I U C L I D

Data Set

Existing Chemical	:	ID: 141-53-7
CAS No.	:	141-53-7
EINECS Name	:	sodium formate
EINECS No.	:	205-488-0
TSCA Name	:	Formic acid, sodium salt
Molecular Formula	:	CH2O2.Na
Printing date	:	19.12.2001
Revision date	:	
Date of last Update	:	19.12.2001
Number of Pages	:	24
Chapter (profile)	:	Chapter: 1, 2, 3, 4, 5, 7
Reliability (profile)	:	Reliability: without reliability, 1, 2, 3, 4
Flags (profile)	:	Flags: without flag, confidential, non confidential, WGK (DE), TA-Luft (DE), Material Safety Dataset, Risk Assessment, Directive 67/548/EEC, SIDS

1.0.1 OECD AND COMPANY INFORMATION

Type : lead organisation
Name : American Chemistry Council, Formates Panel
Partner :
Date :
Street : 1300 Wilson Boulevard
Town : 22209 Arlington, VA
Country : United States
Phone :
Telefax :
Telex :
Cedex :
25.05.2001

Type : cooperating company
Name : BASF Corporation
Partner :
Date :
Street :
Town :
Country :
Phone :
Telefax :
Telex :
Cedex :
19.12.2001

Type : cooperating company
Name : Bayer Corporation
Partner :
Date :
Street :
Town :
Country :
Phone :
Telefax :
Telex :
Cedex :
19.12.2001

Type : cooperating company
Name : Celanese Ltd
Partner :
Date :
Street :
Town :
Country :
Phone :
Telefax :
Telex :
Cedex :
19.12.2001

Type : cooperating company
Name : GEO Specialty Chemicals
Partner :
Date :
Street :

Town :
Country :
Phone :
Telefax :
Telex :
Cedex :
19.12.2001

Type : cooperating company
Name : Hercules Inc
Partner :
Date :
Street :
Town :
Country :
Phone :
Telefax :
Telex :
Cedex :
19.12.2001

1.1 GENERAL SUBSTANCE INFORMATION

Substance type : organometallic
Physical status : solid
Purity : % w/w
Test substance : Varies
19.12.2001

25.05.2001

1.2 SYNONYMS

Ameisensaeure, Natriumsalz
25.05.2001

Formic acid, sodium salt
25.05.2001

Natriumformiat
25.05.2001

Sodium methanoate
25.05.2001

2.1 MELTING POINT

Value	:	= 253 ° C
Sublimation	:	
Method	:	
Year	:	
GLP	:	no
Test substance	:	
Reliability	:	(2) valid with restrictions

25.05.2001 (22)

2.2 BOILING POINT

2.4 VAPOUR PRESSURE

Value	:	= 0 at ° C
Remark	:	This material is a solid salt and as such is considered to have negligible vapor pressure. It should be kept in mind, however, that it is in equilibrium with formic acid in solution and volatilization from solution is therefore pH dependent.
Conclusion		Material considered non-volatile as a dry solid.
Reliability	:	(4) not assignable

13.11.2001 (22)

2.5 PARTITION COEFFICIENT

2.6.1 WATER SOLUBILITY

Value	:	= 550 g/l at 20 ° C
Qualitative	:	
Pka	:	at 25 ° C
PH	:	ca. 9 - 10 at 50 g/l and 20 ° C
Source	:	Huels AG Marl
Reliability	:	(2) valid with restrictions

25.05.2001 (22) (25)

3.1.1 PHOTODEGRADATION

Type	:	other
Light source	:	
Light spect.	:	nm
Rel. intensity	:	based on Intensity of Sunlight
Remark	:	Since this material is not volatile, the only potential photolytic reaction that needs to be considered is direct photolysis at the earths surface. Direct photolysis is not possible because this material does not have a chromophore absorbing at a wavelength of 290 nm or above, and the presence of such a chromophore is a necessary condition for photolysis.
Reliability	:	(4) not assignable

14.11.2001 (17)

3.1.2 STABILITY IN WATER

Type	:	abiotic
t1/2 pH4	:	at degree C
t1/2 pH7	:	at degree C
t1/2 pH9	:	at degree C
Remark	:	Disassociates in water to sodium ion and formate ion. Both of these are considered stable in water. A carboxylic acid is generally the final product of hydrolysis reactions
Reliability	:	(4) not assignable

14.11.2001 (16)

3.3.2 DISTRIBUTION

Media	:	air - biota - sediment(s) - soil - water
Method	:	Calculation according Mackay, Level III
Year	:	2001
Remark	:	Assumptions used in model:

Molecular Wt: 68.01
Henry's LC : 7.53e-007 atm-m3/mole (Henrywin program)
Vapor Press : 7.53e-008 mm Hg (Mpbpwin program)
Liquid VP : 9.87e-007 mm Hg (super-cooled)
Melting Pt : 138 deg C (Mpbpwin program)
Log Kow : -4.27 (Kowwin program)
Soil Koc : 2.2e-005 (calc by model)

Half-Lives (hr), (based upon user-entry)*
Air: 504
Water: 120
Soil: 120
Sediment: 1440

* This calculation was conducted using a water half-life of 120 hours based

on actual data. The soil half-life was estimated at 120 hours on the basis of the water value. Air half-life was set at 504 hours which is the model calculated result for formic acid. This was done presuming that volatilized material would exist primarily as formic acid.

Result :

	Concentration (percent)	Half-Life (hr)	Emissions (kg/hr)
Air	7.11	1e+005	1000
Water	48.7	360	1000
Soil	44.1	360	1000
Sediment	0.0811	1.44e+003	0

	Fugacity (atm)	Reaction (kg/hr)	Advection (kg/hr)	Reaction (percent)	Advection (percent)
Air	7.03e-011	51.4	374	1.71	12.5
Water	1.03e-011	1.07e+003	186	35.7	6.19
Soil	4.67e-010	1.32e+003	0	43.9	0
Sed	8.56e-012	0.149	0.00619	0.00496	0.000206

Persistence Time: 150 hr
Reaction Time: 185 hr
Advection Time: 807 hr
Percent Reacted: 81.3
Percent Advected: 18.7

Half-Lives (hr), (based upon user-entry):
Air: 504
Water: 120
Soil: 120
Sediment: 1440

Advection Times (hr):
Air: 100
Water: 1000
Sediment: 5e+004

Advection Time: 1.19e+003 hr
Percent Reacted: 68.8
Percent Advected: 31.2

Test substance : Sodium Formate CAS Number 141-53-7
Reliability : (2) valid with restrictions
19.12.2001 (7)

3.5 BIODEGRADATION

Type : aerobic
Inoculum : activated sludge, domestic
Concentration : 20mg/l related to DOC (Dissolved Organic Carbon) related to
Contact time :
Degradation : = 92 % after 21 day
Result : readily biodegradable

Deg. Product	:	
Method	:	
Year	:	1981
GLP	:	no
Test substance	:	
Method	:	OECD Guide–line 301 E "Ready biodegradability: Modified OECD Screening Test"
Source	:	Huels AG Marl
Test substance	:	Sodium Formate, CAS Number 141-53-7
Reliability	:	(2) valid with restrictions

15.11.2001 (12)

Type	:	aerobic
Inoculum	:	domestic sewage
Concentration	:	300mg/l related to DOC (Dissolved Organic Carbon) related to
Contact time	:	9 day
Degradation	:	= 100 % after 9 day
Result	:	inherently biodegradable
Deg. Product	:	
Method	:	
Year	:	1985
GLP	:	
Test substance	:	
Method	:	OECD Guide–line 302 B "Inherent biodegradability: Modified"
Remark	:	Inoculum: activated sludge, domestic
Source	:	Huels AG Marl
Test substance	:	Sodium Formate, CAS Number 141-53-7
Conclusion	:	inherently biodegradable
Reliability	:	(4) not assignable

19.12.2001 (11)

Type	:	aerobic
Inoculum	:	domestic sewage
Concentration	:	10mg/l related to DOC (Dissolved Organic Carbon) related to
Contact time	:	
Degradation	:	= 97.5 % after
Result	:	inherently biodegradable
Method	:	OECD Guide–line 303 A "Simulation Test – Aerobic Sewage"
Remark	:	The 97,5 % loss of DOC refers to an average retention time of 3 hours.
Source	:	Huels AG Marl
Test substance	:	Sodium Formate, CAS Number 141-53-7
Reliability	:	(4) not assignable

19.12.2001 (12)

4.1 ACUTE/PROLONGED TOXICITY TO FISH

Type	:	flow through
Species	:	Pimephales promelas (Fish, fresh water)
Exposure period	:	96 hour(s)
Unit	:	mg/l
Analytical monitoring	:	yes
NOEC	:	m = 954
LC0	:	m = 954
LC50	:	c > 1000
Method	:	EPA OTS 797.1400
Year	:	1990
GLP	:	yes
Test substance	:	
Method	:	The study was conducted using a flow-through design at 5 nominal concentrations (63, 125, 250, 500 and 1000 mg/L) test material. Actual concentrations were measured (duplicate) at the beginning and end of the 96-hour exposure period and the means were: 58, 116, 223, 461 and 954 mg/L. Dilution water was blended soft water with a hardness of 40-48 mg/L, alkalinity of 52-56 mg/L, and a pH of 7.4 to 7.5. Twenty fish (mean weight 0.23 g) per concentration were exposed using a flow rate of 6.4 volume replacements per day for the 30-liter aquaria. Fish were observed daily for mortality and compound related sub-lethal effects. Temperature, oxygen levels and pH were measured at 0, 48 and 96 hours.
Result	:	No mortality or sub-lethal effects were observed at any concentration. Oxygen, temperature and pH were within the protocol specified limits. The measure concentrations were similar to the target (nominal) concentrations.
Source	:	Celanese Ltd
Test substance	:	Sodium formate, described as white granules, received from Hoechst Celanese Corporation coded C-01261. Purity not specified.
Conclusion	:	Under these conditions, the LC50, LC0 and NOEC were all greater than 954 mg/L. The LC50 is greater than 1000 mg/L
Reliability	:	(1) valid without restriction

26.05.2001 (3)

Type	:	flow through
Species	:	Salmo gairdneri (Fish, estuary, fresh water)
Exposure period	:	96 hour(s)
Unit	:	mg/l
Analytical monitoring	:	yes
NOEC	:	m > 887
LC0	:	m > 887
LC50	:	c > 1000
Method	:	EPA OTS 797.1400
Year	:	1990
GLP	:	yes
Test substance	:	
Method	:	The study was conducted using a flow-through design at 5 nominal concentrations (63, 125, 250, 500 and 1000 mg/L) test material. Actual concentrations were measured (duplicate) at the beginning and end of the 96-hour exposure period and the means were: 54, 105, 215, 443 and 887 mg/L. Dilution water was blended soft water with a hardness of 48 mg/L, alkalinity of 56-58 mg/L, temperature from 12-13

degrees and a pH of 7.7 to 7.8. Twenty fish (mean weight 0.70 g) per concentration were exposed using a flow rate of 6.4 volume replacements per day for the 30-liter aquaria. Fish were observed daily for mortality and compound related sub-lethal effects. Temperature, oxygen levels and pH were measured at 0, 48 and 96 hours.

Result : No mortality or sub-lethal effects were observed at any concentration. Oxygen, temperature and pH were within the protocol specified limits. The measured concentrations were similar to the target (nominal) concentrations.
Source : Celanese Ltd
Test substance : Sodium formate, described as white granules, received from Hoechst Celanese Corporation coded C-01261. Purity not specified.
Conclusion : Under these conditions, the LC50, LC0 and NOEC were all greater than 887 mg/L. The LC50 is greater than 1000 mg/L
Reliability : (1) valid without restriction
26.05.2001 (1)

Type : static
Species : Leuciscus idus (Fish, fresh water)
Exposure period : 48 hour(s)
Unit : mg/l
Analytical monitoring :
LC50 : m > 1000
Method :
Year :
GLP : no
Test substance :
Method : other: Bestimmung der Wirkung von Wasserinhaltsstoffen auf Fische, DIN 38412 Teil 15 (Determination of the effect of substances contained in water on fish, DIN 38412 part of 15)
Source : Huels AG Marl
Test substance : Sodium Formate, CAS Number 141-53-7
Reliability : (4) not assignable
15.11.2001 (13)

Type : static
Species : Lepomis macrochirus (Fish, fresh water)
Exposure period : 24 hour(s)
Unit : mg/l
Analytical monitoring :
LC50 : m = 5000
Method :
Year : 1965
GLP :
Test substance :
Method : other: Standard method for the determination of the fish toxicity of pure substances after Freeman
Source : Huels AG Marl
Test substance : Sodium Formate, CAS Number 141-53-7
Reliability : (4) not assignable
Rated as 4 since relies on secondary (IUCLID) reference.
15.11.2001 (9) (10)

4.2 ACUTE TOXICITY TO AQUATIC INVERTEBRATES

Type : flow through
Species : Daphnia magna (Crustacea)
Exposure period : 48 hour(s)

Unit	:	mg/l
Analytical monitoring	:	yes
NOEC	:	m = 120
EC0	:	m = 247
EC50	:	m > 1070
Method	:	
Year	:	1990
GLP	:	yes
Test substance	:	
Method	:	The study was conducted using a flow-through design at 5 nominal concentrations (60, 120, 250, 500 and 1000 mg/L) test material. Actual concentrations were measured (duplicate) at the beginning and end of the 96-hour exposure period and the means were: 74, 122, 247, 447 and 1070mg/L. Dilution water was blended well water/RO water with a hardness of 178 mg/L, alkalinity of 210 mg/L, and a pH of 7.8. Twenty first-instar daphnids per concentration were exposed (four replicate chambers of five daphnids at each concentration plus control) using a flow rate of 6.1 volume replacements per day for the 1-liter test chambers containing five daphnids each. Daphnids were observed daily for mortality and compound related sub-lethal effects. Temperature, oxygen levels, pH and test material concentrations were measured at 0 and 48 hours.
Result	:	The mortality and extent of sublethal effects are shown in the table.

		MORTALITY		
Nom. Conc	Meas Conc	24 hr	48 hr	Other Effects
0	0	1	1	none
60	74	1	1	none
120	122	0	0	none
250	247	0	0	very few
599	447	1	1	ffew
1000	1070	1	1	Many

Test substance	:	Sodium formate, described as white granules, received from Hoechst Celanese Corporation coded C-01261. Purity not specified.
Conclusion	:	Under these conditions, the EC50 for daphnids was greater than 1070 mg/L, the NOEC was 122 mg/L.
Reliability	:	(1) valid without restriction

19.12.2001 (2)

4.3 TOXICITY TO AQUATIC PLANTS E.G. ALGAE

Species	:	Selenastrum capricornutum (Algae)
Endpoint	:	growth rate
Exposure period	:	
Unit	:	mg/l
Analytical monitoring	:	yes
NOEC	:	m = 125
EC10	:	c = 99
EC50	:	c = 790
Method	:	other
Year	:	1990
GLP	:	yes
Test substance	:	
Method	:	Two preliminary toxicity tests were conducted to set concentration levels for the definitive test. In the first

96-hour preliminary test, test concentrations of 1, 10 or 100 mg/L produced growth inhibitions of 0, 18 or 50%, respectively. The second preliminary test was started as a definitive test with triplicate cultures at concentrations of 20, 40, 80, 160 or 320 mg/L. Algal cells counts in this study wer 110, 110, 110, 110 or 86 % of the control population. Thus it was determined that there was an insufficient inhibitory response to define the IC50 and a final definitive test was set up. Algal media was inoculated with 1 million cells of test organism into triplicate 250 ml flasks, closed with a foam plug, containing 100 ml algal growth media. Dilutions of test material in growth media were prepared from a 1000 mg/L stock of test material in growth media. Flasks were incubated and agitated (100 rpm) in random positions for 96 hours under 4300 Lux lighting at 24 degrees C. Cell counts were conducted daily for each test replicate using a hemacytometer and compound microscope. Concentration of test material in the media was determined at the beginning and end of the incubation period and mean concentrations reported. Cell counts for each replicate and controls were subjected to analysis of variance (ANOVA) followed by Dunnett's test accepting p< 0.05 as significant. IC50 values were calculated from a regression plot. Two regression plots were constructed using either the mean cell count or the log of the cell count. The regression equation giving the best fit was used to determine the IC50.
.

Remark : Supported by a 1984 Huels study reported in IUCLID 2000, in which the EC50 for Scenedesmus subspicatus was reported to be greater than or equal to 1000 mg/L.
.

Result : Measured concentrations were very close to nominal concentrations, the concentration at termination was similar to the starting concentration and no loss of test material was apparent. Concentrations above 250 mg/L were inhibitory and the data are shown in the table.

Mean cells counts were as follows:

Nomin Conc	Meas Conc	TIME (hours) 24	48	72	96
0(mg/L)	<5	2.9	12	45	140
63	58.3	2.0	8.2*	40	140
125	121	1.1*	8.3*	30*	110
250	243	1.3*	6.8*	28*	93*
500	498	0.78*	4.6*	27*	88*
1000	1001	0.93*	3.5*	8*	61*

Counts are in units of 10,000 cells/ml
* Denotes significant inhibition at p<0.0

A quadratic equation was developed using percent difference in cell count from control versus ln concentration. From this equation, the EC50 was calculated to be 790 mg/L and the EC10 as 99 mg/L (based on nominal concentrations). The NOEC is considered to be 125 mg/L.

Test substance : Sodium formate, described as white granules, received from Hoechst Celanese Corporation coded C-01261. Purity not specified.

Conclusion : Under these conditions, the 96-hour EC50 for algal growth was 790 mg/L and the NOEC was estimated to be 125 mg/L. The

EC10 was calculated to be 99 mg/L from thje regression equation.

Reliability : (1) valid without restriction
15.11.2001 (4)

4.7 BIOLOGICAL EFFECTS MONITORING

Method : Transport Canada conducted and environmental assessment to compare the use of sodium formate (NaFo) with urea as a runway anti-icer/deicer at the Halifax International Airport. Over the winter of 1991-92, 16 tons of NaFo were used on a taxiway with a unique drainage system so that potential environmental effects of NaFo could be identified. Urea was used on two runways and its effects wre compared with those from NAFo. Streams and groundwater were monitored for several parameters with the following issues of primary importance:

* The effect on ground and surface water, especially oxygen depletion
* The effect on the microbial community
* The effect on aquatic biota
* The mobilization of metals
* The effect on vegetation

The effects of sodium formate on surface vegetation growth were also determined in a greenhouse study in which sodium formate solution was applied bi-weekly to representative plants at rates from 0.1 to 48 grams per square meter of soil. Biweekly concentrations at and above 33 g/m2 reduced plant biomass growth. These inhibitory concentrations are, however, very high concentrations that would not be encountered in this application of sodium formate.

Remark : Year 1992

Conclusion : The effects of sodium formate on surface vegetation growth were also determined in a greenhouse study in which sodium formate solution was applied bi-weekly to representative plants at rates from 0.1 to 48 grams per square meter of soil. Biweekly concentrations at and above 33 g/m2 reduced plant biomass growth. These inhibitory concentrations are, however, very high concentrations that would not be encountered in this application of sodium formate.

The conclusions drawn are: The use of sodium formate as a de-icing agent applied during the winter of 1991-1992 at the Halifax international airport, appears to have had no effect on.

1. The in situ concentration of total heterotrophic bacteria whether these were either aerobic or anerobic and either psychrophilic of mesophilic bacteria.
2. The in situ concentrations of fungi, whether these fungi were either psychrophilic or mesophilic moulds.
3. The soil respiration characteristics of the rate of carbon dioxide evolved, the proportion of organic carbon metabolized, or the temperature coefficient Q10.
4. Application of NaFo to vegetated soil from the NaFo test area when applied biweekly at concentrations of less than 2000 mg NaFo/L did not appear to inhibit vegetative plant growth. Application of NaFo at greater concentrations, specifically 3500 and 5000 mg NaFo/L did inhibit vegetative plant growth appreciably (approximately 65 percent and 70 percent respectively).
5. When NaFo was applied in single applications, the inhibition of surface vegetative growth was directly proportional to the mass of NaFo applied. Application of 500 mg NaFo/kg, which is equivalent to 84.5 g/m2 ,

caused 50 percent inhibition. Concentrations of between 1000 and 3500 mg/kg (169 and 591.5 g/M2 respectively) caused approximately 75 percent inhibition and 5000 mg/kg (845 g/m2) caused approximately 95 percent inhibition.
6. Results of the microbiological evaluation tests suggest that, except.at unusually high concentrations of NaFo that are unlikely to be encountered during normal use as a de?icing agent, NaFo causes no deleterious disruptions in the in situ microbiological populations.

Results of the vegetative surface growth tests suggest that when NaFo is applied in moderate concentrations over a prolonged period of time at concentrations of less than 2000 mg NaFo/1, no deleterious disruptions in the plant life may be expected. However, spills of solid NaFo on vegetated surfaces should be avoided, as doses of as little as 1.69 g NaFo/M2 may cause deleterious disruptions in the surface plant growth.

Reliability : (1) valid without restriction
15.11.2001 (26)

13.09.2001

Method :
Conclusion : The conclusions drawn are: The use of sodium formate as a de-icing agent applied during the winter of 1991-1992 at the Halifax international airport, appears to have had no effect on.
1. The in situ concentration of total heterotrophic bacteria whether these were either aerobic or anerobic and either psychrophilic of mesophilic bacteria.
2. The in situ concentrations of fungi, whether these fungi were either psychrophilic or mesophilic moulds.
3. The soil respiration characteristics of the rate of carbon dioxide evolved, the proportion of organic carbon metabolized, or the temperature coefficient Q10.
4. Application of NaFo to vegetated soil from the NaFo test area when applied bi?weekly at concentrations of less than 2000 mg NaFo/L did not appear to inhibit vegetative plant growth. Application of NaFo at greater concentrations, specifically 3500 and 5000 mg NaFo/L did inhibit vegetative plant growth appreciably (approximately 65 percent and 70 percent respectively).
5. When NaFo was applied in single applications, the inhibition of surface vegetative growth was directly proportional to the mass of NaFo applied. Application of 500 mg NaFo/kg, which is equivalent to 84.5 g/m2 , caused 50 percent inhibition. Concentrations of between 1000 and 3500 mg/kg (169 and 591.5 g/M2 respectively) caused approximately 75 percent inhibition and 5000 mg/kg (845 g/m2) caused approximately 95 percent inhibition.
6. Results of the microbiological evaluation tests suggest that, except.at unusually high concentrations of NaFo that are unlikely to be encountered during normal use as a de?icing agent, NaFo causes no deleterious disruptions in the in situ microbiological populations.

13.09.2001

5.1.1 ACUTE ORAL TOXICITY

Type	:	LD50
Species	:	rat
Strain	:	
Sex	:	
Number of animals	:	
Vehicle	:	
Value	:	> 3000 mg/kg bw
Method	:	OECD Guide-line 401 "Acute Oral Toxicity"
Year	:	1989
GLP	:	no
Test substance	:	as prescribed by 1.1 - 1.4
Remark	:	Information obtained from the IUCLID 2000 document. This is listed as an unpublished study by Hules dated 1989. The full report was not available for review.
Source	:	Huels AG Marl
Test substance	:	Sodium Formate, CAS Number 141-53-7
Reliability	:	(4) not assignable Assigned as 4 since it relies on a secondary source (IUCLID 2000)

15.11.2001 (15)

Type	:	LD50
Species	:	mouse
Strain	:	C57BL
Sex	:	
Number of animals	:	
Vehicle	:	
Value	:	= 4700 mg/kg bw
Method	:	
Year	:	1982
GLP	:	no data
Test substance	:	
Remark	:	C57BL/6Cs folic acid deficient (FAD) mice were used in this study. 12 weeks prior to LD50 determination, 6 mice were fed a diet supplemented with 3 mg of folic acid/kg diet. 6 mice received a diet without folic acid supplements. FAD–mice fed with a supplemented diet showed a slightly higher LD50 (4700 mg/kg) than mice fed a diet without folic acid supplements (LD50 3700 mg/kg).
Source	:	Huels AG Marl
Test substance	:	Sodium Formate, CAS Number 141-53-7
Reliability	:	(2) valid with restrictions

15.11.2001 (23)

Type	:	LD50
Species	:	mouse
Strain	:	
Sex	:	
Number of animals	:	
Vehicle	:	
Value	:	= 11200 mg/kg bw
Method	:	
Year	:	1969
GLP	:	no
Test substance	:	
Method	:	Details not provided except that it was part of a series of studies of formic acid and four formate salts and that 54 animals were used to determint the

LD50.

Result :

The LD50 range for sodium formate was given as 9,600 to 12,800

Source : Huels G AG, Literature

Test substance :

Sodium Formate, CAS Number 141-53-7

Reliability : (2) valid with restrictions

Assigned as 2 since it was published with the acute toxicity of several other formates and it fits the expected pattern.

