

SECTION-1: Identification of the substance / mixture and the company / undertaking

Catalogue Number	CS-T-09179
Product Name	2,3-Butanedione
CAS No.	431-03-8
Category	Fine Chemicals
Synonyms	2,3-Butanedione; 2,3-Dioxobutane; Butanedione
Brand	Clearsynth Labs Ltd.
Identified uses	Laboratory Chemicals
Uses advised against	Not available
Company	Clearsynth Labs Ltd. Mumbai, India
Emergency Phone #	+91-22-245045900
REACH No.	Not available

SECTION 2: Hazards identification

Disclaimer: This is sample MSDS. Please email sales@clearsynth.com for more details.

2.1 Classification of the substance or mixture-Regulation (EC) No 1272/2008:

Skin irritation (Category 2)

Acute toxicity (Category 4)

2.2 Label Elements

Signal Word: Warning



Hazard Statement(s)

Code	Statement
H225	Not available
H302	Harmful if swallowed.
H315	Causes skin irritation.

H317	May cause an allergic skin reaction.
H318	Causes serious eye damage.
H331	Not available
H373	Not available
H332	Harmful if inhaled.
H335	Not available
H351	Not available
H370	Not available
H372	Not available

Precautionary Statement(s)

Code	Statement
P210	Not available
P233	Not available
P240	Not available
P241	Not available
P242	Not available
P243	Not available
P260	Not available
P261	Avoid breathing dust/fume/gas/mist/vapours/spray.
P264	Wash hands thoroughly after handling.
P264+P265	Not available
P270	Not available
P271	Use only outdoors or in a well-ventilated area.
P272	Not available
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P301+P317	Not available
P302+P352	IF ON SKIN: Wash with plenty of water and soap.
P303+P361+P353	Not available
P304+P340	IF INHALED: Remove person to fresh air and keep comfortable for breathing.

P305+P354+P338	Not available
P316	Not available
P317	Not available
P319	Get medical help if you feel unwell.
P321	Specific treatment (see ... on this label).
P330	Not available
P332+P317	If skin irritation occurs: Get medical help.
P333+P317	Not available
P362+P364	Take off contaminated clothing and wash it before reuse.
P370+P378	Not available
P403+P233	Store in a well-ventilated place. Keep container tightly closed.
P403+P235	Not available
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulation
P203	Not available
P308+P316	Not available
P318	Not available

SECTION 3: Composition / information on ingredients

3.1 Substance

Component : 2,3-Butanedione

CAS Number : 431-03-8

Molecular Formula : C₄H₆O₂

Molecular Weight : 86.09

Parent Chemical : -

Synonyms : 2,3-Butanedione; 2,3-Dioxobutane; Butanedione

Concentration : Not available

SECTION 4: First aid measures

SECTION 4: First-aid measures

4.1 Description of first aid measures

General advice:

- Remove contaminated clothing and shoes. Seek medical attention if symptoms persist.
- Show this safety data sheet to the doctor in attendance.

Inhalation:

- Move person to fresh air. Keep at rest in a position comfortable for breathing.
- If breathing is difficult, seek medical attention.

Skin contact:

- Wash with plenty of soap and water.
- Seek medical attention if irritation develops or persists.

Eye contact:

- Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do.
- Continue rinsing and obtain medical attention.

Ingestion:

- Rinse mouth. Do NOT induce vomiting.
- Never give anything by mouth to an unconscious person.
- Seek medical attention.

4.2 Most important symptoms and effects, both acute and delayed

- Not available.

4.3 Indication of any immediate medical attention and special treatment needed

- Treat symptomatically.
- No data available.

SECTION 5: Firefighting measures

SECTION 5: Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media:

- Use extinguishing measures appropriate to local circumstances and the surrounding environment.
- Not available.

Unsuitable extinguishing media:

- Not available.

5.2 Special hazards arising from the substance or mixture

- Vapors may form explosive mixtures with air.
- Hazardous combustion products: Not available.

