1 - 1.4
Source: Degussa AG Frankfurt am Main

(145)

Type: DNA damage and repair assay
System of testing: no data
Concentration:
Metabolic activation:
Result: negative
Method: other: not specified
Year: GLP: no data
Test substance: no data
Source: Degussa AG Frankfurt am Main

(146)

Type:
System of testing:
Concentration:
Metabolic activation:
Result:
Method:
Year: GLP:
Test substance:
Remark: no data
Source: Zeoline Engis

5.6 Genetic Toxicity 'in Vivo'

Type:
Species: Sex:
Strain:
Route of admin.:
Exposure period:
Doses:
Result:
Method:
Year: GLP:
Test substance:
Remark: no data
Source: Zeoline Engis

Type:
Species: Sex:
Strain:
Route of admin.:
Exposure period:
Doses:
Result:
Method:
Year: GLP:
Test substance:
Remark: No data available.
Source: UOP MS. S.p.A. Assago MI

5.7 Carcinogenicity

Species: rat **Sex:** male/female
Strain: Sprague-Dawley
Route of admin.: i.p.
Exposure period: Lifelong
Frequency of treatment: Once
Post. obs. period: Lifelong
Doses: ca. 100 mg/kg body weight (25 mg in 1 ml H2O per animal)
Result:
Control Group: yes
Method: other: Method described in reference Maltoni (1988)
Year: 1988 **GLP:** no data
Test substance: other TS: Zeolite Type A
Remark: Injection of Zeolite Type A into the intraperitoneal cavity of rats did neither increase the overall rate of tumors, nor increase the percentage of animals bearing malignant mammary tumors or leukemias compared to the negative control. No positive control done. The only noticeable finding was the onset of one (1/40) peritoneal mesothelioma at the site of injection of the test substance, compared to the spontaneous onset rate of mesotheliomas in the test strain of 1 in 800 (3/2381). This mesothelioma arose at a very old age of the animal. Given the high responsiveness of the test animals to mesotheliomatogenic effects of particles injected in the serosal cavities, a major response is expected when mesotheliomatogenic materials are injected. The occurrence of one mesothelioma under the tested experimental conditions is not considered to be a major response.

Source: UOP MS. S.p.A. Assago MI

(147)

Species: rat **Sex:** male
Strain: Wistar
Route of admin.: i.p.
Exposure period: From application until natural excretion of the substance
Frequency of treatment: once
Post. obs. period: two years
Doses: ca. 200 mg/kg body weight (50 mg/animal)
Result:
Control Group: yes
Method: other: Henkel KGaA
Year: **GLP:** no
Test substance: as prescribed by 1.1 - 1.4
Remark: Sasil (sodium aluminosilicate) injected into the intra-peritoneal cavity of rats led to the reversible formation of collagenic fibers. No progression of this connective tissue reaction into the lymphatic glands was observed. Sasil is inert deposited in the lymph knots. 6-24 month after application the substance-related symptoms in the intra-peritoneal cavity vanished. No indication for carcinogenicity of the substance was found.

Source: Degussa AG Frankfurt am Main

(148) (149)

Species: rat **Sex:** male/female
Strain: Sprague-Dawley
Route of admin.: i.p.
Exposure period: From application until natural excretion of the substance
Frequency of treatment: once
Post. obs. period: lifelong
Doses: ca. 100 mg/kg body weight (25 mg in 1 ml H2O per animal)
Result:
Control Group: yes
Method: other: method described in reference: Maltoni (1988)
Year: 1988 **GLP:** no data
Test substance: other TS
Remark: Injection of Zeolite MS 4A into the intraperitoneal cavity of rats did neither increase the overall rate of tumors, nor increase the percentage of animals bearing malignant mammary tumors or leucemias compared to the negative control. No positive control done. The only noticeable finding was the onset of one (1/40) peritoneal mesothelioma at the site of injection of the test substance, compared to the spontaneous onset rate of mesotheliomas in the test strain of 1 in 800 (3/2381). This mesothelioma arose at a very old age of the animal. Given the high responsiveness of the test animals to mesotheliomatogenic effects of particles injected in the serosal cavities, a major response is expected when mesotheliomatogenic materials are injected. The occurrence of one mesothelioma under the tested experimental conditions is not considered to be a major response.
Source: Degussa AG Frankfurt am Main
Test substance: Test substance was sodium aluminosilicate, MS 4A, used for molecular sieves.