19.12.2001 (19)

5.1.2 ACUTE INHALATION TOXICITY

Type : LC0
Species : rat
Strain : Sprague-Dawley
Sex : male/female
Number of animals :
Vehicle :
Exposure time : 4 hour(s)
Value : > .67 mg/l
Method : other
Year : 1990
GLP : yes
Test substance :
Method : The solid test material was milled to a fine powder and placed in a glass fluidizing bed. The material was aerosolized using a flow of 30 liters per minute and the dust from the bed was swept at a rate of 5 L/min into a 100 liter plexiglass exposure chamber. The flow rate was 35 L/min, providing an air change every 2.9 minutes. This was considered the maximum level of dust practically attainable with the equipment. It was determined gravimetrically to contain 0.67 mg/L (nominal concentration based on material loss was 10 mg/L) and have a MMAD of 5.4 microns with an Average Geometric Standard Deviation of 2.4. This aerosol was considered respirable. Five animals (males, 9 weeks of age, weight range 321-344 g; females 10 weeks of age, weight range 223-254 g) of each sex were exposed for 4 hours. Animals remained in the chamber for 30 minutes after the test material was cleared from the breathing air. Animals were doubly housed during the acclimation and post-exposure 14-day observation period and singly housed during the exposure. Animals were observed at 0, 15, 30, 45, 60, 120, 180 and 240 minutes during the 4-hour exposure, then examined daily for 14 days. Surviving animals were sacrificed after 14 days and submitted to a gross necropsy. The chamber temperature was 25 degrees and the relative humidity ranges for 17% to 6% with the lower values in the latter part of the study (considered a result of the dessicant activity of fine particles of sodium formate) Chamber concentration of test material was measured at nine intervals during the study and ranged from 0.5 to 0.86 mg/L.

Result : There were no deaths during the exposure or the 14-day observation period. Adverse clinical sighs were minimal and consisted of decreased activity and eyes partly or fully closed during the exposure and lacrimation and nasal discharge but generally fully recovered within a week. There was a slight and transient reduction in body weight gain (or

weight loss) following the exposure but all animals continued to gain weight a few days after the exposure period:

MEAN BODY WEIGHTS (grams) Exposure 0.67 mg/L (4 hours)

DAY	MALES	FEMALES
1	337	235
2	333	230
5	344	236
8	365	244
15	414	255

There were no treatment-related findings at gross necropsy.

Source : Celanese Ltd

Test condition : C-1261 (Sodium Formate), purity 99% active ingredient. The test material was milled by Sturtevant Inc (Boston) on 8 November 1989 and then sent to BioDynamics.

Conclusion : Exposure of rats to the highest practical aerosol concentration of test material, with a large portion in the respirable range, was not associated with adverse effect other than eye and nasal irritation. The acute inhalation LC50 is greater than 0.67 mg/L for a four-hour inhalation exposure.

15.11.2001 (6)

5.4 REPEATED DOSE TOXICITY

Species : rat
Sex : male/female
Strain : Wistar
Route of admin. : drinking water
Exposure period : Lifetime
Frequency of treatment : Continuous
Post obs. period :
Doses : 1.0%
Control group :
Method :
Year :
GLP : no
Test substance :
Method :

The study design encompassed both a five-generation and chronic study in Wistar rats with sodium formate at 1.0% in drinking water. Eight males and 24 females were in the original test group with four controls of each sex. Both microscopic and pathologic investigations were to be done upon natural death of the animals. At the time of this report the study had completed 1.5 years. Studies with calcium formate had been completed and were reported.

Remark :

Almost no specific details were given of the results of the 1% sodium formate multigeneration study. The indication in the summary was that adverse effects were not observed in the ongoing sodium formate drinking-

water study. Due to the lack of details it cannot be confirmed that this was actually the case. In addition the pathological evaluation of the animals had not been conducted.

A group of dogs was also administered 5 grams sodium formate per day in food. Adverse effects were not reported except that some of the dogs refused to eat the dosed food after a few days.

Result :

Specific results for the sodium formate portion of these rat chronic studies were not given except in the summary where it was mentioned that formate levels up to 1 gram per kilogram per day (the approximate dose level of the sodium formate study) were not harmful to health. Update results for these studies could not be found in the open literature.

Test substance :

Sodium Formate, CAS Number 141-53-7

Conclusion :

Sodium formate at 1% in the drinking water did not produce clinically adverse effects in rats after administration for approximately 18 months. The NOEL cannot be determined since pathological investigations had not been conducted.

Reliability : (4) not assignable
18.11.2001 (18)

5.5 GENETIC TOXICITY 'IN VITRO'

Type : Salmonella typhimurium reverse mutation assay
System of testing : Salmonella typhimurium TA 98, TA 100, TA 1535, TA 1537, TA1538
Concentration : up to 5000 ug test substance/plate
Cycotoxic conc. :
Metabolic activation : with and without
Result : negative
Method : other: according to Ames, B.N. et al., Mutat. Res. 31, 347-364
Year : 1975
GLP : no
Test substance : as prescribed by 1.1 - 1.4
Reliability : (2) valid with restrictions
21.09.2001 (14)

Type : Chromosomal aberration test
System of testing : CHO-K1 cells
Concentration : 270, 360, 450, 540, 630 ug/ml (6-14 mM)
Cycotoxic conc. :
Metabolic activation : with and without
Result : negative
Method :
Year :
GLP :
Test substance :
Method :

The study was conducted basically in accord with the OECD 473 guideline "In Vitro Mammalian Chromosome Aberration Test". The only significant variation from this guideline was there were no positive controls reported. As the test materials produced positive results at acidic pH levels, the sensitivity of the procedure was demonstrated.

The procedure was to expose the cells in Ham's F12 medium (with 10% fetal calf serum) to various concentrations of test material for 24 hours in the presence or absence of rat-live S9 prepared from rats pretreated with phenobarbital and 5,6-benzoflavone. At the end of the exposure period, chromosome preparations were made using an air-drying method. Two

hundred metaphases were evaluated per concentration level. Cytotoxicity was assessed by counting surviving cells at the end of the exposure period.

Initially cells were exposed to four concentrations of formic acid in the presence or absence of S9 and evaluated for aberrant cells. These results and the design and results of other studies are provided in "results".

Remark :

This study appears to be a well conducted investigation of the effect of pH on clastogenicity in general and specifically a study of the clastogenicity of formic acid, acetic acid, lactic acid and the sodium salt of these three acids. The procedure closely followed OEDC guideline 473 and the results were published in a peer-reviewed journal. The reliability is further enhanced by the similar results on all three acids and the methodical approach to the problem and conduct of the studies.

Result :

The following dose related increase in aberrant cells was reported:

Conc (mM)	% Aberrant cells	
	(-S9)	(+S9)
6	-	1.0
8	2.0	2.0
10	4.0	20.5
12	15.9	toxic
14	toxic	-

In a second set of experiments the initial pH of the medium was adjusted to pH 5.8 or 6.0 with 14 or 12 mM formic acid it the absence or presence of S9 mix, respectively. These media were then neutralized with 1 M NaOH to pH 6.4 and a second group to pH 7.2. Results were as follows (cell data were read from a graph and are approximate)

Activation	%Aberrant cells		
	pH6.0	pH6.4	pH7.2
-S9	12	4	0
+S9	33	2	3

In a third set of studies, the concentration of the buffer system was increased by supplementation with 34 mM sodium bicarbonate in the absence of S9. Under these conditions, there was no clastogenic activity of 10 or 20 mM formic acid; however, at 25mM 12% aberrant cells were reported and at 30 mM the formic acid was cytotoxic. The 25 and 30 mM concentrations also resulted in acidic pH levels.

Similar studies were also conduced with acetic acid and lactic acid with the same results.

.

Test substance : Sodium formate produced by the neutralization of formic acid with sodium hydroxide or sodium bicarbonate.

Conclusion :

It was concluded that formic acid it not itself clastogenic to these cells but that the acidic conditions were responsible for the chromosome aberrations observed. It can be further concluded the sodium formate (the product of neutralization of formic acid with sodium hydroxide or sodium bicarbonate) is not clastogenic.

Reliability : (1) valid without restriction

16.11.2001 (20)

Type	:	Mouse lymphoma assay
System of testing	:	mouse lymphoma cell line L5178Y TK+/–
Concentration	:	Dose range: 4857-8714 mg/l with metabolic activation; 3571-10000 mg/l without metabolic activation.
Cycotoxic conc.	:	
Metabolic activation	:	with and without
Result	:	positive
Method	:	
Year	:	
GLP	:	
Test substance	:	
Remark	:	This positive result is considered suspicious as no colony sizing data were given. The current OECD 476 (adopted 21 July 1977) guideline requires colony sizing to confirm the positive result. Likewise, the 1994 Mammalian cell gene mutation assays working group report (Mutat Res 1994 Jun;312(3):235-9) states that "Ability to recover small colonies must be convincingly demonstrated when using the L5178Y TK mouse lymphoma assay". In addition, the 1997 report by Coombs et al (The use of L5178Y mouse lymphoma cells to assess the mutagenic, clastogenic and aneugenic properties of chemicals. Mutagenesis 1995 Sep;10(5):403-8) also emphasizes the importance of colony sizing to the acceptability of mouse lymphoma results.
Conclusion	:	No firm conclusion about the mutagenic potential can be drawn from this test
Reliability	:	(3) invalid

15.11.2001 (8)

5.6 GENETIC TOXICITY 'IN VITRO'

Type	:	Drosophila SLRL test
Species	:	Drosophila melanogaster
Sex	:	male
Strain	:	other: Oregon-K
Route of admin.	:	oral feed
Exposure period	:	entire larval stage
Doses	:	0.1% as formic acid
Result	:	negative
Method	:	
Year	:	1969
GLP	:	no
Test substance	:	
Method	:	Oregon-K strain of Drosophila melanogaster were treated using dosed feed with 0.1 % formic acid, or sodium formate produced by neutralization of 0.1% formic acid with glycine-NaOH buffer. The Mueller-5 technique was used to determine sex-linked lethals (M Demerec, Induction of mutations in Drosophila by debenzanthracene, Genetics 33:337-48, 1948). About 50 treated males were mated with M-5 virgins and every third day the males were transferred to two fresh virgins in order to produce three successive broods. .
Remark	:	This study was similar in conduct to the current OECD 477 guideline regarding basic methodology; however, it is not clear that higher levels of sodium formate could not have been used to provide a more robust test of sodium formate genotoxicity. .
Result	:	Oregon-K strain of Drosophila melanogaster were treated using dosed feed with 0.1 % formic acid, or sodium formate produced by neutralization of 0.1% formic acid with glycine-NaOH buffer. The Mueller-5 technique was

used to determine sex-linked lethals (M Demerec, Induction of mutations in Drosophila by debenzanthracene, Genetics 33:337-48, 1948). About 50 treated males were mated with M-5 virgins and every third day the males were transferred to two fresh virgins in order to produce three successive broods.
.

After feeding formic acid or sodium formate over the entire larval stage, treated males mated with females gave the following results:

Formic acid

Brood	# Chromosomes Tested	% Sex-linked lethals
1	786	1.15
2	522	1.34
3	571	1.11

Sodium Formate (only one brood tested)

Brood	# Chromosomes Tested	% Sex-linked lethals
2	544	0.38

Controls

Brood	# Chromosomes Tested	% Sex-linked lethals
all	2584	0.15

The sodium formate sex-linked lethal was not different from the control while the formic acid results were stated as bring significantly different from control as determined by the rank-correlation method.

Test substance :

Sodium formate produced by neutralization of 0.1% formic acid with glycine-NaOH buffer.

Conclusion :

Sodium formate produced by neutralization of formic acid is not positive in the Drosophila SLRL test under these conditions; formic acid, at the same molar concentration produced positive results.
.

Reliability : (2) valid with restrictions
15.11.2001 (24)

5.8 TOXICITY TO REPRODUCTION

5.9 DEVELOPMENTAL TOXICITY/TERATOGENICITY

Species	:	rat
Sex	:	
Strain	:	Sprague-Dawley
Route of admin.	:	other: In vitro incubation using whole-embryo culture
Exposure period	:	48 hr
Frequency of treatment	:	
Duration of test	:	48 hrs
Doses	:	200, 400, 800, 1200, 1600 ug/ml
Control group	:	
Method	:	other: In vitro, whole embryo culture

Year	:	1993
GLP	:	no
Test substance	:	
Remark	:	Other in vitro studies of sodium formate and formic acid on developing embryos have been published and are includid in the formic acid IUCLID document. This study was selected as representative. High concentrations of sodium formate have effects on the embryo in vitro. The significance of this to in vivo developmental toxicity after exposure to formate is not known.
Result	:	The effect of the pH (8.13, 7.75, 7.00, 6.50 and 6.00) on the in vitro teratogenicity of sodium formate (0.2, 0.4, 0.8, 1.2 and 1.6 mg/ml) was investigated in rat embryo cultures (Sprague-Dawley rats, day 9.5 of gestation). Numerous embryonic developmental parameters showed that even the decreasing pH had an influence on embryonic development in this test system. In the highest concentration, the parameters crown-rump length (CRL), head length (HL), somite number (SN), developmental score (DS) and protein concentration were significantly reduced in the incubation medium regardless of the pH. At a test substance concentration of 0.8 and 1.2 mg/ml, these parameters were significantly reduced at a low pH. At a test substance concentration of 0.4 and 0.2 mg/ml, CRL, HL and the protein concentration were still significantly reduced at a pH of 6.5 in the medium. To sum up, a dependence of the embryonic developmental parameters and of embryolethality both on the formate concentration and on the pH in the incubation medium was demonstrated in this test system.
Test substance	:	Sodium Formate, CAS Number 141-53-7
Reliability	:	(2) valid with restrictions
18.11.2001		(5)

Species	:	hen
Sex	:	
Strain	:	
Route of admin.	:	other
Exposure period	:	
Frequency of treatment	:	
Duration of test	:	
Doses	:	5 mg, 10 mg or 20 mg/egg
Control group	:	other: negative and positive (0.025 mg hydrocortisone /egg)
Method	:	Sodium formate at 5, 10 or 20 mg/Egg was injected into fertilized eggs.
Result	:	Sodium formate did not cause deviations in chicken embryos under these conditions.
Conclusion	:	Sodium formate was not teratogenic under these conditions
Reliability	:	(2) valid with restrictions
18.11.2001		(18)

5.11 EXPERIENCE WITH HUMAN EXPOSURE

Memo	:	Experimental exposure to methylformate and its neurobehavioral effects.
Method	:	Groups of 20 subjects were exposed to 100 ppm methyl formate vapor or air (controls) for eight hours. At three periods during the exposure measurements were taken of mood, neurobehavioral performance, vision, and postural sway. At the beginning and end of exposure, spirometry and

odor perception thresholds were measured.
.

Result : After exposure the subjective feeling of fatigue was significantly increased in the methyl formate exposed group. The EMG of the forehead during a difficult task showed a different development for the exposed group. Overall, there was a tendency for diminished performance on several tasks in the exposed group but it was not significant.
.

Conclusion : Methyl formate exposure at 100 ppm was associated with increased subjective fatigue, no other significant changes were found in battery of tests including mood, neurobehavioral performance, vision, and postural sway.
.

Reliability : (2) valid with restrictions
15.11.2001 (21)

(1) Analytical Biochemistry Laboratories Inc Acute Floe-Through Toxicity of Sodium Formate to Rainbow Trout (Oncorhynchus mykiss. Report #38312, Sponsored by Hoechst Celanese, March 16, 1990.

(2) Analytical Biochemistry Laboratories Inc, Columbia MO. Report #38314 Acute Flow-Through Toxicity of Sodium Formate (C-1261) to Daphnia magna. Hoechst-Celanese sponsor, March 13, 1990

(3) Analytical Biochemistry Laboratories Inc. Acute Flow-Through Toxicity of Sodium Formate to Fathead Minnow (Pimephales promelas). Report #38313, Sponsored by Hoechst Celanese, March 16, 1990.

(4) Analytical Biochemistry Laboratories Inc., Acute Toxicity of Sodium Formate to Selenastrum capricornutum Printz. Report #38315, Sponsored by Hoechst Celanese, March 16, 1990.

(5) Andrews JE; Ebron-McCoy M; Kavlock RJ; Rogers JM. Lowering pH increases embryonic sensitivity to formate in whole embryo culture. Toxicology In Vitro 7:757-62 (1993)

(6) BioDynamics Inc. An Acute Inhalationn Toxicity Study of c-1261 in the Rat. Project # 89-8232, Sponsored by Hoechst Celanese Corp , May 31 1990.

(7) Calculated using the Level III model contained in WPIWIN 3.05 Syracuse Research Corporation 2001.

(8) Cameron, T.P.: Short–Term Test Program sponsored by the devision of cancer etiology, National Cancer Institute: zitiert in CCRIS, Chemical Cancer Research Information System (1991)

(9) Dowden, B.F., Bennett, H.J. (1965): J. Water Pollut. Control

(10) Freeman, L. (1953): Sewage and Industrial Wastes 25, 845-848

(11) Huels investigation (unpublished) as cited in IUCLID 2000

(12) Huels investigation (unpublished) as cited in IUDLID 2000

(13) Huels investigation (unpublished), as cited in IUDLID 2000.

(14) Huels Report No. 88/210 (unpublished)

(15) Hules Report #1579, 1989, unpublished data (as cited in IUCLID 2000)

(16) Lyman et al. Handbook of Chemical Property Estimation Methods, American Chemical Society, Washington DC 1990

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(18) Malorny G. Acute and chronic toxicity of formic acid and its formates. Z. Ernaehrungswiss 9:332-339 (1969)

(19) Malorny, G. (1969): Z. Ernaehrungswissenschaft 9, 332-339

(20) Morita, T. et al. Evlauation of clastogenicity of formic acid, acetic acid and lactic acid on cultured mammalian cells Mut. Res. 240, 195-202 (1990)

(21) Sethre T, Laubli T, Berode M, Hangartner M, Krueger H. Experimental exposure to methylformate and its neurobehavioral effects. Int Arch Occup Environ Health. 2000 Aug;73(6):401-9.

(22) Sicherheitsdatenblatt Huels AG vom 04.10.93

(23) Smith, E.N., Taylor, R.T. (1982): Toxicology 25, 271-287 (as cited in IUCLID 2000)

(24) Stumm-Tegethoff, B.F.A.: Theor. Appl. Genetics 39, 330-334 (1969)

(25) Supported by Merck Index listing of "soluble in about 1.3 parts water and Handbook of Chemistry and Physics Listing of v. sol.

(26) Transport Canada, Environmental Impact from the use of Sodium Formate at Halifax International Airport. Volume I: Final Report. Prepared by Nolan Davis & Associates November 1992

I U C L I D

Data Set

Existing Chemical	:	ID: 544-17-2
CAS No.	:	544-17-2
EINECS Name	:	calcium diformate
EINECS No.	:	208-863-7
TSCA Name	:	Formic acid, calcium salt
Molecular Formula	:	CH2O2.1/2Ca

Printing date	:	20.12.2001
Revision date	:	
Date of last Update	:	20.12.2001

1.0.1 OECD AND COMPANY INFORMATION

Type	:	lead organisation
Name	:	American Chemistry Council, Formates Panel
Partner	:	
Date	:	
Street	:	1300 Wilson Boulevard
Town	:	22209 Arlington, VA
Country	:	United States
Phone	:	
Telefax	:	
Telex	:	
Cedex	:	
Source	:	

06.12.2000

Type	:	cooperating company
Name	:	BASF Corporation
Partner	:	
Date	:	
Street	:	
Town	:	
Country	:	
Phone	:	
Telefax	:	
Telex	:	
Cedex	:	

Source : Bayer Corporation Pittsburgh
19.12.2001

Type : cooperating company
Name : Bayer Corporation
Partner :
Date :
Street : 100 Bayer Road
Town : 15205-9741 Pittsburgh, PA
Country : United States
Phone :
Telefax :
Telex :
Cedex :
Source :
06.12.2000

Type : cooperating company
Name : Celanese Ltd
Partner :
Date :
Street :
Town :
Country :
Phone :
Telefax :
Telex :
Cedex :
Source :
19.12.2001

Type : cooperating company
Name : GEO Specialty Chemicals
Partner :
Date :
Street :
Town :
Country :
Phone :
Telefax :
Telex :
Cedex :
19.12.2001

Type : cooperating company
Name : Hercules Incorporated
Partner :
Date :
Street : 1313 North Market Street
Town : 19894-001 Wilmington, DE
Country :
Phone :
Telefax :
Telex :
Cedex :
Source :
06.12.2000

1.1 GENERAL SUBSTANCE INFORMATION

Substance type : organometallic
Physical status : solid
Purity : % w/w
Remark : Typical purity > 98%. Purity of material used in the studies varies depending on the source.

20.12.2001

1.2 SYNONYMS

Calcium formate
Source : Bayer Corporation Pittsburgh
Flag : Critical study for SIDS endpoint
05.11.2001

Formic acid, calcium salt
Source : Bayer Corporation Pittsburgh
05.11.2001

2.1 MELTING POINT

Value	:	> 300 ° C
Sublimation	:	
Method	:	other: Handbook value
Year	:	
GLP	:	
Test substance	:	
Source	:	Bayer Corporation Pittsburgh
Reliability	:	(2) valid with restrictions

11.12.2000 (13)

Value	:	>= 800 ° C
Decomposition	:	yes at ° C
Source	:	Bayer AG Leverkusen Bayer Corporation Pittsburgh

11.12.2000 (1)

2.2 BOILING POINT

Remark	:	n.a.

20.12.2001

2.3 DENSITY

Type	:	relative density
Value	:	2.02 at 19° C
Method	:	other: Handbook value
Year	:	
GLP	:	
Test substance	:	
Source	:	Bayer Corporation Pittsburgh
Reliability	:	(2) valid with restrictions

16.11.2001 (14)

Type	:	bulk density
Value	:	1150 kg/m3 at ° C
Source	:	Bayer AG Leverkusen Bayer Corporation Pittsburgh

11.12.2000 (1)

2.4 VAPOUR PRESSURE

Remark	:	This material is a solid salt and as such is considered to have negligible vapor pressure. It should be kept in mind, however, that it is in equilibrium with formic acid in solution and volatilization from solution is therefore pH dependent
Conclusion		Material considered to be non-volatile as a dry solid.

20.12.2001

2.5 PARTITION COEFFICIENT

Log pow	:	-2.47 at ° C
Method		other (calculated):KOWWIN (v1.65)
Year	:	1999
GLP	:	no
Test substance	:	
Remark	:	n.a. (salt) This value is also pH dependent due to equlibrium with formic acid which has a log Kow of about -0.50
Source	:	
Reliability	:	(2) valid with restrictions

20.12.2001 (1)

2.6.1 WATER SOLUBILITY

Value	:	160 g/l at 20 ° C
Qualitative	:	
Pka	:	at 25 ° C
PH	:	at and ° C
Source	:	Bayer AG Leverkusen Bayer Corporation Pittsburgh
Reliability	:	(4) not assignable

16.11.2001 (1)

Remark	:	Listed in the Merch Index as "Soluble in water"
Reliability	:	(2) valid with restrictions

16.11.2001 (14)

Value	:	ca. 255 g/l at 25 ° C
Qualitative	:	
Pka	:	at 25 ° C
PH	:	at and ° C
Method	:	Estimation using EPIWIN 3.05 with default inputs
Remark	:	There will be a pH dependency on the Calcium solubility. At basic pH levels the calcium is expected to partially precipitate from solution as calcium hydroxide.
Result	:	Water solubility estimated at 1.96 moles per liter. Based on a molecular weight of 130 this is 255 g/L.
Test substance	:	Calcium Formate, CAS Number 544-17-2
Reliability	:	(2) valid with restrictions

16.11.2001 (7)

2.12 ADDITIONAL REMARKS

Remark	:	pH value: ca. 8 at 1 g/l water
Source	:	Bayer AG Leverkusen Bayer Corporation Pittsburgh

28.05.1994 (1)

3.1.1 PHOTODEGRADATION

Type : other
Rel. intensity : based on Intensity of Sunlight
Remark : Since this material is not volatile, the only potential photolytic reaction that needs to be considered is direct photolysis at the earths surface. Direct photolysis is not possible because this material does not have a chromophore absorbing at a wavelength of 290 nm or above, and the presence of such a chromophore is a necessary condition for photolysis.
Reliability : (4) not assignable
14.11.2001 (9)

3.1.2 STABILITY IN WATER

Type : abiotic
t1/2 pH4 : at degree C
t1/2 pH7 : at degree C
t1/2 pH9 : at degree C
Remark : Disassociates in water to clacium ion and formate ion. Both of these are considered stable in water. A carboxylic acid is generally the final product of hydrolysis reactions.
Reliability : (4) not assignable
14.11.2001 (9)

3.3.2 DISTRIBUTION

Media : air - biota - sediment(s) - soil - water
Method : Calculation according Mackay, Level III
Year : 1999
Remark : PROPERTIES OF: Calcium formate

Molecular weight: 130.11
Aqueous solub (mg/l): 1E+006
Vapour pressure (Pa): 3.41305
(atm) 3.36842E-005
(mm Hg) 0.0256
Henry 's law c (Atm-m3/mol): 4.38264E-009
Air-water partition coef: 1.79237E-007
Octanol-water part coef(Kow): 0.00338844
Log Kow: -2.47

Biomass:water part coef: 0.800678
Temperature [deg C] 25

Biodeg rate c(h^-1),T1/2 biomass (h), in 2000 mg/L MLSS (h)
-Primary tank 0.04 15.99 10000.00
-Aeration tank 0.04 15.99 10000.00
-Settling tank 0.04 15.99 10000.00

Result :

	Concentration (percent)	Half-Life (hr)	Emissions (kg/hr)
Air	0.141	1e+005	1000
Water	45.4	360	1000
Soil	54.4	360	1000
Sed	0.0757	1.44e+003	0

	Fugacity (atm)	Reaction (percent)	Advection (percent)
Air	3.31e-012	0.000408	0.588
Water	9.6e-014	6.6	19
Soil	4.26e-012	43.8	0
Sed	8e-014	0.0152	0.000633

Persistence Time: 419 hr
Reaction Time: 521 hr
Advection Time: 2.14e+003 hr
Percent Reacted: 80.4
Percent Advected: 19.6

Half-Lives (hr), (Biowin (Ultimate) and Aopwin):
Air: 1e+005
Water: 360
Soil: 360
Sediment: 1440
-Biowin estimate: 2.912 (weeks)

Advection Times (hr):
Air: 100
Water: 1000
Sediment 1440

Reliability : (2) valid with restrictions
20.12.2001 (12)

3.5 BIODEGRADATION

Type	:	aerobic
Inoculum	:	predominantly domestic sewage
Contact time	:	
Degradation	:	> 75 % after 20 day
Result	:	
Deg. Product	:	
Method	:	OECD Guide-line 301 D "Ready Biodegradability: Closed Bottle Test"
Year	:	1974
GLP	:	no
Test substance	:	
Remark	:	test concentration: 24 mg/l related to TS
Source	:	Bayer AG Leverkusen Bayer Corporation Pittsburgh
Test substance	:	Sodium Formate, CAS Number 141-53-7
Reliability	:	(4) not assignable Assigned score of 4 (not assignable) since not enough information was available to evaluate the adequacy of this study.