5.3 Advice for firefighters

- Wear self-contained breathing apparatus (SCBA) and full protective gear.
- Cool unopened containers exposed to fire with water spray.
- Use water spray to reduce vapors if safe to do so.

SECTION 6: Accidental release measures

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6.1 Personal precautions, protective equipment and emergency procedures

- Evacuate personnel to safe areas.
- Ensure adequate ventilation.

- Avoid breathing vapors/mist.
- Wear appropriate personal protective equipment (see Section 8).
- Eliminate all ignition sources.

6.2 Environmental precautions

- Prevent further leakage or spillage if safe to do so.
- Avoid release to the environment. Prevent entry into drains, sewers, or waterways.

6.3 Methods and material for containment and cleaning up

- Contain spill with inert absorbent material.
- Collect in suitable, closed containers for disposal.
- Wash spill area after material pickup is complete.

6.4 Reference to other sections

- See Section 8 for personal protective equipment.
- See Section 13 for disposal considerations.

SECTION-7: Handling and storage

SECTION 7: Handling and storage

7.1 Precautions for safe handling

- Use only with adequate ventilation.
- Avoid contact with skin and eyes.
- Avoid breathing vapors/mist.
- Keep away from heat, sparks, open flames, and hot surfaces. No smoking.
- Use non-sparking tools and explosion-proof equipment where appropriate.
- Wash hands thoroughly after handling.

7.2 Conditions for safe storage, including any incompatibilities

- Store in a cool, dry, well-ventilated place.
- Keep container tightly closed.
- Store away from incompatible materials: Not available.
- Protect from ignition sources.

7.3 Specific end use(s)

- Fine chemical / laboratory use. No data available.

SECTION 8: Exposure controls / personal protection

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Occupational exposure limits:

- Not available.

Biological limit values:

- Not available.

8.2 Exposure controls

Engineering controls:

- Provide local exhaust ventilation or general dilution ventilation to maintain exposure below applicable limits.

- Use explosion-proof ventilation/equipment where appropriate.

Personal protective equipment (PPE):

Eye/face protection:

- Safety glasses with side shields or chemical splash goggles.

Skin protection:

- Wear protective gloves. Suitable glove material: Not available.
- Wear protective clothing to prevent skin contact.

Respiratory protection:

- If ventilation is inadequate, use a properly fitted respirator with appropriate cartridges/filters.
- Specific respirator type: Not available.

Hygiene measures:

- Handle in accordance with good industrial hygiene and safety practice.
- Remove contaminated clothing and wash before reuse.

Environmental exposure controls:

- Avoid release to the environment.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Test	Result
Appearance	No data available
IR spectrum	No data available
pH	No data available
Solubility	No data available

Property	Value
a) Physical State	No data available
b) Color	No data available
c) Odor	No data available
d) pH	No data available
e) Vapour Pressure	No data available
f) Viscosity	No data available
g) Initial Boiling Point and boiling range	No data available
h) Melting Point / Freezing Point	No data available

Property	Value
i) Auto Ignition Temperature	No data available
j) Flash Point	No data available
k) Explosion Limit, Lower	No data available
l) Explosion Limit, Upper	No data available
m) Decomposition Temperature	No data available
n) Loss on Drying	No data available
o) Relative Density	No data available
p) Solubility (in DMSO)	No data available
q) Oxidizing Properties	No data available

SECTION 10: Stability and reactivity

SECTION 10: Stability and reactivity

10.1 Reactivity

- No data available.

10.2 Chemical stability

- Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

- No data available.

10.4 Conditions to avoid

- Heat, flames, sparks, and other ignition sources.

- Incompatible conditions: Not available.

10.5 Incompatible materials

- Not available.

10.6 Hazardous decomposition products

- Not available.