(150)

Species: mouse **Sex:** male
Strain: Balb/c
Route of admin.: i.p.
Exposure period: Continuous
Frequency of treatment: Once
Post. obs. period:
Doses: 10 mg suspended in 1 ml saline
Result:
Control Group: yes
Method: other: Method specified in reference: Suzuki et al. (1984)
Year: **GLP:** no data
Test substance: other TS: Zeolite Type A
Remark: All animals sacrificed or found dead between 0 and 23 months after injection were systematically necropsied. Gross anatomical and histological observation were done in all of the animals including the controls. Negative controls were treated with and without saline solution. Positive controls were treated with asbestos or fibrous erionite. Whereas the positive controls developed a significant number of

malignant peritoneal tumors (93/394 animals), the synthetic Zeolite Type A treated animals did not develop peritoneal tumors (0/50 animals). The authors conclude: "It was noteworthy that unlike asbestos or fibrous erionite... synthetic Zeolite Type A did not induce peritoneal tumors suggesting that this subtype of zeolite lacks carcinogenetic effect for the peritoneal tissue."

Source: UOP MS. S.p.A. Assago MI

Test substance: Synthetic, cubic Zeolite Type A from Union Carbide Co. was used. Chemical analysis: 44.2% SiO₂, 38.7% Al₂O₃, 17.1% Na₂O.

(151)

Species: mouse

Sex: male

Strain: Balb/c

Route of admin.: i.p.

Exposure period: From application until natural excretion of the substance

Frequency of treatment: once

Post. obs. period: 23 month

Doses: 10 mg suspended in 1 ml saline

Result:

Control Group: yes

Method: other: method specified in reference: Suzuki et al. (1984)

Year: **GLP:** no data

Test substance: as prescribed by 1.1 - 1.4

Remark: All animals sacrificed or found dead between 0 and 23 months after injection were systematically necropsied. Gross anatomical and histological observations were done in all of the animals including the controls. Negative controls were treated with and without saline solution. Positive controls were treated with asbestos or fibrous erionite. Whereas the positive controls developed a significant number of malignant peritoneal tumors (93/394 animals), the synthetic Zeolite-4A-treated animals did not develop peritoneal tumors (0/50 animals). The authors conclude: " It was noteworthy that unlike asbestos or fibrous erionite ... synthetic zeolite 4A did not induce peritoneal tumor suggesting that this subtype of zeolite lacks carcinogenetic effect for the peritoneal tissue."

Source: Degussa AG Frankfurt am Main

Test substance: Synthetic, cubic Zeolite 4A from Union Carbide Co. was used. Chemical analysis: 44.2% SiO₂, 38.7% Al₂O₃, 17.1% Na₂O.

(152)

Species: rat **Sex:** no data
Strain: no data
Route of admin.: inhalation
Exposure period: 22 months
Frequency of treatment: 3 days/week; 5 hrs/day
Post. obs. period: No data
Doses: No data
Result:
Control Group: no data specified
Method: other
Year: 1980 **GLP:** no data
Test substance: other TS: Zeolite Type A
Remark: Method not described in enough detail.
Result: NO EFFECTS were observed in rats exposed to approximately 20 mg/m³ of Type A zeolite. The only compound related effect observed was the presence of the test material in the Alveolar Macrophage and the Lymph Nodes, indicative of detoxification mechanisms for airborne foreign insoluble particulate matter.
Source: UOP MS. S.p.A. Assago MI

(126)