16.11.2001 (1)

4.1 ACUTE/PROLONGED TOXICITY TO FISH

Type	:	static
Species	:	Brachydanio rerio (Fish, fresh water)
Exposure period	:	96 hour(s)
Unit	:	mg/l
Analytical monitoring	:	no
LC0	:	>= 1000
Method	:	other: Letale Wirkung beim Zebrabaerbling, UBA-Verfahrensvorschlag, Mai 1984, Letale Wirkung beim Zebrabaerbling Brachydanio rerio LC0, LC50, LC100, 48-96h
Year	:	1988
GLP	:	no
Test substance	:	other TS: calcium formate: technical grade
Method	:	Translation: Lethal effect with the Zebra barbling, UBA suggested procedure, May 1984, lethal effect with the Zebra barbling Brachydanio rerio LC0, LC50, LC100, 48-96h
Result	:	10 Zebrafish were tested at each of the following concentrations: 12.5, 100, 1000 mg/l. There was no mortality at any concentration. The parameters were checked every 24 hrs.
Source	:	Bayer AG Leverkusen Bayer Corporation Pittsburgh
Test condition	:	Dechlorinated tap water Water hardness: approx. 15 degrees dh Ca: Mg: 4:1 Acid capacity Ks 4.3: 0.1 ±0.02 mmol/l pH: 6.3-6.8 Oxygen saturation greater than or equal to 90%
Reliability	:	(1) valid without restriction
Flag	:	Critical study for SIDS endpoint

16.11.2001 (3)

Type	:	other
Species	:	
Exposure period	:	96 hour(s)
Unit	:	g/l
Analytical monitoring	:	
LC50	:	= 1540
Method	:	other: Calculated (ECOSAR Program) (v0.99e)
Year	:	1999
GLP	:	no
Test substance	:	other TS: molecular structure
Remark	:	The LC50 value is greater than the water solubility (160 g/l).
Source	:	Bayer Corporation Pittsburgh
Test substance	:	Calcium Formate, CAS Number 544-17-2
Reliability	:	(2) valid with restrictions

16.11.2001 (12)

Type	:	static
Species	:	Leuciscus idus (Fish, fresh water)
Exposure period	:	48 hour(s)
Unit	:	mg/l
Analytical monitoring	:	no

LC0	:	>= 1000
Method	:	other: Bestimmung der akuten Wirkung von Stoffen auf Fische. Arbeitskreis "Fischtest" im Hauptausschuss "Detergentien" (15.10.73)
Year	:	1974
GLP	:	no
Test substance	:	
Method	:	Translation: Determination of the acute effect of materials on fish. Working group "fish tests" in the main committee " Detergents " (15.10.73)
Source	:	Bayer AG Leverkusen Bayer Corporation Pittsburgh
Reliability	:	(4) not assignable

16.11.2001 (1)

4.2 ACUTE TOXICITY TO AQUATIC INVERTEBRATES

Type	:	other
Species	:	other: Daphnid
Exposure period	:	48 hour(s)
Unit	:	g/l
Analytical monitoring	:	
EC50	:	= 1210
Method	:	other: Calculated (ECOSAR Program) (v0.99e)
Year	:	1999
GLP	:	no
Test substance	:	other TS: molecular structure
Remark	:	The EC50 value is greater than the water solubility (160 g/l).
Source	:	Bayer AG Leverkusen Bayer Corporation Pittsburgh
Reliability	:	(2) valid with restrictions

13.02.2001 (12)

4.3 TOXICITY TO AQUATIC PLANTS E.G. ALGAE

Species	:	other algae: Green
Endpoint	:	other
Exposure period	:	96 hour(s)
Unit	:	g/l
Analytical monitoring	:	
EC50	:	= 584
Method	:	other: Calculated (ECOSAR Program) (v0.99e)
Year	:	1999
GLP	:	no
Test substance	:	other TS: molecular structure
Remark	:	The EC50 value is greater than the water solubility (160 g/l).
Source	:	Bayer Corporation Pittsburgh
Reliability	:	(2) valid with restrictions

12.12.2000 (12)

4.4 TOXICITY TO MICROORGANISMS E.G. BACTERIA

Type	:	aquatic

Species	:	activated sludge
Exposure period	:	3 hour(s)
Unit	:	mg/l
Analytical monitoring	:	no
EC50	:	> 10000
Method	:	other: Test for Inhibition of Oxygen Consumption by Activated Sludge, ISO 8192
Year	:	1988
GLP	:	no
Test substance	:	
Source	:	Bayer AG Leverkusen Bayer Corporation Pittsburgh
Test condition	:	direct weight

25.05.1994 (1)

5.1.1 ACUTE ORAL TOXICITY

Type	:	LD50
Species	:	rat
Strain	:	
Sex	:	male
Number of animals	:	60
Vehicle	:	water
Value	:	= 3050 mg/kg bw
Method	:	other: Fink and Hund, Arzneim. - Forsch. 15, 1965, p. 624
Year	:	1965
GLP	:	no
Test substance	:	as prescribed by 1.1 - 1.4
Remark	:	There were 10 animals used at each dose level. The doses were: 1.0 g/kg, 2.0 g/kg, 3.1 g/kg, 3.5 g/kg, 3.8 g/kg and 4.0 g/kg.
Source	:	Bayer AG Leverkusen Bayer Corporation Pittsburgh
Reliability	:	(2) valid with restrictions

12.12.2000 (8)

Type	:	LD50
Species	:	rat
Strain	:	no data
Sex	:	
Number of animals	:	
Vehicle	:	CMC
Value	:	ca. 2560 mg/kg bw
Method	:	
Year	:	1979
GLP	:	
Test substance	:	
Result	:	Clinical observations were reduced activity, reduced grip strength, cyanosis, reduced pain reflex, disturbances of co-ordination, and anomalies of position. Dose-response information is not available. Animals dying showed hemorrhage of the stomach and intestinal mucosa. Surviving animals were without adverse necropsy findings at the end of the 14-day observation period.
Source	:	Bayer AG Leverkusen Bayer Corporation Pittsburgh
Test substance	:	Calcium Formate, CAS Number 544-17-2
Reliability	:	(2) valid with restrictions

16.11.2001 (4)

Type	:	LD50
Species	:	rat
Strain	:	
Sex	:	
Number of animals	:	
Vehicle	:	
Value	:	= 2650 mg/kg bw
Source	:	Bayer AG Leverkusen Bayer Corporation Pittsburgh
Reliability	:	(4) not assignable

16.11.2001 (11)

Type	:	LD50
Species	:	mouse
Strain	:	
Sex	:	
Number of animals	:	
Vehicle	:	
Value	:	= 1920 mg/kg bw
Source	:	Bayer AG Leverkusen Bayer Corporation Pittsburgh
Reliability	:	(4) not assignable

16.11.2001 (10)

5.1.4 ACUTE TOXICITY, OTHER ROUTES

Type	:	LD50
Species	:	mouse
Strain	:	
Sex	:	
Number of animals	:	
Vehicle	:	
Route of admin.	:	i.v.
Exposure time	:	
Value	:	= 154 mg/kg bw
Source	:	Bayer AG Leverkusen Bayer Corporation Pittsburgh
Reliability	:	(4) not assignable

16.11.2001 (10)

5.4 REPEATED DOSE TOXICITY

Species	:	rat
Sex	:	male/female
Strain	:	Wistar
Route of admin.	:	drinking water
Exposure period	:	Lifelong
Frequency of treatment	:	Daily
Post obs. period	:	
Doses	:	200 mg/kg/day
Control group	:	yes, concurrent vehicle
NOAEL	:	= 200 mg/kg
Method	:	other
Year	:	
GLP	:	no
Test substance	:	
Method	:	

The study design encompassed both a five-generation and chronic study in Wistar rats with calcium formate at 0.2% in drinking water. Eight males and 24 females were in the original test group with four controls of each sex. Both microscopic and pathologic investigations were done upon natural death of the animals.

An additional series of experiments using 0.4% calcium formate in the drinking water was also in progress and was in the second year and second generation at the time of this publication, histopathology results were not available for this dose level.

Remark :
Limitations to this study include the lack of data presentation for the 0.4% dose group, the limited description of the pathology and histopathology organ list and the modest size of the concurrent control group.

Result :
Bodyweights and bodyweight gains of treated and control animals were similar. Microscopic and histological investigation of lung, spleen, stomach, liver and kidneys showed no suspect findings. Occasional small phagocytic action in reticuloendothelium and reticulo-histocyto elements of lung, spleen and stomach lymph nodes were reported. Two benign spontaneous tumors were seen in old animals and were considered not related to test substance administration.

The study at 0.4% calcium formate had been going on for about two years and it was reported that no disturbances (presumably mortality, body weight, fertility, or developmental toxicity) had been observed up to this point. Pathology and histopathology were in progress pending natural death of the test animals.

Source : Bayer Corporation Pittsburgh
Test substance : Calcium Formate, CAS Number 544-17-2
Reliability : (2) valid with restrictions
18.11.2001 (10)

5.5 GENETIC TOXICITY 'IN VITRO'

Type : Ames test
System of testing : Salmonella typhimurium TA 1535, TA 100, TA 1537, TA 98
Concentration : up to 12,500 ug test substance per plate
Cycotoxic conc. : greater than 12,500 ug/plate in all strains
Metabolic activation : with and without
Result : negative
Method : OECD Guide-line 471 "Genetic Toxicology: Salmonella thyphimurium Reverse Mutation Assay"
Year : 1983
GLP : yes
Test substance : other TS: purity > 99%
Source : Bayer AG Leverkusen
Bayer Corporation Pittsburgh
Test condition :
The following concentrations of calcium formate were tested:
20, 100, 500, 2500, and 12,500 ug/plate.

Positive controls: Sodium azide (only TA 1535)
Nitrofurantoin (only TA 100)
4-Nitro-1,2-phenylene diamine
(only TA 1537 and TA 98)
2-Aminoanthracene

Solvents used: Deionized water was used with calcium formate and DMSO was used with the positive controls.

S9 mix was used for the stimulation of mammalian metabolism. It was made from the livers of adult male Sprague Dawley rats.

Reliability : (1) valid without restriction
07.11.2001 (2)

5.7 CARCINOGENITY

Species	:	rat
Sex	:	male/female
Strain	:	Wistar
Route of admin.	:	drinking water
Exposure period	:	3 years
Frequency of treatment	:	daily
Post. obs. period	:	no
Doses	:	0.2% (3 years), 0.4 % (2 years, pathology not reported)
Result	:	
Control group	:	yes, concurrent vehicle
Method	:	
Year	:	
GLP	:	
Test substance	:	
Method	:	The study design encompassed both a five-generation and chronic study in Wistar rats with calcium formate at 0.2% in drinking water. Eight males and 24 females were in the original test group with four controls of each sex. Both microscopic and pathologic investigations were done upon natural death of the animals. An additional series of experiments using 0.4% calcium formate in the drinking water was also in progress and was in the second year and second generation at the time of this publication, histopathology results were not available for this dose level.
Remark	:	Limitations to this study include the lack achieving a maximum tolerated dose, the modest size of the male F1 group, and the size of the concurrent control group. No of animals: 8 males and 24 females per dose in the F1 group.
Result	:	Bodyweights and bodyweight gains of treated and control animals were similar. Microscopic and histological investigation of lung, spleen, stomach, liver and kidneys showed no suspect findings. Occasional small phagocytic action in reticuloendothelium and reticulo-histocyto elements of lung, spleen and stomach lymph nodes were reported. Two benign spontaneous tumors were seen in old animals and were considered not related to test substance administration. The study at 0.4% calcium formate had been going on for about two years and it was reported that no disturbances (presumably mortality, body weight, fertility, or developmental toxicity) had been observed up to this point. Pathology and histopathology were in progress pending natural death of the test animals.
Source	:	Bayer AG Leverkusen Bayer Corporation Pittsburgh
Test substance	:	Calcium Formate, CAS Number 544-17-2
Conclusion	:	Signs of a chronic intoxication could not be detected by macroscopic or histopathological examinations. There was no increased tumor-rate.
Reliability	:	(2) valid with restrictions

18.11.2001 (10)

5.8 TOXICITY TO REPRODUCTION

Type	:	Fertility
Species	:	rat
Sex	:	male/female
Strain	:	Wistar
Route of admin.	:	drinking water
Exposure period	:	2-5 generations
Frequency of treatment	:	daily
Premating exposure period		
Male	:	6 weeks
Female	:	6 weeks
Duration of test	:	lifelong
Doses	:	0.2 % (5 generations); or 0.4 % (2 generations)
Control group	:	yes, concurrent vehicle
NOAEL Parental	:	200 mg/kg bw
NOAEL F1 Offspr.	:	200 ml/kg bw
Method	:	other
Year	:	
GLP	:	no
Test substance	:	no data
Method	:	The study design encompassed both a five-generation and chronic study in Wistar rats with calcium formate at 0.2% in drinking water. Eight males and 24 females were in the first generation group with four controls of each sex. The fertility of treated animals after 6, 7 or 10 weeks of administration was compared with the fertility of control after 8 weeks of study start. The text of this report indicates that a study with 0.4% calcium formate using the same protocol is in progress and in the second generation with no "disturbances" observed. Thus, it appears that 0.4% calcium formate does not have an adverse effect on fertility. As data were not provided, however, the 0.2% level is considered the reproductive NOEL in this study.
Remark	:	Limitations to this study include the lack of data presentation for the 0.4% dose group; not achieving maternal toxicity at the high dose level; and lack of details concerning reproductive parameters evaluated beyond number, weight and length of pups. No. of animals: 8 males and 24 females per dose level.
Result	:	Numbers of offspring, body weights and body lengths were not different for treated animals as compared with controls. No maternal toxicity was observed, no adverse effects on the offspring were observed on examination.
Source	:	Bayer AG Leverkusen Bayer Corporation Pittsburgh
Test substance	:	Calcium Formate, CAS Number 544-17-2
Conclusion	:	No reduction of fertility; no maternal toxicity; no embryotoxic or teratogenic effects were observed under these conditions. The NOEL for reproduction is 0.2% in drinking water or ca. 200 mg/kg.
Reliability	:	(2) valid with restrictions

18.11.2001 (10)

5.9 DEVELOPMENTAL TOXICITY/TERATOGENICITY

Species	:	rat
Sex	:	female
Strain	:	Wistar
Route of admin.	:	drinking water
Exposure period	:	Continuous during entire period of gestation and at least six weeks prior to gestation.
Frequency of treatment	:	daily
Duration of test	:	
Doses	:	200 mg/kg/day
Control group	:	yes, concurrent vehicle
NOAEL Maternalt.	:	200 mg/kg bw
NOAEL Teratogen	:	200 mg/kg bw
Method	:	other
Year	:	
GLP	:	no
Test substance	:	
Method	:	The study design encompassed both a five-generation and chronic study in Wistar rats with calcium formate at 0.2% in drinking water. Eight males and 24 females were in the first generation group with four controls of each sex. The fertility of treated animals after 6, 7 or 10 weeks of administration was compared with the fertility of control after 8 weeks of study start. A portion of the pups were sacrificed shortly after birth for evaluation of developmental toxicity. The text of this report indicates that a study with 0.4% calcium formate using the same protocol is in progress and in the second generation with no "disturbances" observed. Thus, it appears that 0.4% calcium formate does not have an adverse effect on developmental toxicity. As data were not provided, however, the 0.2% level is considered the developmental NOEL in this study.
Remark	:	Limitations to this study include the lack of data presentation for the 0.4% dose group, not achieving maternal toxicity at the high dose level, and lack of details concerning evaluation of the pups for major malformations and variations.
Result	:	No statisical difference in organ and bone abnormalitites. Growth of treated offspring was similar to controls.
Source	:	Bayer Corporation Pittsburgh
Test substance	:	Calcium Formate, CAS Number 544-17-2
Conclusion	:	No reduction of fertility, maternal toxicity, embryotoxic or teratogenic effects were observed under these conditions. The NOEL for developmental and maternal toxicity is 0.2% in drinking water or ca. 200 mg/kg.
Reliability	:	(2) valid with restrictions

18.11.2001 (10)

(1) Bayer AG data

(2) Bayer AG data, Report No. 17969, 25. 4. 1989

(3) Bruns: Bayer AG, Leverkusen, 22. 2. 1988

(4) Degussa AG data, Akute Toxizitaetspruefung von 'Calciumformiat'nach oraler Applikation an der Ratte, Degussa-US-IT-Nr. 79-0029-DKT, 1979/january

(5) Degussa AG data, Pruefung von Calciumformiat in Augenreiz-test am Kaninchen, Degussa-US-IT-Nr. 78-0016-DKT, 1978/november

(6) Degussa AG data, Pruefung von Calciumformiat in Hautreiz-test am Kaninchen, Degussa-US-IT-Nr. 78-0015-DKT, 1978/november

(7) EPIWIN 3.05, Syracuse Research Corp, Syracuse NY 13210

(8) Loeser, E.: Bayer AG data, short report, 21. 4. 1978

(9) Lyman et al. Handbook of Chemical Property Estimation Methods, American Chemical Society, Washington DC 1990.

(10) Malorny, J. V.: Zeitschrift fuer Ernaehrungswissenschaft 9, 332-339 (1969)

(11) Marhold, J. V.: Sbornik Vysledku Toxixologickeho Vysetreni Latek A Pripravku, Institut Pro Vychovu Vedoucicn Pracovniku Chemickeho Prumyclu, Praha, Czechoslovakia, 66 (1972)

(12) Meylan W. and Howard P. (1999) EPIWin Modeling Program. Syracuse Research Corporation. Environmental Science Center, 6225 Running Ridge Road, North Syracuse, NY 13212-2510.

(13) The Condensed Chemical Dictionary 9th Edition (1977) Hawley, G.G, Van Nostrand Reinhold Co., New York. p.151

(14) The Merck Index 10th Edition (1983) Rahway, New Jersey. p. 230

(15) Thyssen, J.: Bayer AG data, short report, 20. 9. 1978

I U C L I D

Data Set

Existing Chemical	:	ID: 107-31-3
CAS No.	:	107-31-3
EINECS Name	:	methyl formate
EINECS No.	:	203-481-7
TSCA Name	:	Formic acid, methyl ester
Molecular Formula	:	C2H4O2
Memo	:	
Printing date	:	20.12.2001
Revision date	:	
Date of last Update	:	20.12.2001

1.0.1 OECD AND COMPANY INFORMATION

Type	:	lead organisation
Name	:	American Chemistry Council, Formates Panel
Partner	:	
Date	:	
Street	:	1300 Wilson Boulevard
Town	:	22209 Arlington, VA
Country	:	United States
Phone	:	
Telefax	:	
Telex	:	
Cedex	:	

25.05.2001

Type	:	cooperating company
Name	:	Celanese Ltd
Partner	:	
Date	:	
Street	:	
Town	:	
Country	:	
Phone	:	
Telefax	:	

Telex :
Cedex :
20.12.2001

Type : cooperating company
Name : Bayer Corporation
Partner :
Date :
Street :
Town :
Country :
Phone :
Telefax :
Telex :
Cedex :
20.12.2001

Type : cooperating company
Name : BASF Corporation
Partner :
Date :
Street :
Town :
Country :
Phone :
Telefax :
Telex :
Cedex :
20.12.2001

Type : cooperating company
Name : GEO Specialty Chemicals
Partner :
Date :
Street :
Town :
Country :
Phone :
Telefax :
Telex :
Cedex :
20.12.2001

Type : cooperating company
Name : Hercules Inc
Partner :
Date :
Street :
Town :
Country :
Phone :
Telefax :
Telex :
Cedex :
20.12.2001

1.1 GENERAL SUBSTANCE INFORMATION

Substance type : organic
Physical status : liquid
Purity : % w/w
13.12.2000

1.2 SYNONYMS

Ameisensaeuremethylester
30.01.2001

Formic Acid Methyl ester
30.01.2001

Formic acid, methyl ester (6CI, 8CI, 9CI)
30.01.2001

Methanoic acid methyl ester
30.01.2001

Methyl formate
30.01.2001

Methyl methanoate
30.01.2001

Methylformiat
30.01.2001

R 611
30.01.2001

2.1 MELTING POINT

Value : ca. -100 ° C
Remark : Handbook value
Reliability : (2) valid with restrictions
19.11.2001 (25)

Value : = -100.4 ° C
Reliability : (2) valid with restrictions
18.11.2001 (10)

2.2 BOILING POINT

Value : = 31.5 ° C at 760
Remark : Handbook value
Reliability : (2) valid with restrictions
18.11.2001 (25)

Value : = 32.3 ° C at 760
Reliability : (2) valid with restrictions
18.11.2001 (11)

2.3 DENSITY

Type : relative density
Value : = .987 at 15° C
Remark : Handbook value
Reliability : (2) valid with restrictions
18.11.2001 (25)

Type : density
Value : = .968 g/cm3 at 20° C
Reliability : (2) valid with restrictions
18.11.2001 (10)

2.4 VAPOUR PRESSURE

Value : = 644 hPa at 20° C
Reliability : (2) valid with restrictions
18.11.2001 (10)

Value : = 780 at 25° C
Remark : Given as 585.7 mm Hg, converted to hPa
Reliability : (2) valid with restrictions
19.11.2001 (15)

2.5 PARTITION COEFFICIENT

Log pow : = -.21 at 25° C
Method OECD Guide-line 107 "Partition Coefficient (n-octanol/water), Flask-shaking Method"
Year : 1988
GLP : no data

Test substance :
Reliability : (2) valid with restrictions
19.11.2001 (5) (10)

Log pow : = .03 at ° C
Remark : Literature value
Reliability : (2) valid with restrictions
19.11.2001 (19)

Log pow : = -.17 at ° C
Method other (calculated)
Year :
GLP :
Test substance :
23.05.2001 (16)

2.6.1 WATER SOLUBILITY

Value : = 300 g/l at 20 ° C
Qualitative :
Pka : at 25 ° C
PH : = 4 - 5 at 200 g/l and 20 ° C
Reliability : (2) valid with restrictions
18.11.2001 (10)

Value : = 30 vol% at ° C
Qualitative :
Pka : at 25 ° C
PH : at and ° C
Remark : Handbook value
Reliability : (2) valid with restrictions
18.11.2001 (25)

3.1.1 PHOTODEGRADATION

Type	:	air
Light source	:	
Light spect.	:	nm
Rel. intensity	:	based on Intensity of Sunlight
Indirect photolysis		
Sensitizer	:	OH
Conc. of sens.	:	1500000 molecule/cm3
Rate constant	:	= cm3/(molecule*sec)
Degradation	:	% after
Remark	:	ca. 50 % after 71 day Based on 12-hour day
Result	:	Rate Constant: 0.227 (+/-0.034)*10-12 cm^3/molecule*sec at 296 K
Reliability	:	(2) valid with restrictions Calculated by an acceptable method.

20.12.2001 (17)

3.1.2 STABILITY IN WATER

Type	:	abiotic
t1/2 pH4	:	at degree C
t1/2 pH7	:	= 5.1 day at 25 degree C
t1/2 pH9	:	at degree C
t1/2 pH 8	:	= 12.3 hour(s) at 25 degree C
Deg. Product	:	
Method	:	other (calculated)
Year	:	2001
GLP	:	no
Test substance	:	no data
Remark	:	These vlaues are directly from from the HYDROWIN 1.67 program and are based on the Kb calculated by HYDROWIN
Reliability	:	(2) valid with restrictions

19.11.2001 (13)

Type	:	abiotic
t1/2 pH4	:	at degree C
t1/2 pH7	:	= 52 hour(s) at 25 degree C
t1/2 pH9	:	= .5 hour(s) at 25 degree C
Method	:	Calculated from experimental Kb
Remark	:	These are calculated t1/2 values using a value for Kb found in the literature. The pH 4 t1/2 was not calculated because there is also a mechanism for acid based hydrolysis and the vale derived for the base hydrolysis rate constant may give an unreliable estimate.
Result	:	Experimental Kb = 3.66 L/mol-sec
Reliability	:	(2) valid with restrictions Calculated from experimental data by an acceptable method.