SECTION 11: Toxicological information

11.1 Information on toxicological effects

- Acute toxicity: IDENTIFICATION AND USE: Diacetyl (DA) is a yellow liquid. It is used as synthetic flavoring substance and adjuvant. Diacetyl has been widely used as a chemical modifier of proteins, combining with arginine residues. HUMAN EXPOSURE AND TOXICITY: Diacetyl is a diketone flavoring agent that is commonly employed for buttery taste as well as other purposes. Industrial exposure to flavoring agents, particularly diacetyl, has recently been associated with bronchiolitis obliterans, a severe respiratory illness producing fibrosis and obstruction of the small airways. This has been most commonly reported in the microwave popcorn production industry, but it has occurred elsewhere. In addition to bronchiolitis obliterans, spirometry abnormalities (fixed airflow obstruction) and

respiratory symptoms have been associated with exposure. A direct effect on the respiratory epithelium with the disorganized fibrotic repair appears most likely as the underlying mechanism. Current data suggest that diacetyl is the agent responsible, although it is possible that diacetyl is simply a marker for another causative agent. Workers at the microwave popcorn company experienced normal rates of all-cause mortality but higher rates of chronic obstructive pulmonary disease-associated mortality, especially workers employed before the company reduced diacetyl exposure. According to case reports, lung disease could also arise in the consumers of diacetyl-containing popcorn. ANIMAL STUDIES: Male mice were exposed by inhalation to 200 or 400 ppm DA 6 hr/day for 5 days. 400 ppm caused deaths and acute necrotizing rhinitis, laryngitis and bronchitis (proximal large bronchi). Exposure to 200 ppm caused a few deaths and acute necrotizing rhinitis and erosive or necrotizing laryngitis in all mice. There were no lung or bronchiolar lesions in the DA exposed mice. Chronic bronchitis, laryngitis, and rhinitis were present after 2 and 4 weeks of exposure. In rats diacetyl inhalation increases substance P levels in sensory nerves of airway epithelium. Because substance P release in airways promotes inflammation and activation of sensory nerves mediates reflexes, neural changes may contribute to flavorings-related lung disease pathogenesis. When given i.p. to mice once weekly for 24 weeks, diacetyl (1.70 or 8.40 mg/kg [0.0197 or 0.0976 mmol/kg]) did not induce any lung tumors. Groups of hamsters, mice, and rats were given a solution containing 90% diacetyl by gavage on days 6-10 of gestation for hamsters and days 6-15 of gestation for mice and rats. The doses for all species were 16, 74, 345, or 1600 mg/kg bw per day. No effects were seen on maternal survival, weight, or reproductive parameters or on fetal survival or microscopic appearance of external, skeletal, or soft tissues. Diacetyl induced mitotic chromosome loss in *Saccharomyces cerevisiae* in the presence of propionitrile. In several bacterial assays, diacetyl generally showed mutagenic activity in *Salmonella typhimurium* strains TA100, 102, and 104 with and without metabolic activation but none against strain TA98. Conflicting results were obtained in *Escherichia coli* strain WP2 uvra, but nonmutagenicity was demonstrated in the SOS-chromotest using *E. coli* PQ37. Diacetyl was also negative in a micronucleus test using mouse bone marrow cells. Acute exposure to cholinesterase inhibitors can cause a cholinergic crisis characterized by severe nausea/vomiting, salivation, sweating, bradycardia, hypotension, collapse, and convulsions. Increasing muscle weakness is a possibility and may result in death if respiratory muscles are involved. Accumulation of ACh at motor nerves causes overstimulation of nicotinic expression at the neuromuscular junction. When this occurs symptoms such as muscle weakness, fatigue, muscle cramps, fasciculation, and paralysis can be seen. When there is an accumulation of ACh at autonomic ganglia this causes overstimulation of nicotinic expression in the sympathetic system. Symptoms associated with this are hypertension, and hypoglycemia. Overstimulation of nicotinic acetylcholine receptors in the central nervous system, due to accumulation of ACh, results in anxiety, headache, convulsions, ataxia, depression of respiration and circulation, tremor, general weakness, and potentially coma. When there is expression of muscarinic overstimulation due to excess acetylcholine at muscarinic acetylcholine receptors symptoms of visual disturbances, tightness in chest, wheezing due to bronchoconstriction, increased bronchial secretions, increased salivation, lacrimation, sweating, peristalsis, and urination can occur. Certain reproductive effects in fertility, growth, and development for males and females have been linked specifically to organophosphate pesticide exposure. Most of the research on reproductive effects has been conducted on farmers working with pesticides and insecticides in rural areas. In females menstrual cycle disturbances, longer pregnancies, spontaneous abortions, stillbirths, and some developmental effects in offspring have been linked to organophosphate pesticide exposure. Prenatal exposure has been linked to impaired fetal growth and development. Neurotoxic effects have also been linked to poisoning with OP pesticides causing four neurotoxic effects in humans: cholinergic syndrome, intermediate syndrome, organophosphate-induced delayed polyneuropathy (OPIDP), and chronic organophosphate-induced neuropsychiatric disorder (COPIND). These syndromes result after acute and chronic exposure to OP pesticides.