Species: Syrian hamster **Sex:** male/female
Strain:
Route of admin.: inhalation
Exposure period: One year
Frequency of treatment: Five hours a day, three days a week
Post. obs. period: no
Doses: 20 mg/m³
Result:
Control Group: no
Method: other: Henkel KGaA "Chronic Inhalation Toxicity in Hamster"
Year: 1977 **GLP:** no
Test substance: as prescribed by 1.1 - 1.4
Remark: Result: 30 animals were exposed for 1 year and two weeks to 20 mg/m³ of Zeolite A dust. After the inhalation studie was terminated the animals were sacrificed and macroscopically and histologically examined. The airation of the lungs was good, and no pathologic changes were observed. All other organs were uneffected, too. Histologically, some phagocystic cell-areas, that contain extraneous material were found, mainly at the intraalvaolic space. No increase in reticular or collagenular fibres was detectable. No lung tumors were observed. Therefore, the inhaled dust was deposited inert in the lung tissue.
Source: Degussa AG Frankfurt am Main

(153)

Species: monkey **Sex:** male/female
Strain: Macaca Fascicularis
Route of admin.: inhalation
Exposure period: Six month
Frequency of treatment: Six hours per day, five days per week
Post. obs. period: yes
Doses: 0, 1.2, 6.1, and 44.4 mg/m³
Result:
Control Group: yes
Method: other: Hazelton Laboratories Inc. "Chronic Inhalation Toxicity in Monkeys"
Year: 1977 **GLP:** no data
Test substance: as prescribed by 1.1 - 1.4
Remark: Result: After six month of exposure to Zeolit A dust, no compound-induced functional impairments were noted. Histopathology of the 44.4 mg/m³ exposed test animals showed: Granulomatous lesion, alveolitis and bronchiolitis.
Source: Degussa AG Frankfurt am Main
Test substance: Test substance was Sodium-Aluminosilicate (P&G code UDL 1362)

(154)

Species: rat **Sex:** male/female
Strain:
Route of admin.: oral feed
Exposure period: Two years
Frequency of treatment: Continuous
Post. obs. period:
Doses: Approximately 0.6, 6.0, and 60 mg/kg/day
Result:
Control Group: yes
Method: other: Henkel KGaA "Chronic Toxicity and Carcinogenicity"
Year: 1979 **GLP:** no
Test substance: other TS: Zeolite Type A
Remark: Result:
No difference in body-weight gain was observed between controls (50 males and 50 females) and experimental animals. The organ weights of the male animals showed no significant differences when compared to control values. In the females, the relative weights of the adrenal glands of the 0.6 mg/kg/day group as well as the thymus of the 6.0 and 60 mg/kg/day groups differed significantly from those of the controls. No significant incidence of the particular type of tumor or of spontaneous mortality was evident in any group. No treatment-related findings were seen in any of the organs examined histologically, and there was no indication of any treatment-related induction of neoplasms.
Source: UOP MS. S.p.A. Assago MI

(155)

Species: rat **Sex:** male/female
Strain:
Route of admin.: oral feed
Exposure period: two years
Frequency of treatment: continuous
Post. obs. period: two years
Doses: Approximately 0.6, 6.0, and 60 mg/kg/day
Result:
Control Group: yes
Method: other: Henkel KGaA "Chronic Toxicity and Carcinogenicity"
Year: 1979 **GLP:** no
Test substance: as prescribed by 1.1 - 1.4
Remark: Result: No difference in body-weight gain was observed between controls (50 males and 50 females) and experimental animals. The organ weights of the male animals showed no significant differences when compared to control values. In the females, the relative weights of the adrenal glands of the 0.6 mg/kg/day group as well as the thymus of the 6.0 and 60 mg/kg/day groups differed significantly from those of the controls. No significant incidence of a particular type of tumor or of spontaneous mortality was evident in any group. No treatment-related findings were seen in any of the organs examined histologically, and there was no indication of any treatment-related induction of neoplasms.
Source: Degussa AG Frankfurt am Main

(96)