19.11.2001 (18)

3.1.3 STABILITY IN SOIL

Type	:	other
Radiolabel	:	

Concentration :
Soil temp. : degree C
Soil humidity :
Soil classif. :
Year :
Remark : Based upon an estimated Koc of 5, methyl formate is ex–pected to leach readily in soil.
Source: BASF AG Ludwigshafen
Reliability : (2) valid with restrictions
Calculated with an acceptable method.

18.11.2001 (20)

3.3.2 DISTRIBUTION

Media : air - biota - sediment(s) - soil - water
Method : Calculation according Mackay, Level III
Year : 2001
Method : EPIWIN level III model with measured VP, Herry's Law constant and Kow
Remark : Values for half-lives of air, water and soil were adjusted from the defaults based on available data. The experimental Ko/w and vapor pressure was also used in the calculation.
Result : Chem Name : Methyl Formate
Molecular Wt: 60.05
Henry's LC : 0.000223 atm-m3/mole (Henry database)
Vapor Press : 586 mm Hg (user-entered)
Log Kow : -0.21 (user-entered)
Soil Koc : 0.253 (calc by model)

	Concentration (%)	Half-Life (hr)	Emissions (kg/hr)
Air	35.9	1180	1000
Water	36.9	120	1000
Soil	27.1	120	1000
Sediment	0.0618	1440	0

	Fugacity (atm)	Reaction (kg/hr)	Advection (kg/hr)	Reaction (percent)	Advection (percent)
Air	5.57e-010	80.7	1.37e+003	2.69	45.6
Water	2.61e-009	812	141	27.1	4.68
Soil	6.93e-008	598	0	19.9	0
Sed	2.17e-009	0.113	0.00471	0.00378	0.000157

Persistence Time: 127 hr
Reaction Time: 256 hr
Advection Time: 252 hr
Percent Reacted: 49.7
Percent Advected: 50.3

Half-Lives (hr), (based upon user-entry):
Air: 1176
Water: 120
Soil: 120
Sediment: 1440

Advection Times (hr):
Air: 100
Water: 1000
Sediment: 5e+004

Reliability : (2) valid with restrictions
19.11.2001 (14)

3.5 BIODEGRADATION

Type	:	aerobic
Inoculum	:	activated sludge, non-adapted
Concentration	:	51.7mg/l related to Test substance 20mg/l related to DOC (Dissolved Organic Carbon)
Contact time	:	28 day
Degradation	:	= 90 - 100 % after 28 day
Result	:	readily biodegradable
Kinetic of test substance	:	7 day = 77 **%** 14 day = 91 **%** 21 day = 93 **%** 28 day = 93 **%** **%**
Control substance	:	Aniline
Kinetic	:	14 day = 72 **%** 28 day = 91 **%**
Deg. Product	:	
Method	:	
Year	:	1997
GLP	:	yes
Test substance	:	
Method	:	The protocol was the same as the current ISO 14593 [Water quality -- Evaluation of ultimate aerobic biodegradability of organic compounds in aqueous medium -- Method by analysis of inorganic carbon in sealed vessels (CO2 headspace test)] but was conducted prior to the ISO protocol being accepted as an international standard. The procedure was also in accord with the current EPA guideline OPPTS 835.3120 (Sealed-Vessel CO2 Production Test).
Result	:	Although the data fulfilled all OECD criteria for ready biodegradation of the material, the initial report only classified the material, "biologically degradable". This was because at the time the report was written the official method was still in the design phase. Since it is now an international standard, the classification can now be evaluated as "Readily Biodegradable" based on the data presented for both the CO2 evolution and the removal of DOC.
Test substance	:	Methyl formate, purity 97.3%
Conclusion	:	The test material is readily biodegradable
Reliability	:	(1) valid without restriction

09.07.2001 (6)

Type	:	aerobic
Inoculum	:	activated sludge
Contact time	:	
Degradation	:	> 90 % after 7 day
Result	:	
Conclusion	:	The material is biodegradable
Reliability	:	(4) not assignable

18.11.2001 (8)

4.1 ACUTE/PROLONGED TOXICITY TO FISH

Type	:	static
Species	:	Leuciscus idus (Fish, fresh water)
Exposure period	:	96 hour(s)
Unit	:	mg/l
Analytical monitoring	:	no
NOEC	:	m = 46
LC0	:	m = 46
LC50	:	m ca. 120
LC100	:	m <= 215
Method	:	other
Year	:	1989
GLP	:	
Test substance	:	
Method	:	Based on a range-finding study, concentrations were fixed at 10.0, 21.5, 46.4, 100 and 215 mg/L. Test material was directly added to reconstituted fresh water (total hardness 2.5 mmol/L, acid capacity 0.8 mmol/L, pH about 8). Fish, body length 6.3 to 7.5 cm, were added to 10 liter containers of water in groups of 10 at each concentration plus control using all-glass aquaria at 21° C. Mortality was determined at 1, 4, 24, 48, 72, and 96 hours.
Remark	:	The volatility of methyl formate is a concern in this static study using nominal concentrations of methyl formate. As no analytical measurements were conducted, the final concentration of methyl formate may have been much lower due to volatilization and base-catalyzed hydrolysis. The 24-hour result is considered reliable. The lack of additional mortality after 48 hours is consistent with volatilization or hydrolysis. The predicted Henry's Law constant indicates that volatilization will be relative slow in comparison to the duration of the test. Hydrolysis, however, might be a significant means of test material loss. The half live for hydrolysis calculated from the hydroxyl ion concentration at pH 7.4 (the nominal pH during the test) and the Kb of 15.7 L/mol-sec (derived from Hydrowin) is 48 hours. Therefore, significant loss of test material to hydrolysis is expected during the 96 hours of the test. The concentration of non-hydrolyzed test material at the end of the test would be about 25% of the original. The result is supported by the ECOSAR prediction using the ester model of a 96-hour LC50 of 132 mg/L. This is of the same magnitude as the highest concentration of Methyl formate (500 mg/L) reduced by hydrolysis and evaporation to the range of 100 mg/L by the end of the 96-hour study
Result	:	Mortality was as follows:

Nominal

Conc	# fish	2h	4h	24	48	72	96
10.0	10	0	0	0	0	0	0
21.5	10	0	0	0	0	0	0
46.4	10	0	0	0	0	0	0
100.0	10	0	0	1	3	3	3
215.0	10	0	0	10	10	10	10

Adverse clinical sighs were limited to "tumbling" for the 100 mg/L group at the 24 hour observation and the 215 mg/L group at the 4 hour observation

Oxygen levels and pH remained within normal ranges throughout the study. The recorded temperature remained at 21° C at all measurements.

The ca 115 mg/L LC50 was interpolated from these data.

Source : BASF AG Ludwigshafen
Test substance : Methyl formate, purity 97.7%
Conclusion : The 24-hour LC50 for methyl formate in this study is > 100 mg/L.
Reliability : (2) valid with restrictions
18.11.2001

4.2 ACUTE TOXICITY TO AQUATIC INVERTEBRATES

Type : static
Species : Daphnia magna (Crustacea)
Exposure period : 48 hour(s)
Unit : mg/l
Analytical monitoring : no
EC0 : m = 500
EC50 : m > 500
EC100 : m > 500
Method : Directive 84/449/EEC, C.2 "Acute toxicity for Daphnia"
Year : 1988
GLP : no
Test substance :
Method :

The study was run in accord with the EU guideline 79/831 EWG Annex C2, without any concentration analysis. Five daphnids were exposed per container with four container per concentration for a total of 20 daphnids per concentration. Concentrations were 0, 62.5, 125, 250 and 500 mg/L. A 500 mg/L stock was prepared and diluted to produce the dilution series. THe test was conducted in filtered tap water with a hardness of 2.7 mmol/L at a pH of 7.7 to 8.3.

Remark :

The test material was susceptible to volatility and base-catalyzed hydrolysis and as no analytical measurements were taken, the actual concentrations during the test are not known.

Concerning the possible volatility of methyl formate in this study conducted under static conditions, although methyl formate has a high vapor pressure, it is hydrophilic and hence binds to water reducing its rate of volatilization from aqueous media. The Henry's Law constant for methyl formate of 2.23E-4 atm-m3/mole (found in EPIWIN 3.05 Henry's Law experimental dataset) is in a range where atmospheric loss during a study will occur but probably would not be highly significant under normal experimental conditions.

Base catalyzed hydrolysis, however, is expected to be a significant source of test material conversion to hydrolysis products. Using the measured Kb at 25° C, and a typical pH reported during this study of 8.0, the initial concentration

of 500 mg/L would be expected to fall to about 30 mg/L after 24 hours (four half-lives) and to about 2 mg/L by the end of the 48 hour study. As the temperature was a bit lower than 25°C, the levels may not have fallen as much due to hydrolysis but it is expected that the vast majority of the initial methyl formate would be converted to methanol and formic acid by the end of the 48-hour test period.

Although the concentration of test material and hydrolysis products cannot be established with certainty, the results are considered sufficient for characterization of the toxicity of Methyl formate to invertebrates because under environmental conditions rapid hydrolysis will also occur and the initial level was five times the maximum level recommended for a limit test under current OECD guidance.

Result : There was no mortality at any time or concentration thoughout the test.
Test substance : Methyl formate, purity 97%
Conclusion : The 48-hour EC50 for this material is greater than 500 mg/L based on nominal concentrations
Reliability : (2) valid with restrictions
10.07.2001 (7)

Type :
Species : other aquatic crustacea: Chaetogammarus marinus
Exposure period : 96 hour(s)
Unit : mg/l
Analytical monitoring :
NOEC : m = 32
EC0 : m = 320
Method :

exposure time: 24-96 h;
LC0 and LC100 based on nominal concentration
organism length= 5 mm
glass stoppered conical flasks were used
initial pH of medium =8
medium = sea water
temperature: 15 deg C
salinity: 28 o/oo
renewal every 24 hours
Test in duplicate, 10 animals per vessel
volume = 1000 sea water
no analysis
Concentrations = 1, 10, 32, 100, 320, 560, 1000 mg/L
pH varied from 7.9 at 0 mg/L to 6.9 at 1000 mg/L

Test substance : Methyl formate, Fluka AG, Purity > 97%
Reliability : (2) valid with restrictions
18.11.2001 (1)

4.3 TOXICITY TO AQUATIC PLANTS E.G. ALGAE

Species	:	Scenedesmus subspicatus (Algae)
Endpoint	:	
Exposure period	:	96 hour(s)
Unit	:	mg/l
Analytical monitoring	:	
EC50	:	c = 190
EC20	:	c = 90
Method	:	other: Scenedesmus-Zellvermehrungs Hemmtest, DIN 38412 Teil 9,
Year	:	
GLP	:	
Test substance	:	
Remark	:	EC90(72h) >500 mg/l.
Source	:	BASF AG Ludwigshafen
Reliability	:	(2) valid with restrictions

24.05.2001 (9)

5.1.1 ACUTE ORAL TOXICITY

Type	:	LD50
Species	:	rat
Strain	:	Sprague-Dawley
Sex	:	male/female
Number of animals	:	
Vehicle	:	
Value	:	ca. 1500 mg/kg bw
Method	:	
Year	:	1979
GLP	:	no
Test substance	:	
Method	:	The test material in aqua dest. was administered at a volume of 10 mg/kg to group of 5 Sprague-Dawley rats of each sex. Five dose levels were administered and animals were observed for 14 days prior to sacrifice and necropsy. The age of rats was not reported; however, bodyweights are provided.
Result	:	The following mortality was recorded, all deaths occurred within the first hour after dosing.

DOSE (mg/kg)	Males	Females
2150	5/5	5/5
1470	2/5	2/5
1000	0/5	0/5
681	0/5	0/5
464	0/5	0/5

The following clinical signs were reported

Dose	Signs
2150	Irregular respiration Apathy Staggering Spastic gait Cyanotic Poor general appearance Shortness of breath
1470	Irregular respiration Apathy Staggering Poor general appearance
1000	Irregular respiration Apathy Poor general appearance
681	none reported
464	none reported

The flowing necropsy observation were reported in animals dying from exposure:

Lungs: Bloodfilled with edema

Stomach: Erosion of the glandular stomach
Heart: Dilation
Intestine: Irritation

Body weights were as follows:

Males: mean body weights

		DAYS AFTER TREATMENT		
Dose	0-day	2-4	7	14
2150	190	-	-	-
1470	270	300	321	344
1000	270	289	317	336
681	260	288	312	329
464	200	231	252	277

Females: mean body weights

Dose	0-day	2-4	7	14
2150	180	-	-	-
1470	180	192	208	211
1000	190	216	222	232
681	200	223	228	231
464	210	232	240	244

Test substance : methyl formate, purity 98 %
Conclusion : The Acute oral LD50 for rats is about 1500 mg/kg
Reliability : (2) valid with restrictions
23.05.2001 (2)

Type : LD50
Species : rabbit
Strain :
Sex :
Number of animals :
Vehicle :
Value : = 1600 mg/kg bw
Method :
Year : 1972
GLP :
Test substance :
Remark : The value refers to LD50/24 hours and ND50 (narcotic dose 50%) according to the authors.
24.05.2001 (23)

5.1.2 ACUTE INHALATION TOXICITY

Type : LC50
Species : rat
Strain : Sprague-Dawley
Sex : male/female
Number of animals :
Vehicle :
Exposure time : 4
Value : > 21 mg/l
Method : other
Year : 1988
GLP : yes
Test substance : as prescribed by 1.1 - 1.4
Method : Three male and three female animals were treated using

whole-body exposure to vapors of test material for 4 hours. Animals were housed individually. Males were 8-weeks old and weighed between 298 and 314 grams at the time of the exposure. Females were 10 weeks old and weighed between 216 and 229 grams. The target and nominal concentrations were 20 mg/L. Actual concentration was measured once an hour during the exposure using a MIRAN 1A Ambient Air analyzer. Mean measured concentration was 21 mg/L over the 4-hour exposure. Temperature during the exposure ranged from 76 to 78 °F., relative humidity ranged from 48 to 50%. Rats were observed daily for adverse clinical manifestations for seven days after exposure and were sacrificed without post-mortem exposure.
-

Remark : This study is considered key and considered reliable for establishing the LC50 value even though it does not meet the current OECD guideline. The study was conducted under glp conditions and the nominal and measured concentrations of test substance were similar. Animals showed few serious clinical signs during the exposure and recovered rapidly.
-

Result : All animals survived the duration of the study. Observations noted during exposure included lacrimation, reduced activities, and eyes closed. Signs exhibited upon removal from the chamber and during the two-hour poet-exposure period were limited to a few secretory signs and ano-genital staining. Virtually no adverse sings were exhibited by animals during the 7-day observation period. Animal weights were recorded prior to exposure and at the end of the 7-day observation period. All animals gained weight during this period and the body weight date were considered unremarkable by the study director.
-

Conclusion : The 4-hour inhalation LC50 in rats is greater than 21 mg/L
Reliability : (2) valid with restrictions
13.07.2001 (12)

Type : LC50
Species : rat
Strain : Sprague-Dawley
Sex : male/female
Number of animals : 20
Vehicle :
Exposure time : 4 hour(s)
Value : > 5.2 mg/l
Method : other
Year : 1979
GLP : no
Test substance : other TS
Method :

Ten male and ten female rats were exposed by whole body inhalation to vapors of the test substance at a nominal concentration of 19.4 mg/L (measured concentration of 5.2 mg/L). Animals were housed five per wire cage during the exposure. Exposure concentration was determined by gas chromatography. Animals were observed for 14 days after the exposure sacrificed and necropsied.

Remark : This study is considered supporting information.
Result :

No animal died during the study. Clinical signs were limited to watering eyes and ruffled fur and were cleared after day 2 of the study. Some males showed hair loss on the muzzle.

Body weights (mean)

	Males wt (g)		Females wt (g)	
Day	Test	Control	Test	Control
Start	187	188	189	187
Day 7	224	218	203	197
Day14	260	267	213	206

Test condition :
Methylformate. Prod. Nr 04837Purity 98%
Reliability : (2) valid with restrictions
23.05.2001 (3)

Type : other
Species : other
Strain : no data
Sex : no data
Number of animals :
Vehicle :
Exposure time :
Method :
Year : 1941
GLP : no
Test substance :
Method : Results of the exposure of unspecified (presumably rats) experimental animals to the vapors of methyl formate are presented in this brief report of experimental findings. No experimental details were presented.
Remark : This study is considered supporting
Result : The following results are provided:

Kills most animals in a short time	50,000 ppm
Dangerous to life in 30 to 60 minutes	15,000 - 25,000 ppm
Maximum concentration tolerated for 60 min without serious disturbances	5,000 ppm
Maximum concentration for prolonged (8 hours) exposure without serous disturbances	1,500-2000 ppm

The conclusions also stares that narcosis and irritation were identified as effects of acute vapor esposure
Test condition : Methyl formate, purity unspecified
Conclusion : The acute LC50 is greater than 5000 ppm for 1 hour and 2000 ppm for 8 hours.
Reliability : (4) not assignable
23.05.2001

5.1.3 ACUTE DERMAL TOXICITY

Type : LD50
Species : rat
Strain :
Sex :
Number of animals :
Vehicle :
Value : > 4000 ml/kg bw

Method	:	
Year	:	1978
GLP	:	
Test substance	:	
Method	:	Rats were treated and observed for 14 days, no other information
Remark	:	This result is supported by a 1990 screening-level dermal toxicity study of methyl formate sponsored by Hoechst Celanese in which 0/4 treated rabbits died at a dermal dose of 5,000 mg/kg (BioDynamics Inc, Acute Dermal Toxicity, Rabbits C-1160, sponsored by Hoechst Celanese, 2/28/1990)
Result	:	The LD50 was found to be > 4000 mg/kg. The following clinical signs were observed: Slight apathy Staggering Spastic gait irregular breathing
Test substance	:	Methyl Formate, purity 98%
Reliability	:	(4) not assignable

11.09.2001 (3)

5.4 REPEATED DOSE TOXICITY

Species	:	rat
Sex	:	no data
Strain	:	Wistar
Route of admin.	:	drinking water
Exposure period	:	1.5 years
Frequency of treatment	:	Continuous
Post obs. period	:	none
Doses	:	1% (= 274 mg/animal formate or 185 mg/animal calculated to formic acid according to the authors)
Control group	:	no data specified
Method	:	
Year	:	
GLP	:	no
Test substance	:	
Method	:	Six animals per group
Remark	:	The results are only available as a brief keynote summary.
Result	:	No toxicity detected
Test substance	:	Sodium formate in the drinking water at 1%
Conclusion	:	Sodium formate at 1% in the drinking water did not produce clinically adverse effects in rats after administration for approximately 18 months. The NOEL cannot be determined since pathological investigations had not been conducted.
Reliability	:	(4) not assignable

19.11.2001 (21)

Species	:	rat
Sex	:	male/female
Strain	:	Wistar
Route of admin.	:	drinking water
Exposure period	:	Lifelong
Frequency of treatment	:	Daily
Post obs. period	:	
Doses	:	200 mg/kg/day

Control group : yes, concurrent vehicle
NOAEL : = 200 mg/kg
Method :
Year :
GLP : no
Test substance :
Method :

The study design encompassed both a five-generation and chronic study in Wistar rats with calcium formate at 0.2% in drinking water. Eight males and 24 females were in the original test group with four controls of each sex. Both microscopic and pathologic investigations were done upon natural death of the animals.

An additional series of experiments using 0.4% calcium formate in the drinking water was also in progress and was in the second year and second generation at the time of this publication, histopathology results were not available for this dose level.

Remark :

Limitations to this study include the lack of data presentation for the 0.4% dose group, the limited description of the pathology and histopathology organ list and the modest size of the concurrent control group. In addition, this study does not take into account the effect of the methanol produced by hydrolysis of methyl formate.

Result :

Bodyweights and bodyweight gains of treated and control animals were similar. Microscopic and histological investigation of lung, spleen, stomach, liver and kidneys showed no suspect findings. Occasional small phagocytic action in reticuloendothelium and reticulo-histocyto elements of lung, spleen and stomach lymph nodes were reported. Two benign spontaneous tumors were seen in old animals and were considered not related to test substance administration.

The study at 0.4% calcium formate had been going on for about two years and it was reported that no disturbances (presumably mortality, body weight, fertility, or developmental toxicity) had been observed up to this point. Pathology and histopathology were in progress pending natural death of the test animals.

Test substance :

Calcium Formate, CAS Number 544-17-2

Conclusion :

This study shows that the formate portion of methyl formate up to the equivalent of 200 mg/kg as calcium formate has no adverse effect on rats dosed in drinking water.

Reliability : (2) valid with restrictions
19.11.2001

5.5 GENETIC TOXICITY 'IN VITRO'

Type	:	Ames test
System of testing	:	Salmonella typhimurium TA 1535 TA100 TA1537 TA1538 TA98
Concentration	:	0, 667,1000, 3333, 6667, 10000 micrograms/plate
Cycotoxic conc.	:	No appreciable toxicity up to 10000 micrograms per plate
Metabolic activation	:	with and without
Result	:	
Method	:	
Year	:	1989
GLP	:	yes
Test substance	:	
Method	:	The S-9 was prepared from Aroclor-induced rats. Positive controls were: -With S-9 - 2-Aminoanthracene for all strains -Without S-9 - Sodium azide for TA100 and TA1535 - 2-Nitrofluorene for TA98 and TA1538 - ICR-191 for TA1537 Triple plate test One repeat All strains run with the preincubation method at 667 to 10000 micrograms/plate with a 20 minute preincubation using a sealed tube to prevent loss of test material.
Result	:	There was no increase in the number of revertants for any strain at any concentration level of test substance. No bacterial toxicity was reported at any concentration. The positive and negative controls responded appropriately.
Source	:	Hoechst Celanese
Test substance	:	Methyl formate (C-1160)
Conclusion	:	This material was not mutagenic in the Ames test under these experimental conditions.
Reliability	:	(1) valid without restriction

12.07.2001 (22)

Type	:	Ames test
System of testing	:	Salmonella typhimurium TA 1535 TA100 TA1537 TA98
Concentration	:	20 to 5000 ug/plate
Cycotoxic conc.	:	no cytotoxicity reported
Metabolic activation	:	with and without
Result	:	
Method	:	OECD Guide-line 471 "Genetic Toxicology: Salmonella thyphimurium Reverse Mutation Assay"
Year	:	1989
GLP	:	no
Test substance	:	
Method	:	The S-9 was prepared from Aroclor-induced rats. Posiitive controls were: -With S-9 - 2-Aminoanthracene for all strains -Without S-9 - MNNG for TA100 and TA1535 - 4-Nitro-o-phenylendiame for TA98 - 9-Aminoacridine chloride for TA1537

Triple plate test

All strains run with the plate-incorporation method and the preincubation method at 20 to 5000 micrograms/plate. Strain 1535 also run with plate incorporation technigue at five concentrations from 100 to 1000 micrograms/plate.

Result : There was no increase in the number of revertants for any strain at any concentration level of test substance. No bacterial toxicity was reported at any concentration. The positive and negative controls responded appropriately.

Source : BASF AG Ludwigshafen

Test substance : Pure methyl formate, purity 98.4%

Conclusion : This material was not mutagenic in the Ames test under these experimental conditions.

Reliability : (2) valid with restrictions

09.07.2001 (4)

5.11 EXPERIENCE WITH HUMAN EXPOSURE

Method : Ten workers in a Swiss foundry were monitored at ten different times during work. Neurobehavioral tests were performed to determine if the exposures correlated with changes in neurobehavioral parameters. Tests included postural balance (bipedal, monopedal, bipedal blind) simple reaction time and digit span and a combined memory and reaction-time test. A rating of well being was also recorded as was alcohol, nicotine, caffeine and drug consumption.
.

Remark : In a previous study, these same authors reproved that there was a neurobehavioral effect of isopropanol and methylformate esposure to foundry workers. This was designed as a follow up study and the initial observations could not be repeated.

Result : Mean methyl formate concentration during work was 36 ppm while mean isopropanol concentration was 44 ppm. Three workers exceeded the methylformate MAC value of 100 ppm over 8 hours. The MAC value of 400 ppm for isopropanol was not exceeded. There was no correlation between the results of the neurobehavioral testing and the methylformate concentration.

Personal monitoring and urinary methanol concentrations were found to correlate. No neurobehavioral effects were correlated with exposure.

Conclusion : Combined exposure to methylformate and isopropanol in a foundry did not cause any neurobehavioral effects.

21.09.2001 (24)

Memo : Methylformate and isopropanol exposures in a foundry, neurobehavioural effects

21.09.2001

21.09.2001

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(2) BASF AG, Abteilung Toxikologie, unveroeffentlichte

(3) BASF AG, Abteilung Toxikologie, unveroeffentlichte Untersuchung (78/495), 22.05.1979

(4) BASF AG, Abteilung Toxikologie, unveroeffentlichte Untersuchung (89/632), 11.01.1990

(5) BASF AG, Analytisches Labor; unveroeffentlichte Untersuchung (J.Nr. 130365/01 vom 12.07.1988)

(6) BASF AG, Labor Oekologie und Umweltanalytic, Prufung der biologischen Abbaubarkeit von Methylformate, rein im CO2-Headspace-Test nach GLP, EN 45001 und ISO 9002, unpublished report 1997

(7) BASF AG, Labor Oekologie; Bestimmung der akute Wirking von Methylformate gegeguber dem Wasserfloh Daphnia magns Straus. Unpublished Report (0074/88) 1988

(8) BASF AG, Labor Oekologie; unveroeffentlichte Untersuchung

(9) BASF AG, Labor Oekologie; unveroeffentlichte Unter–suchung, (0074/88)

(10) BASF AG, Sicherheitsdatenblatt Methylformiat (08.03.1994)

(11) BASF Ag, Sicherheitsdatenblatt Methylformiat (08.03.1994)

(12) BioDynamics Inc, Project 87-8030, An Acute Inhalation Toxicity Study of C-1160 in the Rat. Sponsored by Hoechst-Celanese, 1/06/1988

(13) Calculated using HYDROWIN v 1.67 as found in EPIWIN 3.05

(14) Calculated using the Level III model contained in EPIWIN 3.05 Syracuse Research Corporation 2001.