- Skin corrosion/irritation: Causes eye irritation, redness and pain. Causes moderate skin irritation. Harmful if swallowed. May cause gastrointestinal irritation with nausea, vomiting and diarrhea. Causes respiratory tract irritation. Vapors may cause dizziness or suffocation. Harmful if inhaled. High exposure to butanedione may cause

headache, drowsiness, lack of coordination and seizures (L1280).

- Serious eye damage/eye irritation: Causes eye irritation, redness and pain. Causes moderate skin irritation.

Harmful if swallowed. May cause gastrointestinal irritation with nausea, vomiting and diarrhea. Causes respiratory tract irritation. Vapors may cause dizziness or suffocation. Harmful if inhaled. High exposure to butanedione may cause headache, drowsiness, lack of coordination and seizures (L1280).

- Respiratory or skin sensitization: No data available.

- Germ cell mutagenicity: IDENTIFICATION AND USE: Diacetyl (DA) is a yellow liquid. It is used as synthetic flavoring substance and adjuvant. Diacetyl has been widely used as a chemical modifier of proteins, combining with arginine residues. HUMAN EXPOSURE AND TOXICITY: Diacetyl is a diketone flavoring agent that is commonly employed for buttery taste as well as other purposes. Industrial exposure to flavoring agents, particularly diacetyl, has recently been associated with bronchiolitis obliterans, a severe respiratory illness producing fibrosis and obstruction of the small airways. This has been most commonly reported in the microwave popcorn production industry, but it has occurred elsewhere. In addition to bronchiolitis obliterans, spirometry abnormalities (fixed airflow obstruction) and respiratory symptoms have been associated with exposure. A direct effect on the respiratory epithelium with the disorganized fibrotic repair appears most likely as the underlying mechanism. Current data suggest that diacetyl is the agent responsible, although it is possible that diacetyl is simply a marker for another causative agent. Workers at the microwave popcorn company experienced normal rates of all-cause mortality but higher rates of chronic obstructive pulmonary disease-associated mortality, especially workers employed before the company reduced diacetyl exposure. According to case reports, lung disease could also arise in the consumers of diacetyl-containing popcorn. ANIMAL STUDIES: Male mice were exposed by inhalation to 200 or 400 ppm DA 6 hr/day for 5 days. 400 ppm caused deaths and acute necrotizing rhinitis, laryngitis and bronchitis (proximal large bronchi). Exposure to 200 ppm caused a few deaths and acute necrotizing rhinitis and erosive or necrotizing laryngitis in all mice. There were no lung or bronchiolar lesions in the DA exposed mice. Chronic bronchitis, laryngitis, and rhinitis were present after 2 and 4 weeks of exposure. In rats diacetyl inhalation increases substance P levels in sensory nerves of airway epithelium. Because substance P release in airways promotes inflammation and activation of sensory nerves mediates reflexes, neural changes may contribute to flavorings-related lung disease pathogenesis. When given i.p. to mice once weekly for 24 weeks, diacetyl (1.70 or 8.40 mg/kg [0.0197 or 0.0976 mmol/kg]) did not induce any lung tumors. Groups of hamsters, mice, and rats were given a solution containing 90% diacetyl by gavage on days 6-10 of gestation for hamsters and days 6-15 of gestation for mice and rats. The doses for all species were 16, 74, 345, or 1600 mg/kg bw per day. No effects were seen on maternal survival, weight, or reproductive parameters or on fetal survival or microscopic appearance of external, skeletal, or soft tissues. Diacetyl induced mitotic chromosome loss in *Saccharomyces cerevisiae* in the presence of propionitrile. In several bacterial assays, diacetyl generally showed mutagenic activity in *Salmonella typhimurium* strains TA100, 102, and 104 with and without metabolic activation but none against strain TA98. Conflicting results were obtained in *Escherichia coli* strain WP2 uvra, but nonmutagenicity was demonstrated in the SOS-chromotest using *E. coli* PQ37. Diacetyl was also negative in a micronucleus test using mouse bone marrow cells.