Species: **Sex:**
Strain:
Route of admin.:
Exposure period:
Frequency of treatment:
Post. obs. period:
Doses:
Result:
Control Group:
Method:
Year: **GLP:**
Test substance:
Remark: no carcinogenicity
Source: Zeoline Engis

5.8 Toxicity to Reproduction

Type:
Species: **Sex:**
Strain:
Route of admin.:
Exposure Period:
Frequency of treatment:
Duration of test:
Doses:
Control Group:
Method:
Year: **GLP:**
Test substance:
Remark: no data
Source: Zeoline Engis

Type:
Species: **Sex:**
Strain:
Route of admin.:
Exposure Period:
Frequency of treatment:
Duration of test:
Doses:
Control Group:
Method:
Year: **GLP:**
Test substance:
Remark: No data available.
Source: UOP MS. S.p.A. Assago MI

5.9 Developmental Toxicity/Teratogenicity

Species: rat **Sex:** no data
Strain: no data
Route of admin.: gavage
Exposure period: 6-15 days
Frequency of treatment: Daily on days 6-15 of pregnancy
Duration of test: No data
Doses: 74 mg/kg
Control Group: yes, concurrent vehicle
Method: other
Year: 1978 **GLP:** no data
Test substance: other TS: Zeolite Type A
Remark: No data with regard to method.
Result: NO EFFECTS were seen from zeolite Type A on maternal health, fetal growth or soft or hard tissue abnormalities.
Source: UOP MS. S.p.A. Assago MI

(156)

Species: rat **Sex:** no data
Strain: Sprague-Dawley
Route of admin.: gavage
Exposure period: During days 6-15
Frequency of treatment:
Duration of test:
Doses: 74 and 1600 mg/kg body weight
Control Group: yes
NOAEL Maternalt.: >= 1600 mg/kg bw
NOAEL Teratogen.: >= 1600 mg/kg bw
Method: other: Standard FDA Segment II Protocol
Year: **GLP:** no data
Test substance: other TS: Zeolite Type A
Remark: No experimental data given. The authors state "Synthetic Type A Zeolite produced no adverse effects on the dam, the embryo or the fetus at any doses tested. The detergent builder zeolite A does not present a teratogenic hazard to the consumer".
Source: UOP MS. S.p.A. Assago MI
Test substance: Detergent-type Zeolite A, containing 15,8% sodium, 19.0% silicon, and 20.1% aluminum.

(157)

Species: rat **Sex:** no data
Strain: Sprague-Dawley
Route of admin.: gavage
Exposure period: during days 6-15
Frequency of treatment:
Duration of test:
Doses: 74 and 1600 mg/kg body weight
Control Group: yes
NOAEL Maternalt.: >= 1600 mg/kg bw
NOAEL Teratogen.: >= 1600 mg/kg bw
Method: other: Standard FDA Segment II Protocol
Year: **GLP:** no data
Test substance: as prescribed by 1.1 - 1.4
Remark: No experimental data given. The authors state "Synthetic type A zeolite produced no adverse effects on the dam, the embryo or the foetus at any doses tested. The detergent builder zeolite A does not present a teratogenic hazard to the consumer".
Source: Degussa AG Frankfurt am Main
Test substance: Detergent-type Zeolite A, containing 15.8% sodium, 19.0% silicon, and 20.1% aluminum.

(158)

Species: **Sex:**
Strain:
Route of admin.:
Exposure period:
Frequency of treatment:
Duration of test:
Doses:
Control Group:
Method:
Year: **GLP:**
Test substance:
Remark: no data
Source: Zeoline Engis

5.10 Other Relevant Information

Type: Cytotoxicity
Remark: Several zeolites have been evaluated for the LC50 using the rabbit alveolar macrophage (RAM) test to estimate pulmonary effects in vitro. Th isolated macrophages are incubated with the test substance for 20 h and the percent of viable cells is recorded. It was found that potassium aluminosilicate has a LC50-value of > 1.000 ug/ml. Assessing cytotoxicity by the standard EPA guidelines, potassium and by analogy sodium aluminosilicate is considered relatively non-toxic.
Source: UOP MS. S.p.A. Assago MI (159)