(15) Daubert TE, Danner, RP. Physical and Thermodynamic Properties of Pure Chemicals Data Compilation. Washington, D.C.: Taylor and Francis, 1989 as cited in Hazardous Substance Data Base update of 2/08/2000

(16) EPIWIN 3.04 Calculation

(17) EPIWIN 3.05, Syracuse Research Corp, Syracuse NY 13210

(18) From table in HYDROWIN v1.67 Syracuse Research Corporation 2001

(19) Hansch. C., A. Leo and D. Hoekman. 1995. Exploring QSAR. Hydrophobic, Electronic, and Steric Constants. ACS Professional Reference Book. Washington, DC: American Chemical Society.

(20) Lyman,W.J. et al., Handbook of Chemical Property Estima–tion Methods, NY, McGraw–Hill, 4–9, (1982), zitiert nach: HSDB 07/1993

(21) Malorny, G.: Z. Ernaehrungswiss. 9, 332-339 (1969)

(22) Microbiological Associates Inc, Salmonella/Mammalian Preincubation Mutagenicity Assay with a Closed Phase Induction System. Report T8837.502002. 09/27/1989. Sponsored by Hoechst Celanese

(23) Munch J.C.: Industr. Med. Surg. 41 (4), 31 (1972) cited in: Henschler D.: MAK–Begruendung (1974)

(24) Sethre T, Laubli T, Hangartner M, Berode M, Krueger H. Isopropanol and methylformate exposure in a foundry: exposure data and neurobehavioural measurements. Int Arch Occup Environ Health. 2000 Nov;73(8):528-36.

(25) The Merck Index, 10th Edition (1983) Rahway, New Jersey. p. 870

I U C L I D

D a t a S e t

Existing Chemical	Substance ID: 64-18-6
CAS No.	64-18-6
EINECS Name	Formic acid
EINECS No.	200-579-1
Molecular Weight	46.03
Molecular Formula	CH2O2

Producer Related Part

Company:	BASF AG
Creation date:	12-NOV-1992

Substance Related Part

Company:	BASF AG
Creation date:	12-NOV-1992

Memo: Master

Printing date:	09-NOV-2000
Revision date:	01-JUN-1994
Date of last Update:	**24-MAY-2000**

Number of Pages: **80**

Chapter (profile):	Chapter: 1, 2, 3, 4, 5, 7
Reliability (profile):	Reliability: without reliability, 1, 2, 3, 4
Flags (profile):	Flags: without flag, confidential, non confidential, WGK (DE), TA-Luft (DE), Material Safety Data Set, Risk Assessment, Directive 67/548/EEC

1.0.1 OECD and Company Information

-

1.0.2 Location of Production Site

-

1.0.3 Identity of Recipients

-

1.1 General Substance Information

Substance type: Organic
Physical status: Liquid
Purity: >= 99 % w/w
Remark: The Iuclid Data Sheet is also submitted on behalf of BASF Antwerpen N.V. (B).
The substance-related part is also submitted on behalf of the following companies:

BP Chemicals LTD (GB)
Huels AG,
Kemira OY (SF)
Norsk Hydro A/S (N)
Novo Nordisk A/S (DK)
Perstorp AB (S)
Perstorp SpA, Div. Polyols (I)

15-MAR-2000 (1)

1.1.1 Spectra

-

1.2 Synonyms

Ameisensaeure

Ameisensaure

Aminic acid

Formic acid (7CI, 8CI, 9CI)

Formira

Formisoton

Formylic acid

Hydrogen carboxylic acid

Methanoic acid

Methanoic acid monomer

Myrmicyl

1.3 Impurities

-

1.4 Additives

-

1.5 Quantity

-

1.6.1 Labelling

Labelling: As in Directive 67/548/EEC
Symbols: C
Nota: B
Specific limits: Yes
R-Phrases: (35) Causes severe burns
S-Phrases: (1/2) Keep locked up and out of reach of children
(23) Do not breathe vapour
(26) In case of contact with eyes, rinse immediately with plenty of water and seek medical advice
(45) In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible)
Remark: INDEX No. 607-001-00-0
01-MAR-2000 (1) (2) (3)

1.6.2 Classification

Classification: As in Directive 67/548/EEC
Class of danger: Corrosive
R-Phrases: (35) Causes severe burns
Remark: INDEX No. 607-001-00-0
01-MAR-2000 (1) (2) (3)

1.7 Use Pattern

-

1.7.1 Technology Production/Use

-

1.8 Occupational Exposure Limit Values

Type of limit: MAK (DE)
Limit value: 5 ml/m3
Short term expos.
Limit value: 10 ml/m3
Schedule: 5 minute(s)
Frequency: 8 times
01-MAR-2000 (1) (4)

Type of limit: MAK (DE)
Limit value: 9 mg/m3
01-MAR-2000 (1) (4)

Type of limit: TLV (US)
Limit value: 9.4 mg/m3
01-MAR-2000 (5) (1)

Type of limit: TLV (US)
Limit value:
Remark: Limit value: 5 ppm
01-MAR-2000 (5) (1)

1.9 Source of Exposure

-

1.10.1 Recommendations/Precautionary Measures

-

1.10.2 Emergency Measures

-

1.11 Packaging

-

1.12 Possib. of Rendering Subst. Harmless

-

1.13 Statements Concerning Waste

-

1.14.1 Water Pollution

Classified by: KBwS (DE)
Labelled by: KBwS (DE)
Class of danger: 1 (weakly water polluting)
01-MAR-2000 (1)

1.14.2 Major Accident Hazards

Legislation: Stoerfallverordnung (DE)
Substance listed: No
01-MAR-2000 (1) (6)

1.14.3 Air Pollution

Classified by: TA-Luft (DE)
Labelled by: TA-Luft (DE)
Number: 3.1.7 (organic substances)
Class of danger: III
01-MAR-2000 (1)

1.15 Additional Remarks

-

1.16 Last Literature Search

-

1.17 Reviews

-

1.18 Listings e.g. Chemical Inventories

-

2.1 Melting Point

Value: = 8 degrees C
Reliability: (4) Not assignable
Manufacturer / producer data without proof
04-MAY-2000 (7)

Value: = 8.4 degrees C
Reliability: (4) Not assignable
Manufacturer / producer data without proof
24-JAN-2000 (8)

2.2 Boiling Point

Value: = 100.6 degrees C at 1013 hPa
Reliability: (4) Not assignable
Manufacturer / producer data without proof
24-JAN-2000 (8)

Value: = 100.8 degrees C
Reliability: (4) Not assignable
Secondary citation
24-JAN-2000 (9)

Value: = 101 degrees C
Reliability: (4) Not assignable
Manufacturer / producer data without proof
04-MAY-2000 (7)

2.3 Density

Type: Density
Value: = 1.22 g/cm3 at 20 degrees C
Reliability: (4) Not assignable
Manufacturer / producer data without proof
04-MAY-2000 (7)

Type: Relative density
Value: = 1.22 at 20 degrees C
Remark: Specific gravity 20/4 °C
Reliability: (4) Not assignable
Handbook
24-MAY-2000 (10)

Type: Density
Value: = 1.2223 g/cm3 at 20 degrees C
Reliability: (4) Not assignable
Manufacturer / producer data without proof
24-JAN-2000 (8)

2.3.1 Granulometry

-

2.4 Vapour Pressure

Value: = 42 hPa at 20 degrees C
Reliability: (4) Not assignable
Manufacturer / producer data without proof
04-MAY-2000 (7)

Value: = 44 hPa at 20 degrees C
Reliability: (4) Not assignable
Manufacturer / producer data without proof
24-JAN-2000 (8)

Value: = 46.7 hPa at 20 degrees C
Reliability: (4) Not assignable
Handbook
24-MAY-2000 (10)

Value: = 72 hPa at 30 degrees C
Reliability: (4) Not assignable
Handbook
24-MAY-2000 (10)

Value: = 170 hPa at 50 degrees C
Reliability: (4) Not assignable
Manufacturer / producer data without proof
04-MAY-2000 (7)

2.5 Partition Coefficient

log Pow: = -.54 at 20 degrees C
Method: Other (measured)
Year:
Reliability: (2) Valid with restrictions
Discrepancy between documented test parameters and standard methods, but scientifically acceptable
24-MAY-2000 (11)

log Pow: = -.492
Method: Other (calculated): Increment method by Rekker with computer program of CompuDrug Ltd.
Year:
Reliability: (2) Valid with restrictions
Calculated value in accordance with generally accepted standard methods
24-MAY-2000 (12)

log Pow:
Method:
Year:
Result: Log P oct = -1.55/-0.22 (calculated)
Reliability: (4) Not assignable
Handbook
24-MAY-2000 (10)

2.6.1 Water Solubility

Value: At 20 degrees C
Qualitative: Miscible
pH: 2.2 at 10 g/l and 20 degrees C
Reliability: (4) Not assignable
Manufacturer / producer data without proof
04-MAY-2000 (7)

Value: At 25 degrees C
Qualitative: Miscible
Reliability: (4) Not assignable
Secondary citation
24-JAN-2000 (9)

2.6.2 Surface Tension

-

2.7 Flash Point

Value: = 48 degrees C
Type: Closed cup
Method: Other: DIN 51 755
Year:
Test substance: Formic acid, purity 99%
Reliability: (1) Valid without restriction
National standard specification
04-MAY-2000 (13)

2.8 Auto Flammability

Value: 480 degrees C
Method: Other: DIN 51 794
Remark: Ignition temperature
Reliability: (4) Not assignable
Manufacturer / producer data without proof
04-MAY-2000 (7)

Value: = 505 degrees C
Method: Other: DIN 51 794
Remark: Ignition temperature
Test substance: Formic acid, purity 99%
Reliability: (1) Valid without restriction
National standard specification
24-JAN-2000 (14)

2.9 Flammability

-

2.10 Explosive Properties

Result: Not explosive
Remark: Because of chemical structure
Reliability: (2) Valid with restrictions
Expert judgement
24-JAN-2000 (15)

2.11 Oxidizing Properties

Result: No oxidizing properties
Remark: Because of chemical structure
Reliability: (2) Valid with restrictions
Expert judgement
24-JAN-2000 (15)

2.12 Additional Remarks

Result: Explosive limits in air: 13.5 - 36.5 vol.%
Test substance: Formic acid, purity 99%
Reliability: (2) Valid with restrictions
Discrepancy between documented test parameters and standard methods, but scientifically acceptable
24-JAN-2000 (14)

Result: Viscosity: 1.8 mPa.s at 20 °C

Explosion limits: 12 - 38 vol.%

Hazardous reactions:
Exothermic reaction with: alkalis, amines or products containing amines
Thermal decomposition products: carbon monoxide
Reliability: (4) Not assignable
Manufacturer / producer data without proof
04-MAY-2000 (7)

3.1.1 Photodegradation

Type: Air
INDIRECT PHOTOLYSIS
Sensitizer: OH
Conc. of sens.: 500000 molecule/cm3
Degradation: = 50% after 35.7 days
Method:
Year: **GLP:**
Test substance:
Remark: Rate constant: 4.5*10^-13 cm^3/mol*sec
Test condition: Gas phase reaction with OH radicals; 25 degrees C
(16)

Type: Other: Water / air
Method:
Year: **GLP:**
Test substance:
Remark: Gas and solution phase rate constants: K(gas)= 3.7*10^-3 cm^3/mol*sec; K(solution)= 2.2*10^-13 cm^3/mol*sec
(17)

Type: Water
INDIRECT PHOTOLYSIS
Sensitizer: OH
Degradation: = 50% after .9 year
Method:
Year: **GLP:**
Test substance:
Remark: Rate constant: 2.5*10^9 M^-1 sec^-1
Test condition: pH=7; temperature 15-25 deg C
(18)

Type: Water
INDIRECT PHOTOLYSIS
Sensitizer: OH
Method:
Year: **GLP:**
Test substance:
Remark: Rate constant: 0.28*10^10 l/mol*sec
Test condition: OH formed by pulsed radiolysis; neutral pH
(19)

Type: Water
Method:
Year: **GLP:**
Test substance:
Result: Rate constants for reaction of OH radicals (297 K) in water with HCOO- (340 +/- 39) x 10e7 mol e-1 sec e-1 and for HCOOH (10.1 +/- 1.3) x 10e7 mol e-1 sec -1.
Reliability: (2) Valid with restrictions
23-NOV-1999 (20)

Type: Water
Method:
Year: **GLP:**
Test substance:
Result: k (HCOOH) = (3.3 +/- 1.0) x 10e5 l mol e-1 sec e-1, k (HCOO-) = (5.0 +/- 0.4) x 10e7 l mol e-1 sec e-1 (298 K)
Reliability: (2) Valid with restrictions
24-NOV-1999 (21)

Type: Other
Method:
Year: **GLP:**
Test substance:
Remark: Rate constant (298 K): K= (10.37 +/- 0.04)*10^-12 cm^3/mol* sec.
(22)

3.1.2 Stability in Water

-

3.1.3 Stability in Soil

-

3.2 Monitoring Data (Environment)

Type of measurement: Other
Medium: Other: Food / rain
Remark: Numerous foodstuffs and beverages, such as milk, cheese, wine, fruits, honey and coffee, contain formic acid; natural concentrations are mentioned in a range of from 1-7,700 mg/kg (FDA,PB 266282).
Formic acid is found in the atmosphere and can be detected in rainwater among others:
Rainwater in Ithaca (USA,1977) - 110 ug/l; rainwater in New Hampshire (USA,1977) - 9.2 ug/l; rainwater in the Taunus (1983/84) - 120 ug/l (Hahn, 1986)
Rainwater in Hanover (1987) - 260 ug/l (Winkeler et al., 1988)
Rainwater in Juelich (1986) - 250 ug/l. (Mueller,1986)
(23)

Type of measurement: Other
Medium: Other: Industrial effluent (paper manufacture)
Remark: Evidence of 18 mg/l (gas liquid chromatography mass spectrometry)
(24)

Type of measurement: Other
Medium: Other: Sewage & effluents (oxidation pond water)
Remark: Evidence of 31 mg/l (gas liquid chromatography mass spectrometry)
(24)

Type of measurement: Other
Medium: Other: Surface water (lake)
Remark: Evidence of 3-18 ug/l (liquid chromatography)
(25)

Type of measurement: Other
Medium: Other: Surface water (Ohio river)
Remark: Evidence of 10-24 ug/l (gas liquid chromatography)
(26)

Type of measurement: Other
Medium: Other: Industrial influent/effluent (kraft pulp)
Remark: Evidence of 18/31 mg/l (influent to /effluent from stabilization basin)
(27)

Type of measurement: Other
Medium: Biota
Remark: Formic acid is a natural substance which is formed biogenically as an intermediate and final product in the microbial, plant and animal metabolism. It is an excretion product of natural acid-forming prokaryotic fermenting organisms. These anaerobes are bacteria which belong to the enterobacteriaceae and are also typically native to the human intestines (e.g. E. coli). Formic acid is moreover formed in the glands of ants and stinging nettles and in other animals and plants.
09-NOV-1999 (23)

Type of measurement: Other
Medium: Other
Remark: Formic acid found in (ppbv): 1. Germany: Continental anticyclone 1.04 +/- 1.08, marine influence 0.17 +/- 0.06; 2. Amazon/basin, ABLE-2A, dry season: 1.6 +/- 0.6 (boundary layer); 3. Amazon/basin, ABLE-2B, wet season: 0.37 +/- 0.24 (boundary layer), 0.15 +/- 0.09 (free troposphere); 4. Central Africa/DECAFE, dry season: 3.7 +/- 1.0 (boundary layer), 0.9 +/- 0.3 (free troposphere).
(28)

3.3.1 Transport between Environmental Compartments

Type: Volatility
Media: Water - air
Method: Other
Year:
Remark: Henry's constant: 1.67*10^-7 atm*m^3/mol (calculated from original citation: "6*10^3 mol l^-1 atm^-1")
The Henry's Law Constant indicates that volatilization from water would not be significant.
(29) (30)

3.3.2 Distribution

Media: Air - biota - sediment(s) - soil - water
Method: Calculation according to Mackay, Level I
Year:
Result: Water: 92%, air: 7.99%, soil: 2.09E-3; sediment: 1.96E-3
Reliability: (1) Valid without restriction
15-NOV-1999 (31)

3.4 Mode of Degradation in Actual Use

-

3.5 Biodegradation

Type: Aerobic
Inoculum: Other: Effluent of a communal sewage treatment plant
Concentration: 20 mg/l related to DOC (Dissolved Organic Carbon)
Degradation: = 98% after 14 days
Result: Readily biodegradable
Kinetic:
7 days = 12%
10 days = 26%
13 days = 93%
14 days = 98%
Method: OECD Guideline 301 E "Ready biodegradability: Modified OECD Screening Test"
Year: **GLP:** Yes
Test substance:
Remark: Lag phase: 7 d; degradation phase: 6 d; test duration: 14 d
test substance 72 mg/l initial concentration
Test condition: Neutralized with NaOH
Reliability: (2) Valid with restrictions
15-NOV-1999 (32)

Type: Aerobic
Inoculum: Other: Effluent of a communal sewage treatment plant
Concentration: 20 mg/l related to DOC (Dissolved Organic Carbon)
Degradation: = 100% after 11 days
Result: Readily biodegradable
Kinetic:
2 days = 2%
3 days = 4%
7 days = 13%
8 days = 38%
9 days = 100%
Method: OECD Guideline 301 E "Ready biodegradability: Modified OECD Screening Test"
Year: **GLP:** Yes
Test substance:
Remark: Lag phase: 6 d; degradation phase: 3 d; test period: 11 d
Test substance 77 mg/l initial concentration
Test condition: Neutralized with NaOH
Reliability: (2) Valid with restrictions
15-NOV-1999 (33)

Type: Aerobic
Inoculum: Other bacteria: freshwater, acclimatized
Degradation: = 51% after 5 days
Method: Other: Sealed bottle test; (BSB of the THSB)
Year: **GLP:**
Test substance:
Remark: Initial concentration 3-10 mg/l test substance
Test results with a variable test period:
Degree of elimination (10/15/20 d) = 47/39/60%
Test condition: neutralized
(34)

Type: Aerobic
Inoculum: Other bacteria: freshwater, not acclimatized
Degradation: = 48% after 5 days
Method: Other: sealed bottle test; (BSB of the THSB)
Year: **GLP:**
Test substance:
Remark: Initial concentration 3-10 mg/l test substance
Test results with a variable test period:
Degree of elimination (10/15/20 d) = 54/66/68%
Test condition: Neutralized
(34)

Type: Aerobic
Inoculum: Other bacteria: salt water, synthetic
Degradation: = 62% after 5 days
Method: Other: Sealed bottle test; (BSB of the THSB)
Year: **GLP:**
Test substance:
Remark: Initial concentration 3-10 mg/l test substance
Test results with a variable test period:
Degree of elimination (10/15/20 d) = 91/92/95%
Test condition: Neutralized

(34)

Type: Aerobic
Inoculum: Other bacteria: Sewage, communal
Degradation: About 80% after 5 days
Method: Other: Respirometric dilution method; (BSB of the THSB)
Year: **GLP:**
Test substance:
Remark: Dilution series: Initial concentration of the test substance variable from 24-1200 mg/l
13-AUG-1996

(35)

Type: Aerobic
Inoculum: Other bacteria: Freshwater
Concentration: 20 mg/l related to test substance
Degradation: = 40.5% after 5 days
Method: Other: Dilution method; (BSB of the THSB)
Year: **GLP:**
Test substance:

(36)

Type: Aerobic
Inoculum: Other bacteria: Salt water, synthetic
Concentration: 40 mg/l related to test substance
Degradation: = 51.7% after 5 days
Method: Other: Dilution method; (BSB of the THSB)
Year: **GLP:**
Test substance:

(36)

Type: Aerobic
Inoculum: Activated sludge
Concentration: 500 mg/l related to test substance
Degradation: = 70% after 1 day
Method: Other: Warburg method; (BSB of the THSB)
Year: **GLP:**
Test substance:
Remark: Test results with a variable test period:
Degree of elimination (6/12 h) = 28.3/45.4%

(37)

3.6 BOD5, COD or BOD5/COD Ratio

-

3.7 Bioaccumulation

Species:
Exposure period:
Concentration:
BCF: Approx. .22
Elimination:
Method: Other
Year: **GLP:**
Test substance:
Remark: BCF calculated on the basis of the log Pow = -0.54 and the equation "log BCF = 0.76 log Pow -0.23"

(38)

Species:
Exposure period:
Concentration:
BCF:
Elimination:
Method: Other
Year: **GLP:**
Test substance:
Remark: The log Pow measured of -0.54 suggests the absence of a bioaccumulation potential.

(23)

3.8 Additional Remarks

-

AQUATIC ORGANISMS

4.1 Acute/Prolonged Toxicity to Fish

Type: Other: No data
Species: Lepomis gibbosus (fish, freshwater)
Exposure period: 24 hour(s)
Unit: mg/l **Analytical monitoring:** No data
LC50: = 5000
Method: Other: Freeman, L.: Sewage Ind. Wastes 25 (7), 845
Year: 1953 **GLP:** No data
Test substance: No data
Remark: Bluegill sunfish
Test substance: Sodium formate
06-SEP-1995 (39) (40)

Type: Other: No data
Species: Lepomis macrochirus (fish, freshwater)
Exposure period: 24 hour(s)
Unit: mg/l **Analytical monitoring:** No data
LC50: = 175
Method: Other: Freeman, L.: Sewage Ind. Wastes 25 (7), 845
Year: 1953 **GLP:** No
Test substance: No data
Remark: The result is only available as a brief secondary citation.
06-SEP-1995 (39) (41)

Type: Static
Species: Leuciscus idus (fish, freshwater)
Exposure period: 48 hour(s)
Unit: mg/l **Analytical monitoring:** No
NOEC: = 100
LC50: = 122
Method: Other: Determination of the effect of water constituents on fish, DIN 38412 part 15
Year: **GLP:** Yes
Test substance: No data
23-OCT-1995 (42)

Type: Static
Species: Leuciscus idus (fish, freshwater)
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:** No
NOEC: 22
LC50: 46 - 100
Method: Other: Determination of the effect of water constituents on fish, DIN 38412 part 15
Year: 1982 **GLP:** No
Test substance: As prescribed by 1.1 - 1.4
Remark: To assess the physiologic effect of the relatively low pH on the golden orfe the highest test concentration (100 mg/l) was investigated in parallel after adjusting the pH with NaOH approximately to the pH of the control. After the pH adjustment, 100 mg/l was tolerated without mortality and without any symptoms.
23-OCT-1995 (43)

4.2 Acute Toxicity to Aquatic Invertebrates

Species: Daphnia magna (Crustacea)
Exposure period: 24 hour(s)
Unit: mg/l **Analytical monitoring:**
EC0: = 25
EC50: = 34.2
EC100: = 50
Method: Directive 84/449/EEC, C.2 "Acute toxicity for Daphnia"
Year: **GLP:**
Test substance:
23-SEP-1999 (44)

Species: Daphnia magna (Crustacea)
Exposure period: 48 hour(s)
Unit: mg/l **Analytical monitoring:**
EC0: = 25
EC50: = 34.2
EC100: = 50
Method: Directive 84/449/EEC, C.2 "Acute toxicity for Daphnia"
Year: **GLP:**
Test substance:
23-SEP-1999 (44)

Species: Daphnia magna (Crustacea)
Exposure period: 48 hour(s)
Unit: mg/l **Analytical monitoring:**
EC50: = 151.2
Method: Other: Test for inhibition of swimming ability (immobilization)
Year: **GLP:**
Test substance:
Remark: Confidence limits: 138-165 mg/l
Test condition: 22 degrees C; pH 7.0-8.2

(45)

Species: Daphnia magna (Crustacea)
Exposure period: 48 hour(s)
Unit: mg/l **Analytical monitoring:**
EC50: = 120
Method:
Year: **GLP:**
Test substance:
Remark: Immobilization

(46)

Species: Other aquatic arthropod: Artemia salina (naupliar larvae)
Exposure period: 24 hour(s)
Unit: mg/l **Analytical monitoring:**
LC50 : = 410
Method:
Year: **GLP:**
Test substance:

(34)

4.3 Toxicity to Aquatic Plants e.g. Algae

Species: Scenedesmus quadricauda (algae)
Endpoint:
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:**
TGK : = 100
Method: Other: Cell multiplication inhibition test
Year: **GLP:**
Test substance:

(46)

Species: Scenedesmus subspicatus (algae)
Endpoint:
Exposure period: 72 hour(s)
Unit: mg/l **Analytical monitoring:**
EC50: = 26.9
EC20 : = 14.9
Method: Other: Scenedesmus cell multiplication inhibition test, DIN 38412 part 9, determination of the inhibitory effect of water constituents on green algae
Year: **GLP:**
Test substance:
Remark: EC90(72h)=45.6 mg/l

(44)

Species: Scenedesmus subspicatus (algae)
Endpoint:
Exposure period: 96 hour(s)
Unit: mg/l **Analytical monitoring:**
EC50: = 25
EC20 : = 12.6
Method: Other: Scenedesmus cell multiplication inhibition test, DIN 38412 part 9, determination of the inhibitory effect of water constituents on green algae
Year: **GLP:**
Test substance:
Remark: EC90(96h)=45.1 mg/l

(44)

4.4 Toxicity to Microorganisms e.g. Bacteria

Type: Aquatic
Species: Other bacteria: Activated sludge, adapted
Exposure period: 30 minute(s)
Unit: mg/l **Analytical monitoring:**
EC20 : > 1000
Method: Other: Test for Inhibition of Oxygen Consumption by Activated Sludge, ISO 8192
Year: **GLP:**
Test substance:
Remark: If the test substance is properly introduced into adapted biological sewage treatment plants, no disorders of the degradation activity of the activated sludge are expected. No respiratory inhibition of activated sludge up to 1000 mg/l
22-NOV-1999 (47)

Type:
Species: Escherichia coli (bacteria)
Exposure period: 24 hour(s)
Unit: mg/l **Analytical monitoring:**
NOEC : = 1000
Method:
Year: **GLP:**
Test substance:
Remark: Below 1000 mg/l without any inhibitory effect on the acid formation by Escherichia coli.