- Carcinogenicity: IDENTIFICATION AND USE: Diacetyl (DA) is a yellow liquid. It is used as synthetic flavoring substance and adjuvant. Diacetyl has been widely used as a chemical modifier of proteins, combining with arginine residues. HUMAN EXPOSURE AND TOXICITY: Diacetyl is a diketone flavoring agent that is commonly employed for buttery taste as well as other purposes. Industrial exposure to flavoring agents, particularly diacetyl, has recently been associated with bronchiolitis obliterans, a severe respiratory illness producing fibrosis and obstruction of the small airways. This has been most commonly reported in the microwave popcorn production industry, but it has occurred elsewhere. In addition to bronchiolitis obliterans, spirometry abnormalities (fixed airflow obstruction) and respiratory symptoms have been associated with exposure. A direct effect on the respiratory epithelium with the disorganized fibrotic repair appears most likely as the underlying mechanism. Current data suggest that diacetyl is the agent responsible, although it is possible that diacetyl is simply a marker for another causative agent. Workers at

the microwave popcorn company experienced normal rates of all-cause mortality but higher rates of chronic obstructive pulmonary disease-associated mortality, especially workers employed before the company reduced diacetyl exposure. According to case reports, lung disease could also arise in the consumers of diacetyl-containing popcorn. **ANIMAL STUDIES:** Male mice were exposed by inhalation to 200 or 400 ppm DA 6 hr/day for 5 days. 400 ppm caused deaths and acute necrotizing rhinitis, laryngitis and bronchitis (proximal large bronchi). Exposure to 200 ppm caused a few deaths and acute necrotizing rhinitis and erosive or necrotizing laryngitis in all mice. There were no lung or bronchiolar lesions in the DA exposed mice. Chronic bronchitis, laryngitis, and rhinitis were present after 2 and 4 weeks of exposure. In rats diacetyl inhalation increases substance P levels in sensory nerves of airway epithelium. Because substance P release in airways promotes inflammation and activation of sensory nerves mediates reflexes, neural changes may contribute to flavorings-related lung disease pathogenesis. When given i.p. to mice once weekly for 24 weeks, diacetyl (1.70 or 8.40 mg/kg [0.0197 or 0.0976 mmol/kg]) did not induce any lung tumors. Groups of hamsters, mice, and rats were given a solution containing 90% diacetyl by gavage on days 6-10 of gestation for hamsters and days 6-15 of gestation for mice and rats. The doses for all species were 16, 74, 345, or 1600 mg/kg bw per day. No effects were seen on maternal survival, weight, or reproductive parameters or on fetal survival or microscopic appearance of external, skeletal, or soft tissues. Diacetyl induced mitotic chromosome loss in *Saccharomyces cerevisiae* in the presence of propionitrile. In several bacterial assays, diacetyl generally showed mutagenic activity in *Salmonella typhimurium* strains TA100, 102, and 104 with and without metabolic activation but none against strain TA98. Conflicting results were obtained in *Escherichia coli* strain WP2 uvra, but nonmutagenicity was demonstrated in the SOS-chromotest using *E. coli* PQ37. Diacetyl was also negative in a micronucleus test using mouse bone marrow cells. **A4:** Not classifiable as a human carcinogen.