Type: Cytotoxicity
Remark: Several zeolites have been evaluated for the LC50 using the rabbit alveolar macrophage (RAM) test to estimate pulmonary effects in vitro. The isolated macrophages are incubated with the test substance for 20 h and the percent of viable cells is recorded. It was found that potassium aluminosilicate has a LC50-value of > 1.000 ug/ml. Assessing cytotoxicity by the standard EPA guidelines, potassium and by analogy sodium aluminosilicate is considered relatively non-toxic.
Source: Degussa AG Frankfurt am Main (160)

Type: other: Developmental toxicity of naturally occurring zeolites
Remark: Test conditions: Two-generation study on Sprague-Dawley rats. The substance (5 %) was administered continuously in the diet to the female animals for 30 weeks.
 Result: Treatment was not associated with observable toxicity or teratogenic effects.
 NOEL (F1 offspring) = 5 %.
Source: Degussa AG Frankfurt am Main
Test substance: Analogy! Clinoptilolite, a naturally occurring zeolite of 72% purity was used. Chemical analysis: 15.4% moisture, 12.2% Al2O3, 63.4% SiO2.

(161)

Type: other: Reproductive toxicity of naturally occurring zeolites
Remark: Test conditions: Two-generation study on Sprague-Dawley rats. The substance (5 %) was administered continuously in the diet to the female animals for 30 weeks.

Result: NOEL (parental) = 5 %, NOEL (F1 offspring) = 5 %.

It is concluded by the authors that clinoptilolite at 5% in the diet of the rat throughout the postweaning portion of the life cycle and through one reproduction and lactation period is not associated with observable toxicologic or teratogenic effects. Neither weight gain, nor litter size or litter weight was effected by the zeolit-containing diet.

Source: Degussa AG Frankfurt am Main
Test substance: Analogy! Clinoptilolite, a naturally occurring zeolite of 72% purity was used. Chemical analysis: 15.4% moisture, 12.2% Al₂O₃, 63.4% SiO₂.

(161)

Type:
Remark: no data
Source: Zeoline Engis

5.11 Experience with Human Exposure

Remark: no additional remarks
Source: Zeoline Engis

Remark: See previous entry 5.2.1
Source: UOP MS. S.p.A. Assago MI

Remark: Cotton- or polyester-patches were washed several times with a Zeolite A-containing detergent. Bound Zeolite A analyzed. It was found that cotton accumulated 2-6 times more Zeolite A (approximately 25.000 ppm) than polyester. The zeolite A-contaminated patches were applied for 48 h by Finn-Chambers onto the backs of 40 healthy volunteers (20 seborrheic type, 20 sebostatic type) to test for skin irritation. Scores were recorded 20 min, 24 h, and 48 h after removal of the patches. Result: all subjects tolerated the washed patches without any skin reaction.

In a second experiment, a wear-test was conducted in 15 children, age between 7 month and 6 years. Similar washed cotton T-shirts (ca. 8.000 ppm Zeolite A bound) were worn by the children for up to 11 days. Neither was a case of a skin reaction seen, nor did the children complain any unpleasant skin sensations.

This experiment leads to the conclusion, that the on the clothes remaining amounts of Zeolite A do not pose a risk for skin irritation for consumers, to even for the sensitive skin of babies.

Source: Degussa AG Frankfurt am Main

(162)

Remark:

Twelve healthy non-smoking male volunteers inhaled monodisperse 1 and 4 μm diam. fused aluminosilicate particles, labeled with $[85]\text{Sr}$ and $[88]\text{Y}$, respectively. Retention was followed for 372-533 days. Approximately 7% of the initial lung deposit of 1 μm particles and 40% of the 4 μm particles were rapidly cleared from the lung. Retention of the remaining material generally followed a 2 component exponential funktion, the phases having half-times of the order of tenth of days and several hundred of days, respectively.

Source:

Degussa AG Frankfurt am Main

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7.1 Risk Assessment

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