(46)

Type:
Species: Pseudomonas putida (bacteria)
Exposure period: 17 hour(s)
Unit: mg/l **Analytical monitoring:**
EC10: = 33.9
EC50: = 46.7
EC90 : = 59.5
Method: Other: Pseudomonas cell multiplication inhibitory test, DIN 38412 part 8, adopted for yellow publication, determination of the inhibitory effect of water constituents on bacteria
Year: **GLP:**
Test substance:

(44)

4.5 Chronic Toxicity to Aquatic Organisms

4.5.1 Chronic Toxicity to Fish

-

4.5.2 Chronic Toxicity to Aquatic Invertebrates

-

TERRESTRIAL ORGANISMS

4.6.1 Toxicity to Soil Dwelling Organisms

-

4.6.2 Toxicity to Terrestrial Plants

-

4.6.3 Toxicity to other Non-Mamm. Terrestrial Species

Species: Other avian: Red-winged blackbird
Endpoint: Other: Mortality and repellency
Expos. period:
Unit:
LD50 : >= 111
Method: Other
Year: **GLP:** No data
Test substance: No data
Remark: The acute oral toxicity and a "repellency toxicity index" were determined.
07-DEC-1995 (48)

Species: Other avian: Red-winged blackbird
Endpoint:
Expos. period:
Unit: mg/kg bw
LD50 : > 111
Method: Other: Acute toxicity test
Year: **GLP:**
Test substance:
(23)

4.7 Biological Effects Monitoring

-

4.8 Biotransformation and Kinetics

-

4.9 Additional Remarks

Memo: Aedes aegyptii (insect larva): LC50 = 400 mg/l (4 h), or LC50 = 0.04 % v/v (4 h); 22 - 24 °C
13-JAN-2000 (49)

5.1 Acute Toxicity

5.1.1 Acute Oral Toxicity

Type: LD50
Species: Rat
Sex:
Number of Animals:
Vehicle:
Value: = 1830 mg/kg bw
Method: Other: No data
Year: **GLP:** No
Test substance: No data
Remark: The result is only available as a table in the form of a secondary citation.
06-SEP-1995 (50) (51)

Type: LD50
Species: Rat
Sex:
Number of Animals:
Vehicle:
Value: = 1210 mg/kg bw
Method: Other: No data
Year: **GLP:** No
Test substance: No data
Remark: The result is only available as a secondary citation.
06-SEP-1995 (52) (41)

Type: LD50
Species: Rat
Sex:
Number of Animals:
Vehicle:
Value: = 730 mg/kg bw
Method: OECD Guideline 401 "Acute Oral Toxicity"
Year: 1981 **GLP:** No data
Test substance: No data
Remark: 5 males and 5 females were used per dose group (501, 631, 794 and 1000 mg/kg). The observation period was 14 days.
Result: According to the authors, body weight gain was reduced clearly related to the dose.
Test substance: Formic acid 99%
11-SEP-1995 (53)

Type: LD50
Species: Rat
Sex:
Number of Animals:
Vehicle:
Value: = 1100 mg/kg bw
Method: Other: No data
Year: **GLP:** No data
Test substance: No data
Remark: The result is only available as a secondary citation.
07-DEC-1995 (54)

Type: LD50
Species: Rat
Sex:
Number of Animals:
Vehicle:
Value: = 3050 mg/kg bw
Method: Other
Year: **GLP:** No
Test substance: Other TS
Test substance: Calcium formate
23-OCT-1995 (55)

Type: LD50
Species: Mouse
Sex:
Number of Animals:
Vehicle:
Value: = 1100 mg/kg bw
Method: Other: No data
Year: **GLP:** No
Test substance: No data
Remark: 55 animals were used; no further data. The result is only available as a table.
06-SEP-1995 (50) (56) (51)

Type: LD50
Species: Mouse
Sex:
Number of Animals:
Vehicle:
Value: = 11200 mg/kg bw
Method: Other: No data
Year: **GLP:** No
Test substance: Other TS
Remark: 45 animals were used; no further data. The result is only available as a table.
Test substance: Sodium formate
05-SEP-1995 (56)

Type: LD50
Species: Mouse
Sex:
Number of Animals:
Vehicle:
Value: = 1920 mg/kg bw
Method: Other: No data
Year: **GLP:** No
Test substance: Other TS
Remark: 45 animals were used; no further data. The result is only available as a table.
Test substance: Calcium formate
05-SEP-1995 (56)

Type: LD50
Species: Mouse
Sex:
Number of Animals:
Vehicle:
Value: = 700 mg/kg bw
Method: Other: No data
Year: **GLP:** No data
Test substance: No data
Remark: The result is only available as a secondary citation.
07-DEC-1995 (54)

Type: LDLo
Species: Rabbit
Sex:
Number of Animals:
Vehicle:
Value: > 4000 mg/kg bw
Method: Other
Year: **GLP:** No data
Test substance: Other TS
Test substance: Formic acid
28-JUL-1997 (57)

Type: Other
Species: Dog
Sex:
Number of Animals:
Vehicle:
Value: = 4000 mg/kg bw
Method: Other: No data
Year: **GLP:** No
Test substance: Other TS
Remark: Deaths occurred. In the source, supposed methemoglobin formation is described. The original (Fleig 1907) is not available, and von Oettingen (1959) does not mention this effect. The finding seems to be unlikely.
Test substance: Test substance: Sodium formate
05-SEP-1995 (50) (58) (41) (59)

Type: LDLo
Species: Sheep
Sex:
Number of Animals:
Vehicle:
Value:
Method: Other
Year: **GLP:** No data
Test substance: Other TS
Remark: Formic acid (150 mg/kg) was without any adverse effect except for some indications of anorexia.
Test substance: Formic acid
29-JUL-1997 (60)

5.1.2 Acute Inhalation Toxicity

Type: LC50
Species: Rat
Sex:
Number of Animals:
Vehicle:
Exposure time: 4 hour(s)
Value: = 7.4 mg/l
Method: Other: BASF test
Year: **GLP:** No
Test substance: As prescribed by 1.1 - 1.4
Remark: Whole-body exposure (vapor). 10 males and 10 females were used per group. The animals were observed for 14 days.
05-SEP-1995 (61)

Type: LC50
Species: Rat
Sex:
Number of Animals:
Vehicle:
Exposure time: 15 minute(s)
Value: = 15 mg/l
Method: Other: No data
Year: **GLP:** No data
Test substance: No data
Remark: The result is only available as a secondary citation.
06-SEP-1995 (54)

Type: Other: IHT
Species: Rat
Sex:
Number of Animals:
Vehicle:
Exposure time: 50 minute(s)
Value:
Method: Other: Carried out on the basis of the method described by H.F. Smith et al.: Am. Ind. Hyg. Ass.J. 23, 95-107 (1962)
Year: 1962 **GLP:** no
Test substance: As prescribed by 1.1 - 1.4
Remark: Mortality (2/12) after 3 minutes, 5/6 after 10 min. and 6/6 after 30 and 50 min respectively. Exposure to an atmosphere enriched or saturated at 20 degrees C.
06-SEP-1995 (62)

Type: Other: IHT
Species: Rat
Sex:
Number of Animals:
Vehicle:
Exposure time: 7 hour(s)
Value:
Method: Other: Carried out on the basis of the method described by H.F. Smith et al: Am. Ind. Hyg. Ass. J. 23, 95-107 (1962)
Year: 1962 **GLP:** No
Test substance: Other TS
Remark: No mortality after 30 min. Exposure to an atmosphere enriched or saturated at 20 degrees C.
Lethality after prolonged exposure
Test substance: Formic acid 50% in water
05-SEP-1995 (63)

Type: Other: IHT
Species: Rat
Sex:
Number of Animals:
Vehicle:
Exposure time: 7 hour(s)
Value:
Method: Other: BASF test
Year: **GLP:** No
Test substance: Other TS
Remark: No mortality after 3-hour exposure to an atmosphere enriched or saturated at 20 degrees C.
Lethality after prolonged exposure.
Test substance: Formic acid 25% in water
05-SEP-1995 (64)

Type: Other: IHT
Species: Rat
Sex:
Number of Animals:
Vehicle:
Exposure time: 7 hour(s)
Value:
Method: Other: BASF test
Year: **GLP:** No
Test substance: Other TS
Remark: No mortality after 7-hour exposure to an atmosphere enriched or saturated at 20 degrees C.
Test substance: Formic acid 10% in water
05-SEP-1995 (65)

Type: Other: IHT
Species: Rat
Sex:
Number of Animals:
Vehicle:
Exposure time: 10 minute(s)
Value:
Method: OECD Guideline 403 "Acute Inhalation Toxicity"
Year: 1981 **GLP:** No data
Test substance: No data
Remark: Inhalation hazard test: Lethality in 6 of 6 rats used after 10-min exposure to an atmosphere saturated at 20 degrees C (44,168 ppm)
06-SEP-1995 (66)

Type: Other: IHT
Species: Rat
Sex: Male/female
Number of Animals: 6
Vehicle:
Exposure time: 116 minute(s)
Value:
Method: Other: IHT
Year: 1981 **GLP:** No
Test substance: Other TS
Remark: 12/12 rats died after 10 and 116 min by inhalation of an atmosphere that had been saturated with the volatile part of the compound at 20 degrees centigrade. 8/12 rats died after 3 min by inhalation.
Test substance: Formic acid, purity >98%
16-MAY-2000 (67)

Type: LC50
Species: Mouse
Sex:
Number of Animals:
Vehicle:
Exposure time: 15 minute(s)
Value: = 6.2 mg/l
Method: Other: No data
Year: **GLP:** No data
Test substance: No data
Remark: The result is only available as a secondary citation.
07-DEC-1995 (54)

5.1.3 Acute Dermal Toxicity

-

5.1.4 Acute Toxicity, other Routes

Type: LD50
Species: Mouse
Sex:
Number of Animals:
Vehicle:
Route of admin.: i.p.
Value: = 940 mg/kg bw
Method: Other: No data
Year: **GLP:** No
Test substance: No data
Remark: The result is only available as a secondary citation.
07-DEC-1995 (50) (51) (68) (52)

Type: LD0
Species: Rabbit
Sex:
Number of Animals:
Vehicle:
Route of admin.: s.c.
Value: > 300 mg/kg bw
Method: Other
Year: **GLP:** No data
Test substance: Other TS
Remark: Rabbits tolerated a 300 mg/kg s.c. administration without adverse effect.
Test substance: Formic acid
28-JUL-1997 (69)

Type: LDLo
Species: Rabbit
Sex:
Number of Animals:
Vehicle:
Route of admin.: s.c.
Value:
Method: Other
Year: **GLP:** No data
Test substance: Other TS
Remark: Doses of 0.46-1.25 mg/kg caused central nervous system depression, vasoconstriction and diuresis in rabbits; larger doses (about 4 g/kg) produced convulsions and death.
Test substance: Formic acid
29-JUL-1997 (69)

Type: LD50
Species: Mouse
Sex:
Number of Animals:
Vehicle:
Route of admin.: i.v.
Value: = 145 mg/kg bw
Method: Other: No data
Year: **GLP:** No
Test substance: No data
Remark: 50 animals were used; no further data. The result is only available as a table.
07-DEC-1995 (50) (56) (51) (52)

Type: Other: MLD
Species: Rabbit
Sex:
Number of Animals:
Vehicle:
Route of admin.: i.v.
Value: = 239 mg/kg bw
Method: Other: No data
Year: **GLP:** No
Test substance: No data
Remark: Deaths occurred. The result is only available in a table as a secondary citation.
06-SEP-1995 (50)

5.2 Corrosiveness and Irritation

5.2.1 Skin Irritation

Species: Rabbit
Concentration:

Exposure:
Exposure Time:
Number of Animals:
PDII:
Result: Corrosive
EC classificat.:
Method: Other: No data
Year: **GLP:** No
Test substance: No data
Remark: The various results are only available as secondary citations.
07-DEC-1995 (70) (51) (71) (72) (52) (73)

Species: Rabbit
Concentration:

Exposure:
Exposure Time:
Number of Animals:
PDII:
Result:
EC classificat.:
Method: Other: 610 mg open
Year: **GLP:** No
Test substance: No data
Remark: The result is only available as a secondary citation.
Effect: "mild" according to RTECS
06-SEP-1995 (74)

Species: Other: No data
Concentration:

Exposure:
Exposure Time:
Number of Animals:
PDII:
Result: Highly corrosive
EC classificat.:
Method: Other
Year: **GLP:** No data
Test substance: No data
23-OCT-1995 (75)

5.2.2 Eye Irritation

Species: Rabbit
Concentration:
Dose:
Exposure Time:
Comment:
Number of Animals:
Result: Irritating
EC classificat.:
Method: Other: Application to the cornea
Year: **GLP:** No data
Test substance: No data
06-SEP-1995 (76)

Species: Rabbit
Concentration:
Dose:
Exposure Time:
Comment:
Number of Animals:
Result: Irritating
EC classificat.:
Method: Other: No data
Year: **GLP:** No
Test substance: No data
Remark: Method: 122 mg
Effect: "severe" according to RTECS
The result is only available as a secondary citation.
06-SEP-1995 (74)

Species: Other: No data
Concentration:
Dose:
Exposure Time:
Comment:
Number of Animals:
Result: Irritating
EC classificat.:
Method: Other: No data
Year: **GLP:** No
Test substance: No data
Remark: Conjunctivitis, corneal injuries
Origin of the result not comprehensible
06-SEP-1995 (77)

5.3 Sensitization

Type: No data
Species: Human
Number of Animals:
Vehicle:
Result:
Classification:
Method: Other: No data
Year: **GLP:** No data
Test substance: No data
Remark: According to the present secondary source (HSDB), sensitization to formic acid may occur in rare cases in persons who had previously been exposed to formaldehyde.
06-SEP-1995 (76)

5.4 Repeated Dose Toxicity

Species: Rat **Sex:** Male
Strain: Wistar
Route of admin.: Inhalation
Exposure period: 3-8 days
Frequency of treatment: 6 h daily
Post. obs. period: No data
Doses: 0.037 mg/l (20 ppm)
Control Group: Yes, concurrent vehicle
Method: Other
Year: **GLP:** No data
Test substance: No data
Result: No clinical symptoms. On the 3rd day of exposure, the glutathione concentration was reduced in the liver and kidneys and increased in the brain as compared with the control. The cerebral and acid proteinase activity was increased at the end of the test. The hepatic superoxide dismutase activity was below the control level whereas the activity of the ethoxycoumarin deethylase was increased. The activities of cytochrome P450 and ethoxycoumarin deethylase were reduced in the kidneys. No relation of the changes to the duration of exposure.
06-SEP-1995 (78) (79)

Species: Rat **Sex:** Male/female
Strain: Fischer 344
Route of admin.: Inhalation
Exposure period: 13 weeks
Frequency of treatment: 5 days per week, 6 hours a day
Post. obs. period: None
Doses: 0.015; 0.030; 0.061; 0.122; 0.244 mg/l (8, 16, 32, 64, 128 ppm)
Control Group: Yes, concurrent no treatment
NOAEL: .06 mg/l
LOAEL: .12 mg/l
Method: Other
Year: **GLP:** Yes
Test substance: No data
Remark: 10 males and 10 females were used per group. Another 10 males and 10 females per group were used for the clinicopathologic examination which was carried out on the 3rd and 23rd day of the study. The body weights were determined at the beginning and at the end of the study and at weekly intervals in between. The organ weights (thymus, heart, right kidney, lungs, liver and right testis) were determined. Hematologic and biochemical serum examinations as well as gross-pathologic and histopathologic organ examinations were carried out at the end of the study.

Result: All animals used survived. The body weight of the males of the 32 ppm group was slightly but significantly increased at the end of the study. The body weight gains of the males of the 16, 32 and 64 ppm groups were also significantly increased. No definitely substance-related clinical signs of toxicity were observed during the study. The hematologic changes observed were all slight: At the end of the study, the number of neutrophils was significantly but not dose-dependently reduced in animals of both sexes in all dose groups. Other hematologic changes were rather of an incidental nature and not relevant. Furthermore, few and slight changes of the biochemical serum parameters were observed.
No unusual gross lesions were observed. The absolute liver weights were significantly increased in the males of all exposure groups, and the relative liver weights were significantly increased in the three highest dose groups only. The absolute and relative lung weights were significantly reduced in the females of all exposure groups. In the males, the relative lung weights were significantly reduced in all exposure groups, and the absolute lung weights were significantly reduced in the two highest dose groups only. Most of the histopathologic changes at the respiratory and olfactory nasal epithelia were restricted to the highest dose group. The respiratory epithelium mainly showed slight squamous epithelial metaplasias, and the olfactory epithelium showed minimal to slight degenerative changes. In the 32 and 64 ppm groups, a minimal degeneration of the olfactory epithelium was observed in one male in each case.

As compared with the 2-week study (q.v.), there was no increase in the degree of lesions after prolonged exposure. According to the NTP, a NOAEL of 64 ppm (0.122 mg/l) is obtained from the results of this 13-week study, whereas a NOAEL of 32 ppm (0.06 mg/l) is obtained from the results of the 2-week study.

Test substance: Formic acid, approx. 95% with approx. 5% water

11-SEP-1995 (80) (81)

Species: Rat **Sex:** Male/female
Strain: Fischer 344
Route of admin.: Inhalation
Exposure period: 12 days
Frequency of treatment: 5 days per week, 6 hours per day
Post. obs. period: 1 day
Doses: 0.06; 0.12; 0.24; 0.48; 0.95 mg/l (31; 62.5; 125; 250; 500 ppm)
Control Group: Yes, concurrent no treatment
NOAEL: .06 mg/l
LOAEL: .12 mg/l
Method: Other
Year: **GLP:** No
Test substance: No data
Remark: The study was used as a pretest for the 13-week study. 5 males and 5 females were used per group. After the 3rd day of exposure, the urine of the animals was collected for 16 hours. The following parameters were determined in the urine: volume, pH, glucose, protein and activities of aspartate aminotransferase (AST), gamma-glutamyl transpeptidase (GGT) and alkaline phosphatase (AP). One day after the end of exposure, blood samples were taken and examined. The animals and their organs (liver, thymus, right kidney, right testis, heart and lungs) were examined by gross pathology, and the respiratory organs were also examined histopathologically.
Result: In the highest dose group, three males and one female died on the 10th day of exposure. The body weights at the end of the study were significantly reduced in the males of the two highest dose groups and in the females of the highest dose group. In the two highest dose groups, clinical signs typical of substances which irritate the respiratory tract were observed: nasal discharge, increased preening, hypoactivity and labored breathing. In the highest dose group, corneal opacities were detected in the animals exposed during the study; at necropsy, this effect was however confirmed gross-pathologically and histopathologically in only one male. There were no relevant substance-induced influences on the blood pH, coagulation and serum electrolyte concentrations. At the two highest dose levels, urinalysis showed a reduction in the volume of the 16-hour urine in the animals of both sexes and a simultaneous increase of the specific density due to this. The absolute and relative thymus weights were significantly reduced in animals of both sexes of the highest dose group. The other absolute organ weights did not show any significant changes. The relative kidney weight was significantly increased in animals of both sexes, and the relative heart weight was increased only in the females of the highest dose group.

Histopathologic changes were detected in the upper respiratory tract in animals of both sexes from a test substance concentration of 0.12 mg/l (62.5 ppm) onward in relation to the dose. Up to a concentration of 0.48 mg/l (250 ppm), squamous epithelial metaplasias, inflammations and necroses of the respiratory epithelium as well as necroses of the olfactory epithelium were detected. In the highest concentration, the severest lesions also were squamous epithelial metaplasias and inflammations in the larynx. There were no substance-induced histopathologic changes in the lowest dose.

To sum up, the inhalation of the test substance only led to slight effects of systemic toxicity; the histopathologic changes observed were typical of the inhalation exposure of irritant substances.

Test substance: Formic acid, approx. 95% with approx. 5% water

11-SEP-1995 (80) (81)

Species: Rat **Sex:** No data
Strain: No data
Route of admin.: Oral feed
Exposure period: 5-6 weeks
Frequency of treatment: Continuously with the feed
Post. obs. period: No data
Doses: 0.5 and 1.0% (= 2500 mg/kg/d according to the authors, no information whether 0.5 or 1.0%)
Control Group: Yes, concurrent no treatment
Method: Other: No data
Year: **GLP:** No
Test substance: No data
Remark: Cited according to: Sporn, A. et al.: Igiena (Bucharest) 11, 507-515 (1962)
Result: 8 animals were used per group. Retarded body weight gain, reduction of the organ weights (liver and kidneys in both dose groups, adrenal and spleen in the lowest dose group only), no dose dependence.

The results are only available as a brief keynote summary (secondary citation).

11-SEP-1995 (50)

Species: Rat **Sex:** Male/female
Strain: No data
Route of admin.: Drinking water
Exposure period: Up to 27 weeks
Frequency of treatment: Continuously in the drinking water
Post. obs. period: No data
Doses: 8.2, 10.25, 90, 160, 360 mg/kg/d
Control Group: No data specified
Method: Other: No data
Year: **GLP:** No
Test substance: No data
Result: Group 1: 0.01% in the feed for 11 weeks, 6 animals, 8.2 mg/kg/d.
Group 2: 0.01% in the feed for 14 weeks, 3 animals, 10.25 mg/kg/d.
Group 3: 0.1% in the feed for 15 weeks, 6 animals, 90 mg/kg/d.
Group 4: 0.01% in the feed for 12 weeks and subsequently 0.25% for 15 weeks, 4 animals, 160 mg/kg/d.
Group 5: 0.1% in the feed for 17 weeks and subsequently 0.5% for 9 weeks, 3 animals, 360 mg/kg/d.

Reduction of feed consumption and growth in the highest dose (group 5). Mortality: 1/6 and 2/4 in groups 1 and 4 respectively, otherwise no mortality.
The results are only available as a brief keynote summary or as a table in the original literature (Solmann (1921)). The study does not comply with criteria valid today.
11-SEP-1995 (50) (82)

Species: Rat **Sex:** Male/female
Strain: Wistar
Route of admin.: Drinking water
Exposure period: Lifelong (2-3 years)
Frequency of treatment: Continuously in the drinking water
Post. obs. period: None
Doses: 0.2 and 0.4% (= 150-200 mg/kg/d in the lowest dose according to the authors)
Control Group: Yes, concurrent no treatment
Method: Other: No data
Year: **GLP:** No
Test substance: Other TS
Remark: The results are only summarized in keynotes or presented briefly in a table in the case of body weight gain.
Result: 6 animals were used per group.
No clinical or pathologic changes (growth or organ functions) were detected in any dose group; in particular, there were no disorders of the ocular fundus. The

study includes several generations (up to 5). At the beginning, 8 males and 24 females were used.
Test substance: Ca formate in the drinking water
06-SEP-1995 (56)

Species: Rat **Sex:** No data
Strain: Wistar
Route of admin.: Drinking water
Exposure period: 1.5 years
Frequency of treatment: Continuously in the drinking water
Post. obs. period: None
Doses: 1% (= 274 mg/animal formate or 185 mg/animal calculated to formic acid according to the authors)
Control Group: No data specified
Method: Other: No data
Year: **GLP:** No
Test substance: Other TS
Remark: The results are only available as a brief keynote summary.
Result: No toxicity detected
6 animals/group
Test substance: Na formate in the drinking water
06-SEP-1995 (56)

Species: Rat **Sex:** No data
Strain: No data
Route of admin.: Drinking water
Exposure period: 6 weeks
Frequency of treatment: Continuously in the drinking water
Post. obs. period: No data
Doses: 0.5 and 1.0% (approx. 2500 mg/kg/d according to the authors; no information whether 0.5 or 1.0%)
Control Group: Yes, concurrent no treatment
Method: Other: No data
Year: **GLP:** No
Test substance: No data
Remark: Cited according to: Sporn, A. et al.: Igiena (Bucharest) 11, 507-515 (1962)
Result: 8 animals were used per group. Reduced body weight gain, reduction of organ weights (liver, kidney and adrenal in both dose groups and spleen only in the lowest dose group); no dose dependence

The results are only available as a brief keynote summary (secondary citation).
11-SEP-1995 (50)

Species: Mouse **Sex:** No data
Strain: B6C3F1
Route of admin.: Inhalation
Exposure period: 13 weeks
Frequency of treatment: 5 days per week, 6 hours per day
Post. obs. period: None
Doses: 0.015; 0.030; 0.061; 0.122; 0.244 mg/l (8, 16, 32, 64, 128 ppm)
Control Group: Yes, concurrent no treatment
NOAEL: .06 mg/l
LOAEL: .12 mg/l
Method: Other
Year: **GLP:** No data
Test substance: No data
Remark: 10 males and 10 females were used per group. The body weights were determined at the beginning and at the end of the study and at weekly intervals in between. The organ weights (thymus, heart, right kidney, lungs, liver and right testis) were determined. At the end of the study, the animals were examined by gross pathology. Some organs were assessed gross-pathologically and histopathologically.
Result: According to the authors, there were no clinical signs of toxicity throughout the study, nor was there any mortality due to exposure. The table shows, however, that only 9 of 10 males and females in each case survived in the highest dose group; the authors do not give any further details. The body weight gains were significantly reduced in the animals of both sexes in the highest dose group, and in the females they were still significantly reduced even in the 64 ppm group. In the highest dose group, the body weights at the end of the study were significantly reduced in the animals of both sexes; this also led to increased relative organ weights in some cases. However, slight, significant increases of the relative liver or kidney weights were detected in the males or females of the 32 and 64 ppm groups.
No gross-pathologic changes were observed. Minimal histopathologic lesions (degenerations) were only observed at the olfactory nasal epithelium in some animals of the two highest dose groups.

According to the NTP, a NOAEL of 64 ppm (0.122 mg/l) is obtained from the results of the 13-week study; taking into account the 2-week study (q.v.), however, the NTP fixed a NOAEL of 32 ppm (0.06 mg/l).
Test substance: Formic acid, approx. 95% with approx. 5% water
11-SEP-1995 (80) (81)

Species: Mouse **Sex:** Male/female
Strain: B6C3F1
Route of admin.: Inhalation
Exposure period: 12 days
Frequency of treatment: 5 days per week, 6 hours per day
Post. obs. period: 1 day
Doses: 0.06; 0.12; 0.24; 0.48; 0.95 mg/l (31; 62.5; 125; 250; 500 ppm)
Control Group: Yes, concurrent no treatment
NOAEL: .06 mg/l
LOAEL: .12 mg/l
Method: Other
Year: **GLP:** No
Test substance: No data
Remark: The study served as a pretest for the 13-week study. 5 males and 5 females were used per group. The animals and their organs (liver, thymus, right kidney, right testis, heart and lungs) were assessed by gross pathology, and the respiratory organs were also examined histopathologically.
Result: All animals of the highest dose group died during the first week of the study; one female of the 250 ppm group (0.48 mg/l) had to be sacrificed on the 4th day on account of its moribund state. At the end of the study, the body weights of the animals of both sexes were significantly reduced in the 250 ppm group. Clinical signs of toxicity due to exposure were only observed in the two highest dose groups and were typical of the exposure to irritant substances by inhalation as in the case of the study with rats. Corneal opacities were observed in the males and females of the highest dose group.
The deaths that occurred were attributed to swelling of the nasal mucosa up to nasal occlusion and severe impairment of respiration due to this. No gross-pathologic changes were observed in any other animals at necropsy at the end of the study. The relative kidney weights of the males of the 62.5, 125 and 250 ppm groups and of the females of the 250 ppm group were slightly increased. In the 250 ppm group, the absolute and relative thymus weights were reduced in animals of both sexes and the relative lung weights were slightly increased. The histopathologic changes showed no substantial sex-specific differences and, except for the highest dose group, they were detected only in the nasal passages. The severity of the histopathologic changes observed (squamous epithelial metaplasias, inflammation and necroses) was dose-dependent, and larynx, pharynx and trachea were also affected in the highest dose group. The males of the two lowest doses showed no changes due to exposure; two females

of the 62.5 ppm group demonstrated squamous epithelial metaplasias of the respiratory epithelium. No histopathologic changes were observed in the lowest dose.

To sum up, inhalative exposure to the test substance only led to slight systemic toxicity; the histopathologic changes observed were typical of the inhalation of irritant substances. When comparing the species, the mouse proved to be more sensitive than the rat.

Test substance: Formic acid, approx. 95% with approx. 5% water

11-SEP-1995 (80) (81)

Species: Mouse **Sex:** No data
Strain: Swiss
Route of admin.: Dermal
Exposure period: 50 days
Frequency of treatment: Twice per week
Post. obs. period: None
Doses: No data
Control Group: Yes, concurrent no treatment
Method: Other
Year: **GLP:** No
Test substance: No data
Remark: The method is not acceptable and does not comply with current criteria. Moreover, documentation is inadequate. Therefore, the study cannot be assessed.
Result: Painting at the ear with 8% formic acid in mineral oil. As compared with tumor promotors (croton oil, Tween 60), no histopathologic or histomorphometric changes

11-SEP-1995 (83)

Species: Dog **Sex:** No data
Strain: No data
Route of admin.: Oral feed
Exposure period: No data
Frequency of treatment: Daily
Post. obs. period: No data
Doses: 500 mg/animal (?)
Control Group: No data specified
Method: Other: No data
Year: **GLP:** No
Test substance: No data
Result: No toxicity detected; no further data. Only secondary citation

06-SEP-1995 (59)

5.5 Genetic Toxicity 'in Vitro'

Type: Ames test
System of testing: Salmonella typhimurium TA98, TA100, TA1535, TA1537
Concentration: No data
Metabolic activation: With and without
Result:
Method: Other
Year: **GLP:** No data
Test substance: No data
Remark: Method: Spot test and plate incorporation assay. Bacteriotoxicity was detected; the authors do not make any statement about mutagenicity.
06-SEP-1995 (84)

Type: Ames test
System of testing: Salmonella typhimurium TA98, TA100, TA1535, TA1537
Concentration: 20, 100, 250, 500, 1000, 2000, 2500, 4000, 8000, 12500 ug/plate
Metabolic activation: With and without
Result: Negative
Method: Other: Ames, B.N. et al.: Mutation Research 31, 347-364
Year: 1975 **GLP:** Yes
Test substance: Other TS
Test substance: Calcium formate
23-OCT-1995 (85)

Type: Ames test
System of testing: Salmonella typhimurium TA97, TA98, TA100, TA1535
Concentration: 10, 33, 100, 333, 1000, 3333 ug/plate
Metabolic activation: With and without
Result: Negative
Method: Other: Haworth, S. et al.: Environ. Mutagen. 5, Suppl. 1, 3-142
Year: 1983 **GLP:** No
Test substance: No data
Test substance: Formic acid, approx. 95% with approx. 5% water
06-SEP-1995 (81) (86)

Type: Ames test
System of testing: TA100
Concentration: No data
Metabolic activation: With and without
Result: Negative
Method: Other: Based on Ames, B.N. et al.: Mutation Research 31, 347-364
Year: 1975 **GLP:** No data
Test substance: No data
06-SEP-1995 (87)

Type: Cytogenetic assay
System of testing: CHO-K1 cells
Concentration: 270, 360, 450, 540, 630 ug/ml (6-14 mM)
Metabolic activation: With and without
Result: Ambiguous
Method: Other
Year: **GLP:** No data
Test substance: No data
Remark: Chromosome aberrations were examined. The unbuffered or unneutralized acid was clastogenic at pH values around 6.0 (10-14 mM) and cytotoxic from pH 5.7 (12-16 mM). Clastogenicity is stopped by neutralization with NaOH or by increasing the buffer concentrations in the incubation medium. The authors conclude from this that it is not the substance as such that induces chromosome damage but that the latter is due to the acid pH of the incubation medium as a nonspecific effect.
06-SEP-1995 (88)

Type: Escherichia coli reverse mutation assay
System of testing: Escherichia coli Sd-4
Concentration: 50, 60, 65, 70, 75 ug/ml
Metabolic activation: Without
Result: Positive
Method: Other
Year: **GLP:** No
Test substance: No data
Remark: Weakly positive result (without S9 mix).
The number of bacteria was varied while the test substance concentration remained at almost the same level. The survival rate was reduced with a decrease in the bacterial count (from 100% at 1.5 x 10E9 bacteria up to 2.8% at 2.6 x 10E7). In parallel, the number of mutations was reduced with an increase in the survival rate.
06-SEP-1995 (89)

Type: Mouse lymphoma assay
System of testing: L5178Y mouse lymphoma cells
Concentration: No data
Metabolic activation: No data
Result:
Method: Other: No data
Year: **GLP:** No data
Test substance: No data
Remark: Within the NTP, a mutagenicity test is to be carried out in L5178Y mouse lymphoma cells. No results have been available so far.
07-DEC-1995 (90)

Type: Sister chromatid exchange assay
System of testing: Chinese hamster V79 cells
Concentration: 18.4, 27.6, 46.0, 92.0 ug/ml (0.4, 0.6, 1.0, 2.0 mM)
Metabolic activation: With and without
Result: Negative
Method: Other
Year: **GLP:** No data
Test substance: No data
Remark: No increased SCE frequency with and without S9 mix
08-SEP-1995 (91)

Type: Sister chromatid exchange assay
System of testing: Human lymphocytes
Concentration: 29 - 460 ug/ml (0.63 - 10 mM)
Metabolic activation: Without
Result: Negative
Method: Other
Year: **GLP:** No data
Test substance: No data
Remark: Statistically significantly increased SCE frequency only in the highest concentration (10 mM), otherwise not; however, the pH that is reduced by almost one unit due to the addition of formic acid must be taken into account here.
Test substance: Formic acid, 98-100%
11-SEP-1995 (92)

Type: Other: SOS chromotest
System of testing: Escherichia coli PQ37
Concentration: Up to the solubility limit, but maximally 100 mM (3-5 concentrations)
Metabolic activation: With and without
Result: Negative
Method: Other: Quillardet, P. and Hofnung, M.: Mutation Research 147, 65-78
Year: 1985 **GLP:** No data
Test substance: No data
Remark: In this test system, the SOS gene expression which is induced by DNA damage is measured.
06-SEP-1995 (93)

5.6 Genetic Toxicity 'in Vivo'

Type: Drosophila SLRL test
Species: Drosophila melanogaster **Sex:** Male/female
Strain: Other: Oregon-K
Route of admin.: Other: inhalation and oral feed
Exposure period: 24 h (inhal.); instar and 24 h after hatching (feed)
Doses: No data
Result:
Method: Other: Demerec, M.: Genetics 33, 337-348
Year: 1948 **GLP:** No
Test substance: No data
Remark: Positive after inhalative exposure and administration via the diet with mutation rates of 1.31 and 1.11% as compared with the control limit of 0.15% in each case. If the pH was buffered to 7.5 in the feeding study, there was no increased mutation rate.
06-SEP-1995 (94) (95)

5.7 Carcinogenicity

Species: Mouse **Sex:** No data
Strain: Swiss
Route of admin.: Dermal
Exposure period: 50 days
Frequency of treatment: Twice per week
Post. obs. period: None
Doses: No data
Result:
Control Group: Yes, concurrent vehicle
Method: Other
Year: **GLP:** No
Test substance: No data
Remark: The method is not acceptable and does not comply with current criteria. Moreover, documentation is inadequate. Therefore, the study cannot be assessed.
Result: Painting at the ear with 8% formic acid in mineral oil. As compared with tumor promotors (croton oil, Tween 60), no histopathologic or histomorphometric changes.
06-SEP-1995 (83)

Species: Rat **Sex:** Male/female
Strain: Wistar
Route of admin.: Drinking water
Exposure period: Lifelong (2-3 years)
Frequency of treatment: Continuously in the drinking water
Post. obs. period: None
Doses: 0.2 and 0.4% (= 150 - 200 mg/kg/d according to the authors)
Result:
Control Group: Yes, concurrent no treatment
Method: Other: No data
Year: **GLP:** No
Test substance: Other TS
Result: No neoplasias were observed. However, the conduct of the study does not comply with current requirements (6 animals per group). See also chapter: Toxicity after repeated administration
Test substance: Calcium formate
06-SEP-1995 (56)

Species: Rat **Sex:** No data
Strain: Wistar
Route of admin.: Drinking water
Exposure period: 1.5 years
Frequency of treatment: Continuously in the drinking water
Post. obs. period: None
Doses: 1% (= 274 mg/animal formate or 185 mg/animal calculated to formic acid according to the authors)
Result:
Control Group: No data specified
Method: Other: No data
Year: **GLP:** No
Test substance: Other TS
Result: No neoplasias were observed. However, the conduct of the study does not comply with current requirements (6 animals per group). See also chapter: Toxicity after repeated administration
Test substance: Sodium formate
11-SEP-1995 (56)

5.8 Toxicity to Reproduction

Type: Fertility
Species: Rat **Sex:** Male/female
Strain: Wistar
Route of admin.: Drinking water
Exposure Period: Up to 5th (0.2%) or 2nd (0.4%) generation
Frequency of treatment: Continuously in the drinking water
Premating Exposure Period
male: No data
female: No data
Duration of test: Over several generations
Doses: 0.2 and 0.4% (150-200 mg/kg/d according to the authors)
Control Group: Yes, concurrent no treatment
Method: Other: No data
Year: **GLP:** No
Test substance: Other TS
Remark: The conduct of the study does not comply with current criteria. Moreover, documentation is inadequate. Therefore, the study cannot be assessed.
Result: No influence on fertility or offspring over several generations. No indication of teratogenicity. The fertility of the dams, weight at birth and the weight gain of the offspring were measured.
Test substance: Calcium formate
06-SEP-1995 (56)

Type: Fertility
Species: Rat **Sex:** Male/female
Strain: Fischer 344
Route of admin.: Inhalation
Exposure Period: 13 weeks
Frequency of treatment: 5 days per week, 6 hours per day
Premating Exposure Period
male: No mating
female: No mating
Duration of test: 13 weeks
Doses: 0.015, 0.061, 0.244 mg/l (8, 32, 128 ppm)
Control Group: Yes, concurrent no treatment
Method: Other
Year: **GLP:** Yes
Test substance: No data
Remark: 10 males and 10 females were used per group. The investigation was carried out together with a subchronic study (see chapter 5.4). The weight of the left epididymis, sperm motility and concentration or vaginal cytology and estrous cycles were determined.
Result: Formic acid had no effects on sperm motility, sperm concentration, testicular and epididymal weights or on the duration of the estrous cycles due to exposure.
Test substance: Formic acid, approx. 95% with approx. 5% water
08-SEP-1995 (80) (81)

Type: Fertility
Species: Mouse **Sex:** Male/female
Strain: B6C3F1
Route of admin.: Inhalation
Exposure Period: 13 weeks
Frequency of treatment: 5 days per week, 6 hours per day
Premating Exposure Period
male: No mating
female: No mating
Duration of test: 13 weeks
Doses: 0.015, 0.061, 0.244 mg/l (8, 32, 128 ppm)
Control Group: Yes, concurrent no treatment
Method: Other
Year: **GLP:** Yes
Test substance: No data
Remark: 10 males and 10 females were used per group. The investigation was carried out together with a subchronic study (see chapter 5.4). The weight of the left epididymis, sperm motility and concentration or vaginal cytology and estrous cycles were determined.
Result: Formic acid showed no effects on the testicular and epididymal weights or on the duration of the estrous cycles due to exposure. On account of the high motility value of

the control group, sperm motility was reduced in all exposure groups. No substance-induced influences were detected as compared with the historical control.

Test substance: Formic acid, approx. 95% with approx. 5% water

08-SEP-1995 (80) (81)

5.9 Developmental Toxicity/Teratogenicity

Species: Mouse **Sex:** Female
Strain: CD-1
Route of admin.: Gavage
Exposure period: 8th day of gestation
Frequency of treatment: Single dose
Duration of test: Up to the 10th or 18th day of gestation
Doses: 750 mg/kg/d
Control Group: Yes, concurrent vehicle
Method: Other
Year: **GLP:** No data
Test substance: Other TS
Result: In a pilot study, sodium formate was administered in doses of 25, 250, 500 and 750 mg/kg to CD-1 mice by gavage on the 8th day of gestation. The aim was to determine the formate dose necessary to generate a formate concentration in the blood which is achieved after the inhalation of 10,000 ppm methanol for 6h/d. This blood formate concentration was reached at 750 mg/kg.

In the main study with 750 mg/kg, maximally maternal formate concentrations were obtained in the plasma (1.05 mM) and decidua (2 mmol/kg) which were comparable with those after inhalative methanol exposure (10,000 or 15,000 ppm, 6h/d). No significantly increased incidence of CNS defects (open anterior neural tubes) were observed. The red blood count and the decidua folate concentration were unchanged.

The study was carried out to determine the proximal teratogen after exposure to methanol. According to the authors, the present study showed that methanol itself rather than the metabolite formate induced teratogenicity (exencephaly) in pregnant CD-1 mice which were exposed to high methanol concentrations.

Test substance: Sodium formate

30-OCT-1995 (96)

Species: Rat **Sex:** No data
Strain: Sprague-Dawley
Route of admin.: Other: In vitro incubation in WEC (whole embryo culture)
Exposure period: 48 h incubation
Frequency of treatment: Single dose
Duration of test: 48 h
Doses: 200, 400, 800, 1200, 1600 ug/ml
Control Group: Yes, concurrent no treatment
Method: Other
Year: **GLP:** No data
Test substance: Other TS
Result: The effect of the pH (8.13, 7.75, 7.00, 6.50 and 6.00) on the in vitro teratogenicity of sodium formate (0.2, 0.4, 0.8, 1.2 and 1.6 mg/ml) was investigated in rat embryo cultures (Sprague-Dawley rats, day 9.5 of gestation). Numerous embryonic developmental parameters showed that even the decreasing pH had an influence on embryonic development in this test system. In the highest concentration, the parameters crown-rump length (CRL), head length (HL), somite number (SN), developmental score (DS) and protein concentration were significantly reduced in the incubation medium regardless of the pH. At a test substance concentration of 0.8 and 1.2 mg/ml, these parameters were significantly reduced at a low pH. At a test substance concentration of 0.4 and 0.2 mg/ml, CRL, HL and the protein concentration were still significantly reduced at a pH of 6.5 in the medium. To sum up, a dependence of the embryonic developmental parameters and of embryolethality both on the formate concentration and on the pH in the incubation medium was demonstrated in this test system.
Test substance: Sodium formate
30-OCT-1995 (97)

Species: Rat **Sex:** No data
Strain: Sprague-Dawley
Route of admin.: Other: In vitro incubation in WEC (whole embryo culture)
Exposure period: 24 and 48 h incubation
Frequency of treatment: Single dose
Duration of test: 24 and 48 h
Doses: 200, 400, 800, 1200, 1600, 2000 ug/ml (sodium formate) and 140, 270, 540, 810, 1080 ug/ml (formic acid)
Control Group: Yes, concurrent no treatment
Method: Other
Year: **GLP:** No data
Test substance: Other TS
Result: Rat embryo cultures (9th day of gestation) were treated with the test substances. The pH of the medium was no longer corrected after addition of the test substance. Both after 24- and after 48-h incubation with sodium formate, there was a significant and concentration-dependent reduction of the developmental parameters yolk sac diameter (YSD), crown-rump length (CRL), head length (HL), somite number (SN) and developmental score (DEVSC). Embryolethality was significantly increased only in the highest concentration after 48-h incubation. The number of anomalies (mainly CNS: open anterior and posterior neuropores and erratic neurorrhaphy) was significantly increased at 1.6 and 2.0 mg/ml after 24 h and at 0.8 and 2.0 mg/ml after 48-h incubation. The protein and DNA levels showed a significant and concentration-dependent reduction. Incubations with formic acid also showed a significant and concentration-dependent reduction of YSD, CRL, HL, SN and DEVSC after 24-h incubation and of CRL, HL, SOM and DEVSC after 48 h. Embryolethality was significantly increased in the highest concentration after 24 h and in the two highest concentrations after 48 h. Protein and DNA concentrations showed significant and concentration dependent decreases in both cases. The number of anomalies (open anterior and posterior neuropores, rotatory defects and enlarged maxillary process) showed a significant increase only at 0.81 mg/ml after 48-h incubation.
To sum up, concentration-dependent embryotoxic and dysmorphic changes were detected in the culture both using formate and formic acid in this test system.
Test substance: Formic acid and sodium formate
30-OCT-1995 (98) (99)

Species: Mouse **Sex:** No data
Strain: CD-1
Route of admin.: Other: In vitro incubation in WEC (whole embryo culture)
Exposure period: 5 h incubation
Frequency of treatment: Single dose
Duration of test: 5 h
Doses: 45 ug/ml (1 mM)
Control Group: Yes
Method: Other
Year: **GLP:** No data
Test substance: Other TS
Result: The incubation of CD-1 mouse embryo cells (11th day of gestation) in vitro in serum-free medium with 1mM Na formate only led to a very slight, nonsignificant impairment of 3H-thymidine incorporation. Furthermore, the substantial reduction of thymidine incorporation by the teratogenic substance methoxyacetic acid was considerably weakened after the joint incubation with 1mM Na formate.
Test substance: Sodium formate
23-OCT-1995 (100)

Species: Mouse **Sex:** No data
Strain: CD-1
Route of admin.: Other: In vitro incubation in WEC (whole embryo culture)
Exposure period: 24 h incubation
Frequency of treatment: Single dose
Duration of test: 24 h
Doses: 400, 800, 1600, 2000, 3000 ug/ml (sodium formate) and 270, 540, 810, 1600, 2000 ug/ml (formic acid)
Control Group: Yes, concurrent no treatment
Method: Other
Year: **GLP:** No data
Test substance: Other TS
Result: Mouse embryo cultures (8th day of gestation) were treated with the test substances. The pH of the medium was no longer corrected after the addition of the substances. Both with sodium formate and with formic acid, there was a significant and concentration-dependent reduction of the developmental parameters yolk sac diameter (YSD), crown-rump length (CRL), head length (HL), somite number (SN) and developmental score (DEVSC). Embryolethality was not significantly increased in the case of the incubation with sodium formate; there was a significant incidence of anomalies of the CNS (open anterior and posterior neuropores and erratic neurorrhaphy), enlarged pericardium, enlarged maxillary process and retardation in heart development. In the case of the incubation with formic acid, embryolethality was significantly increased in the three highest concentrations; the number of anomalies was significantly increased from a concentration of >=0.54 mg/ml

and was 100% at 1.6 mg/ml. There was a significant and concentration-dependent reduction of protein and DNA concentrations both with sodium formate and with formic acid. YSD, CRL, HL, SOM and DEVSC showed a significant trend to reduction.
To sum up, concentration-dependent embryotoxic and dysmorphic changes were detected in the culture both using formate and formic acid in this test system. In a species comparison with the rat (see entry before), there were no quantitative or qualitative differences.

Test substance: Formic acid and sodium formate

30-OCT-1995 (98) (99)

Species: Mouse **Sex:** No data
Strain: CD-1
Route of admin.: Other: In vitro incubation in WEC (whole embryo culture)
Exposure period: 12 h incubation
Frequency of treatment: Single dose
Duration of test: 12 h
Doses: 180, 360, 540, 900, 1800 ug formate/ml (4, 8, 12, 20, 40 mM)
Control Group: Yes
Method: Other: Cockroft, D.L., in: Copp, A.J. and Cockroft, D.L. (eds.): Postimplantation Mammalian Embryos - A Practical Approach. IRL Press, Oxford, pp. 15-40
Year: 1990 **GLP:** No data
Test substance: Other TS
Result: Mouse embryo cultures (8th day of gestation) were treated with the test substances. The pH of the medium was no longer corrected after the addition of the substances. There was a significant and concentration-dependent reduction of the developmental parameters yolk sac diameter and crown-rump length. Relative embryonic growth and rotation (75% turning in the embryos treated with the test substance as compared with 90% in the control) were retarded. Moreover, concentration-dependent dysmorphogenic effects, such as dysraphia (incomplete closure of the cranium) with a high and significant incidence only in the highest concentration and a developmental disorder of the neural fold were detected.

Test substance: Sodium formate

30-OCT-1995 (96)

Species: Rat **Sex:** No data
Strain: No data
Route of admin.: Other: In vitro whole embryo culture
Exposure period: 48 h incubation
Frequency of treatment: Single dose
Duration of test: 48 hours
Doses: 0-2 mg/ml
Control Group: Yes
Method: Other: No data
Year: **GLP:** No data
Test substance: Other TS
Remark: Effects of the combination of formic acid and methanol were investigated in the whole embryo culture. Gestational day-9 rat embryos were exposed to various concentrations of methanol and formic acid and the degree of embryotoxicity was compared following 48 h of exposure using the developmental score (DEVSC). Increasing concentrations of either methanol or formate resulted in significant decreases in DEVSC. Exposure to the combination of methanol and formate was less toxic than would have been expected based on the single concentration additivity which suggested an antagonistic activity. This observation was found for embryonic crown length, head length, somite number and DNA concentration.
Test substance: Formic acid, probably neutralized, no further data
29-JUL-1997 (101)

Species: Rat **Sex:** No data
Strain: Sprague-Dawley
Route of admin.: Other: In vitro whole embryo culture
Exposure period: 48 h incubation
Frequency of treatment: Single dose
Duration of test: 48 h
Doses: 0.141-1.055 ul/ml (3.74-27.96 umol/ml)
Control Group: Yes
Method: Other: New, D.A.T., The Mammalian Fetus in Vitro, 15-65, CR Austin (ed), Chapman and Hall, London
Year: 1973 **GLP:** No data
Test substance: Other TS
Remark: In the study, the embryotoxicity of methanol and formic acid was evaluated using rat embryo culture. Rat embryos were explanted on day 10 of gestation and cultured. The results obtained showed that both methanol and formic acid have a concentration-dependent embryotoxic effect on the developing embryo in vitro. The no-effect concentration of formic acid was 7.74 umol/ml while a concentration of 18.66 umol/ml was associated with severe embryotoxicity. When embryos were grown in sera containing 18.66 umol sodium formate/ml or in sera adjusted with hydrochloric acid to pH values similar to those achieved with formic acid, the results indicated that both a low pH and formate contributed to the embryotoxicity of formic acid. The authors concluded that embryotoxicity due

to a low pH or a high formate level would occur only after severe methanol intoxication.
Test substance: Formic acid (89-91%), sodium formate
29-JUL-1997 (102)

Species: Rat **Sex:** Female
Strain: Sprague-Dawley
Route of admin.:
Exposure period: Day 9 of gestation
Frequency of treatment:
Duration of test: 48 hours
Doses: 1.51 mg/ml
Control Group: Yes
Method: Other: In vitro incubation in whole embryo culture (WEC)
Year: 1998 **GLP:** No data
Test substance: Other TS
16-MAY-2000

5.10 Other Relevant Information

Type: Adsorption
Remark: Skin penetration; no data usable directly
06-SEP-1995 (103)

Type: Biochemical or cellular interactions
Remark: Title: An in vitro method for predicting sensitizing properties of inhaled chemicals
06-SEP-1995 (104)

Type: Biochemical or cellular interactions
Remark: The authors investigated the concentrations of 10-formyltetrahydrofolate dehydrogenase (FTHFDH) in tissue preparations of the retina, optical nerve and brain of the rat. Here, the authors observed FTHFDH concentrations that suggest high metabolic capacity of the target organs for formic acid. According to the authors, this might be an explanation for the absence of an ocular effect of formic acid (formate toxicity) in the rat.
08-SEP-1995 (105)

Type: Biochemical or cellular interactions
Remark: The study compared the effects on retinal function and structure of rapidly increasing formate concentrations typical of acute methanol intoxication with low level plateau formate concentrations more likely to be generated by subacute or chronic methanol exposure. Anesthetized rats received i.p. injections of methanol at doses of 4 g/kg followed by supplemental injections of 2 g/kg and 1 g/kg respectively at 12-hour intervals. These dosage regimens were designed to maintain blood formate

concentrations ranging from 8-15 mM or 4-6 mM for 30-40 h. Rats that accumulated the hight formate concentration of 8-15 mM developed metabolic acidosis, retinal dysfunction (reductions in a and b waves of the ERG), and retinal histopathologic changes (vacuolation in the retinal pigment epithelium and photoreceptor inner segments). Rats exposed to 4-6 mM for 48 h showed evidence of retinal dysfunction in the absence of metabolic acidosis and retinal histopathology.

Test substance: Methanol, HPLC grade

29-JUL-1997 (106)

Type: Cytotoxicity
Remark: Title: An evaluation of the utility of four in vitro short term tests for predicting the cytotoxicity of individual compounds derived from tobacco smoke

06-SEP-1995 (107)

Type: Cytotoxicity
Remark: Title: Cytotoxicity of carbohydrates heavily irradiated in solution

06-SEP-1995 (108)

Type: Cytotoxicity
Remark: Title: Formic Acid poisoning: Case report and in vitro study of the hemolytic activity

06-SEP-1995 (109)

Type: Cytotoxicity
Remark: Title: Cytotoxicity Testing of 114 Compounds by the Determination of the Protein Content in HEP G2 Cell Cultures

06-SEP-1995 (110)

Type: Excretion
Remark: The urine specimens of 12 male farmers who were exposed to formic acid in a concentration of 0.0073+/-0.0022 mg/l were examined. Immediately after exposure, the excretion of formic acid was not increased as compared with the control group. After 15 and 30 hours, however, there were substantial and significantly increased concentrations of formic acid in the urine of the persons exposed (factor 2.1 and 3.3). Excretion showed a linear dependence on the exposure concentration. The pH in the urine was unchanged, but the ammonium and calcium excretion was significantly increased 30 hours after exposure.

Test substance: Formic acid

08-SEP-1995 (111) (112)

Type: Metabolism
Remark: The following text generally describes the metabolism of formic acid. The citations on which it is based are listed separately with the titles of the studies.
Formic acid is absorbed well via all routes of administration. As a metabolite, it is partially metabolized into CO2 and expired and partially excreted unchanged in the urine in concentrations of 11.7-60 mg/l. The biologic half-life is between 15 minutes and 1 hour:

Formic acid is absorbed from the gastrointestinal tract, via the lungs and the intact skin. The absorbed substance is degraded to carbon dioxide (CO2) and water and is partially excreted unchanged in the urine. The major part of the absorbed formic acid is metabolized in the liver, but partially also in the intestinal mucosa, lungs, kidneys and spleen. Formic acid is oxidized in relation to folate and according to a katalase-peroxidative mechanism. The half-lives of sodium formate in the blood are 12-23, 31-51 and 55 minutes in rats, monkeys and in humans. Formic acid is metabolized into CO2 considerably more slowly in primates than in rats. The species sensitivity to methanol intoxication (metabolic acidosis caused by formic acid) is possibly dependent on the tetrahydrofolate concentration.
08-SEP-1995

Type: Metabolism
Remark: Title: Evaluation of the Health Aspects of Formic Acid, Sodium Formate, and Ethyl Formate as Food Ingredients
06-SEP-1995 (50)

Type: Metabolism
Remark: Title: Kinetics and toxic effects of repeated intravenous dosage of formic acid in rabbits
06-SEP-1995 (113)

Type: Metabolism
Remark: Title: Studies on Methanol toxicity and formate metabolism in isolated hepatocytes
06-SEP-1995 (114)

Type: Metabolism
Remark: Title: Urinary Formic Acid as an indicator of occupational exposure to Formic Acid and Methanol
06-SEP-1995 (115)

Type: Metabolism
Remark: Title: Urinary Excretion of Formic Acid in rabbits
06-SEP-1995 (116)

Type: Metabolism
Remark: Title: Accumulation of Formic Acid in rabbits after daily dosages
06-SEP-1995 (117)

Type: Metabolism
Remark: Title: Pharmacokinetic and deuterium isotope effect studies on the metabolism of formaldehyde and formate to carbon dioxide in rats in vivo
06-SEP-1995 (118)

Type: Metabolism
Remark: Title: Formate in urine as a biological indicator of formaldehyde exposure: A review
06-SEP-1995 (119)

Type: Metabolism
Remark: Title: Formic-Acid excretion in urine as a biological monitoring parameter in areas with different air-pollution
06-SEP-1995 (120)

Type: Metabolism
Remark: Title: Die akute und chronische Toxizitaet der Ameisensaeure und ihrer Formiate
06-SEP-1995 (56)

Type: Metabolism
Remark: Title: Effect of Renal Formic Acid Excretion on Urinary Calcium and Ammonia Concentrations
06-SEP-1995 (121)

Type: Neurotoxicity
Remark: The authors investigated morphologic lesions caused by sodium formate in cell cultures (primary cerebrocortical fetal mouse cells). According to the authors, information on neurotoxicity, gliotoxicity and cytotoxicity is to be obtained from the lesions investigated. Thus, sodium formate showed specific neurotoxicity in concentrations up to 60 mM (2,760 ug/ml) with lesions mainly in the larger polygonal neurons. Concentrations higher than 120 mM (5,520 ug/ml) led to nonspecific cytotoxicity. Furthermore, changes of the membrane integrity were examined via the release of lactate dehydrogenase and 14C-adenine nucleotides and the metabolic activity of the mitochondria.
Test substance: Sodium formate
08-SEP-1995 (122) (123)

Type: Neurotoxicity
Remark: Formic acid was indicated as the neurotoxic metabolite of methanol.
28-JUL-1997 (124)

Type: Toxicokinetics
Remark: The dose-dependent elimination of formate was investigated in the rat using both in vitro and in vivo systems. The in situ perfused liver was used to define the kinetics of hepatic metabolism and obtain initial in vitro estimates of the hepatic metabolism parameters. Formate was eliminated from the perfused rat liver following the Michaelis-Menten kinetics. Estimates of the Michaelis-Menten parameters obtained from the perfused liver studies were used in a two-compartment pharmacokinetic model of the dose-dependent elimination of formate in vivo. A good fit of the model to the observed in vivo data was obtained. Initial estimates of the Michaelis-Menten parameters, Vmax and Km, obtained from the perfused liver model, were within 40% of the final fitted values of these parameters in the in vivo model.
Test substance: Sodium formate, no further data
29-JUL-1997 (125)

Type: Other
Remark: Title:
"A new in vitro method to determine the corrosivity potential of surfactants and surfactant-based formulations"
Test substance: Formic acid
08-SEP-1995 (126)

Type: Other
Remark: Title:
"Penetration of Industrial Chemicals Across the Skin: A Predictive Model"

On the basis of a model system, the test substance was classified as having a toxicologic potential after dermal application.
Test substance: Formic acid
08-SEP-1995 (127)

Type: Other
Remark: For the validation of a new screening test for skin and eye irritation, conventional pretests were carried out with formic acid, among others. In an open patch test in rats and mice, the test substance showed moderate to severe skin irritation in a 10-12% dilution after a dose applied of 100-120 mg/kg. In an intradermal skin irritation test in rats and mice with 2-3% formic acid, similar effects were obtained with doses of 1-1.5 and 10-15 mg/kg. In an eye irritation test in rats and mice with 5-6% formic acid, moderate to severe effects were observed in doses of 2.5-3 and 25-30 mg/kg.

Test substance: Formic acid
08-SEP-1995 (128)

Type: Other
Remark: Title: the role of formate in methanol-induced exencephaly in CD-1 mice
15-MAY-2000 (129)

Type: Other: Carcinogenicity in vitro
Remark: Formic acid did not show any effect on the metabolic cooperation in Chinese hamster V79 lung fibroblasts.
06-SEP-1995 (130)

Type: Other: Chicken egg test
Remark: The method is not acceptable. Moreover, documentation is inadequate. Therefore, the study cannot be assessed.
Result: Sodium formate was injected into the air space of incubated chicken eggs (5, 10 or 20 mg/egg) and these eggs were incubated further up to the 16th day. There was no increased mortality of the embryos. The survival rate was at the same level as that of the controls. The final weights of the embryos of the eggs treated with sodium formate do not reveal any deviations. Sodium formate that was completely eliminated after 10-12 days of incubation, preferably by oxidation, showed no abnormalities with regard to teratogenicity in the incubated chicken egg. As compared with the untreated controls (n=1051), there was no change in the incidence of malformations either quantitatively or qualitatively.
Test substance: Sodium formate
11-SEP-1995 (56)

Type: Other: Human data
Remark: Occupational health study
10 employees in the formic acid filling plant and in the production of urea formaldehyde resin. Inhalation of methanol (40-160 ppm) and formic acid (2-5.5 ppm) at the workplace. Urine concentration of formic acid 16 h after exposure: 21.2-118 mg/g creatinine
07-DEC-1995 (115)

Type: Other: Human data
Remark: Occupational health study
13 farmers when handling silage solution (approx. 80% formic acid)
Increased urine concentration of formic acid 15 h after exposure
(131)

Type: Other: Human data
Remark: Occupational health study
Employees in a textile factory
Formic acid concentration in the air approx. 15 ppm
Subjective complaints about nausea
06-SEP-1995 (132)

Type: Other: Human data
Remark: Case report
45 cases of ingestion of formic acid. Abdominal pain, vomiting, hematemesis, dysphagia, dyspnea, burns in the gastrointestinal tract with subsequent strictures, coagulation disorders, pneumonia, acute kidney failure and hepatic dysfunction. After ingestion of 45-200 g formic acid, 9 of 16 patients died after perforations in the gastrointestinal tract and 5 died of acute kidney failure.
06-SEP-1995 (133)

Type: Other: Human data
Remark: Case report
53 cases of ingestion of formic acid. Burns of the gastrointestinal tract with esophagus strictures, pneumonia, kidney failure, hypotension and unconsciousness
06-SEP-1995 (134)

Type: Other: Human data
Remark: Case report
3 deaths after ingestion of formic acid. Burns in the gastrointestinal tract, metabolic acidosis, coagulation disorders, hemorrhage, shock, hemolysis, respiratory insufficiency and kidney failure. Methemalbumin level 143 mg% (normally 6 mg%) in the blood
06-SEP-1995 (135)

Type: Other: Human data
Remark: Case report
2 cases of ingestion of formic acid. Irritation, edema, blistering and necrosis of the oropharyngeal mucosa.
It was not possible to detect formic acid in the blood or Urine; no methemoglobinemia
06-SEP-1995 (136)

Type: Other: Human data
Remark: Case report
1 death after ingestion of formic acid (approx. 200 ml of an approx. 50% solution). Blood levels of 348 ug/ml of formic acid approx. 2 h after ingestion. Hematemesis, cyanosis, burns in the gastrointestinal tract, shock, metabolic acidosis and hemolysis. In vitro investigation: Hemolysis by acidity
06-SEP-1995 (109)

Type: Other: Human data
Remark: Case report
1 death after the ingestion of formic acid. Hypotension, respiratory insufficiency, coagulation disorders and kidney failure.
06-SEP-1995 (137)

Type: Other: Human data
Remark: Case report
1 case of a local effect of conc. formic acid on the skin. Burns of the legs with subsequent cicatricial changes. Systemic effects: Nausea, vomiting, metabolic acidosis, hemolysis and hemoglobinuria.
06-SEP-1995 (138)

Type: Other: Human data
Remark: Case report
1 case of a local effect of formic acid on the eye. Swelling and opacity of the cornea, pain, lacrimation and contraction of the pupils.
06-SEP-1995 (139)

Type: Other: Mitoses
Remark: Formamide acid 0.1M, 21 hours produce in Pleurodele eggs a dissociation of spindle fibers appears around agglutinated chromosomes.
16-MAY-2000 (140)

Type: Other: Occupational Regulation
Remark: Title: 'Brief introduction to occupational exposure limits in Japan.' In the article, an occupational exposure limit of 5 ppm (9.4 mg/m3) was recommended for formic acid.
Test substance: Formic acid
29-JUL-1997 (141)

Type: Other: QSAR
Remark: Title:
"Quantitative structure activity relationships for skin corrosivity of organic acids, bases and phenols"
Test substance: Formic acid
08-SEP-1995 (142)

Type: Other: Review
Remark: Summary presentations
07-DEC-1995 (70) (50) (143) (144) (51) (71) (72) (52) (73) (59) (145)

Type: Other: Review
Remark: Formic acid irritates the eyes and nasal and pharyngeal mucosas. Direct contact may lead to severe burns to the skin and eyes and in the mouth and pharynx after oral intake. Nausea, vomiting, hemorrhage, acidosis, hemolysis and damage to the heart and central nervous system may occur.
06-SEP-1995 (146)

Type: Other: Review
Remark: One case of an esophagus burn in a child, among others
06-SEP-1995 (147)

Type: Other: Mode of action
Remark: The administration of formic acid in a nonspecified dose to rabbits, dogs and monkeys (presumably via the feed) led to the same histopathologic changes of the retina and the optic nerve as methanol. Acidosis occurred. The authors speculate that the toxic effects might be due to the metabolism of methanol to formic acid via general acidosis. The study is only available as an abstract and the results cannot be assessed.
06-SEP-1995 (76)

Type: Other: Acute toxicity in vitro
Remark: An in vitro model system with Saccharomyces cerevisiae was tested with a total of 160 substances for its suitability as an in vitro model for the determination of the acute toxicity. According to the authors, the IC50 values determined (50% growth inhibition) correlated well with the LD50 values from the literature.
Test substance: Formic acid
08-SEP-1995 (148) (149)

Type: Other: Blood levels
Remark: The formate concentrations were investigated in the blood of 6 volunteers who were administered 200 mg/kg aspartame orally. At the beginning of the study, the formate concentrations were 1.91 +/- 0.61 mg/100 ml, on an average.
Test substance: Aspartame, formic acid
07-DEC-1995 (150)

Type: Other: Blood levels
Remark: The formate concentrations in the blood and urine were investigated in 20 print workers. The aim was to investigate whether the formate concentrations measured allow conclusions to be drawn about the exposure to methanol in the air; the methanol concentrations measured in the respiratory air were 85, 101 and 134 ppm. The formate concentrations in the blood of the workers increased significantly from 3.2 +/- 2.4 mg/l before the beginning of the shift (in the morning) to 7.9 +/- 3.2 mg/l after the shift (in the evening). The specific formate concentrations in the urine increased from 13.1 +/- 3.9 mg/l to 20.2 +/- 7 mg/l. Compared with this, the formate concentrations in the blood of the control persons showed a slight decrease from 5.6 +/- 4.5 mg/l in the morning to 4.9 +/- 4.2 mg/l in the evening; the specific formate concentrations in the urine were 11.9 +/- 6.4 mg/l in the morning and 11.7 +/- 5.6 mg/l in the evening. There was a great interindividual variability of the formate concentrations. According to the authors, the measurement

of the formate concentration in the blood and urine is an important parameter for monitoring the exposure of workers to methanol.

Test substance: Methanol, formic acid

07-DEC-1995 (151)

Type: Other: Final report on the safety assessment of formic acid
Test substance: Formic acid

16-MAY-2000 (152)

Type: Other: Review
Remark: Summary literature

08-SEP-1995 (153) (154)

Type: Other: Review
Test substance: Formic acid

28-JUL-1997 (155)

Type: Other: Review
Remark: Formic acid, draft

15-MAY-2000 (156)

Type: Other: Review - safety assessment
Remark: Final report on the safety assessment of formic acid

15-MAY-2000 (157)

Type: Other: Skin irritation test in vitro
Remark: In an in vitro test system (bovine udder) various substances severely irritating to the skin were investigated. After 2 hours, the tissue was examined biochemically (cytotoxicity and eicosanoid concentrations) and histopathologically. The substances examined had distinct effects on the prostaglandin E2 concentration and on histopathology. According to the authors, further investigations must be carried out to clarify whether slightly skin-irritating substances are also identified in this in vitro test system.

Test substance: Formic acid, 25%

08-SEP-1995 (158)

5.11 Experience with Human Exposure

Remark: Overview: One case of an esophagus burn in a child, among others

(159)

Remark: Overview: Formic acid irritates the eyes and nasal and pharyngeal mucosas. Direct contact may lead to severe burns to the skin and eyes and in the mouth and pharynx after oral intake. Nausea, vomiting, hemorrhage, acidosis, hemolysis and damage to the heart and central nervous system may occur.

(160)

Remark: Occupational health study: When handling silage solution (approx. 80% formic acid), 13 farmers showed an increased concentration of formic acid in the urine 15 h after exposure. (161)

Remark: Occupational health study: After the inhalation of methanol (40-160 ppm) and formic acid (2-5.5 ppm), 10 employees in the formic acid filling plant and in the production of urea formaldehyde resin showed formic acid concentrations of 21.2-118 mg/g creatinine in the urine 16 h after exposure. (162)

Remark: Occupational health study: Employees of a textile factory complained about nausea at concentrations of formic acid of approx. 15 ppm in the air. (163)

Remark: Case report: 45 cases of ingestion of formic acid were described. Abdominal pain, vomiting, hematemesis, dysphagia, dyspnea, burns in the gastrointestinal tract with subsequent strictures, coagulation disorders, pneumonia, acute kidney failure and hepatic dysfunction occurred. After ingestion of 45-200 g formic acid, 9 of 16 patients died after perforations in the gastrointestinal tract and 5 died of acute kidney failure. (164)

Remark: Case report: 53 cases of ingestion of formic acid are described. Burns of the gastrointestinal tract with esophagus strictures, pneumonia, kidney failure, hypotension and unconsciousness occurred. (165)

Remark: Case report: 5 deaths after ingestion of formic acid are described. Burns in the gastrointestinal tract, metabolic acidosis, coagulation disorders, hemorrhage, shock, hemolysis, respiratory insufficiency and kidney failure occurred. The methemoglobin level was 143 mg% (normally 6 mg%) in the blood. (166)

Remark: Case report: 2 cases of ingestion of formic acid are reported. Irritation, edema, blistering and necrosis of the oropharyngeal mucosa occurred. It was not possible to detect formic acid in the blood or urine. There was no methemoglobinemia. (167)

Remark: Case report: One death is reported after ingestion of formic acid (approx. 200 ml of an approx. 50% solution). The blood level is 348 ug/ml formic acid approx. 2h after ingestion. Hematemesis, cyanosis, burns in the gastrointestinal tract, shock, metabolic acidosis and hemolysis occurred.

(168)

Remark: Case report: One death is reported after ingestion of formic acid with hypotension, respiratory insufficiency, coagulation disorders and kidney failure.

(169)

Remark: Case report: One case of a local effect of conc. formic acid on the skin with burns of the legs with subsequent cicatricial changes and nausea, vomiting, metabolic acidosis, hemolysis and hemoglobinuria is reported.

(170)

Remark: Case report: One case of a local effect of formic acid on the eye with swelling and opacity of the cornea, pain, lacrimation and contraction of the pupils is reported.

(171)

Remark: 12 farmers were exposed to an average of 7.3 mg/m3/8h formic acid when handling silage. =0 h after exposure, renal ammonia formation and calcium were increased in the urine.

(172)

Remark: The mean concentration of formic acid in the urine is reported to be 21 mg/l for female and male adults between 20 and 80 years.

(173)

Remark: Case report: After splashing of a drop (0.8 ml 90% formic acid and 0.2 ml 30% hydrogen peroxide) into the eye, there was swelling of the conjunctiva and cornea with complete reversibility after 36-60 hours.

(174)

Remark: From 1989-93, a total of 3 cases of skin and/or eye corrosions after accidental local exposure to formic acid were referred to hospital for further treatment.

(175)

Remark: Twelve male farmers were exposed to 7.3 + 2.2 mg formic acid/m3 for 8 h in silage making. Each gave urine samples immediately, 15h and 30h after the end of the exposure. The excretion of formate was linearly related to the exposure 15 and 30h after exposure. Exposure increased renal ammoniagenesis and urinary calcium at 30h post exposure. Both biochemical effects may be explained by the interaction of formic acid with the oxidative metabolism of renal tubular cells, as formic acid is a known inhibitor of cytochrome oxidase.

25-MAR-1997 (176)

Remark: Report on use of urinary formic acid as a biologic exposure index of methanol exposure.

25-MAR-1997 (177)

Remark: Report on absence of formic acid accumulation in urine following five days of methanol exposure.

25-MAR-1997 (178)

Remark: Report on formic acid excretion in the urine of persons environmentally and occupationally exposed to formaldehyde.

25-MAR-1997 (179)

Remark: Ingestion of over 60 g of formic acid by an adult is potentially fatal. A case of a 36-year-old woman with a history of depression who ingested 110 g of formic acid is reported. She survived a complicated intensive care hospitalization following usage of intravenous folinic acid, urinary alkalinization, intravenous furosemide and supportive care. It is suggested to minimize formate toxicity by enhancing hepatic formate degradation via the folinic acid ¤one carbon pool¤ and by enhanced renal elimination of formate.

25-MAR-1997 (180)

Remark: Systemic toxicity developed in a 3-year-old girl burned by formic acid over 35% of her total body surface area. The patient presented with profound metabolic acidosis and a serum formate level of 400 óg/ml, the highest reported in the literature for poisoning by any route. The patient was successfully treated with hemodialysis, IV bicarbonate, and supportive measures.

25-MAR-1997 (181)

Remark: After inhalation of 200 ppm methanol for 4 h in 22 subjects serum methanol conc. were increased by more than fourfold, as were urinary methanol excretion rates, although formate conc. were not increased over background conc.

25-MAR-1997 (182)

Remark: A case in which a patient sustained an inhalation injury as a result of aerosolized formic acid is reported. The patient sustained a partial thickness burn to the face from a chemical spray; however, as a result of aerosolization, he also inhaled formic acid. This resulted in a reversible pulmonary chemical injury. Inhalation of formic acid results in a reactive airway dysfunction syndrome, a common response to inhalation of an occupational irritant.

25-MAR-1997 (183)

Remark: Compilation of concentrations of drugs affecting digestive system and metabolism. For formic acid the following concentrations in serum/plasma were noted:
Habitual/therapeutic 0-12 µg/ml and toxic 120 µg/ml

Reliability: (4) Not assignable
Only secondary literature

25-NOV-1999 (184)

Remark: Systemic toxicity developed in a 3-year-old girl burned by formic acid over 35% of her total body surface area. The patient presented with profound metabolic acidosis and a serum formate level of 400 µg/ml. The patient was successfully treated with hemodialysis, IV bicarbonate, and supportive measures.

Reliability: (2) Valid with restrictions
Acceptable study, meets basic scientific principles

29-NOV-1999 (185)

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7.1 Risk Assessment

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