- **Reproductive toxicity:** **IDENTIFICATION AND USE:** Diacetyl (DA) is a yellow liquid. It is used as synthetic flavoring substance and adjuvant. Diacetyl has been widely used as a chemical modifier of proteins, combining with arginine residues. **HUMAN EXPOSURE AND TOXICITY:** Diacetyl is a diketone flavoring agent that is commonly employed for buttery taste as well as other purposes. Industrial exposure to flavoring agents, particularly diacetyl, has recently been associated with bronchiolitis obliterans, a severe respiratory illness producing fibrosis and obstruction of the small airways. This has been most commonly reported in the microwave popcorn production industry, but it has occurred elsewhere. In addition to bronchiolitis obliterans, spirometry abnormalities (fixed airflow obstruction) and respiratory symptoms have been associated with exposure. A direct effect on the respiratory epithelium with the disorganized fibrotic repair appears most likely as the underlying mechanism. Current data suggest that diacetyl is the agent responsible, although it is possible that diacetyl is simply a marker for another causative agent. Workers at the microwave popcorn company experienced normal rates of all-cause mortality but higher rates of chronic obstructive pulmonary disease-associated mortality, especially workers employed before the company reduced diacetyl exposure. According to case reports, lung disease could also arise in the consumers of diacetyl-containing popcorn. **ANIMAL STUDIES:** Male mice were exposed by inhalation to 200 or 400 ppm DA 6 hr/day for 5 days. 400 ppm caused deaths and acute necrotizing rhinitis, laryngitis and bronchitis (proximal large bronchi). Exposure to 200 ppm caused a few deaths and acute necrotizing rhinitis and erosive or necrotizing laryngitis in all mice. There were no lung or bronchiolar lesions in the DA exposed mice. Chronic bronchitis, laryngitis, and rhinitis were present after 2 and 4 weeks of exposure. In rats diacetyl inhalation increases substance P levels in sensory nerves of airway epithelium. Because substance P release in airways promotes inflammation and activation of sensory nerves mediates reflexes, neural changes may contribute to flavorings-related lung disease pathogenesis. When given i.p. to mice once weekly for 24 weeks, diacetyl (1.70 or 8.40 mg/kg [0.0197 or 0.0976 mmol/kg]) did not induce any lung tumors. Groups of hamsters, mice, and rats were given a solution containing 90% diacetyl by gavage on days 6-10 of gestation for hamsters and days 6-15 of gestation for mice and rats. The doses for all species were 16, 74, 345, or 1600 mg/kg bw per day. No effects were seen on maternal survival, weight, or reproductive parameters or on fetal survival or microscopic appearance of external, skeletal, or soft tissues. Diacetyl induced mitotic chromosome loss in *Saccharomyces cerevisiae* in the presence of propionitrile. In several bacterial assays, diacetyl generally showed

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- STOT-single exposure: No data available.

- STOT-repeated exposure: IDENTIFICATION AND USE: Diacetyl (DA) is a yellow liquid. It is used as synthetic flavoring substance and adjuvant. Diacetyl has been widely used as a chemical modifier of proteins, combining with arginine residues. HUMAN EXPOSURE AND TOXICITY: Diacetyl is a diketone flavoring agent that is commonly employed for buttery taste as well as other purposes. Industrial exposure to flavoring agents, particularly diacetyl, has recently been associated with bronchiolitis obliterans, a severe respiratory illness producing fibrosis and obstruction of the small airways. This has been most commonly reported in the microwave popcorn production industry, but it has occurred elsewhere. In addition to bronchiolitis obliterans, spirometry abnormalities (fixed airflow obstruction) and respiratory symptoms have been associated with exposure. A direct effect on the respiratory epithelium with the disorganized fibrotic repair appears most likely as the underlying mechanism. Current data suggest that diacetyl is the agent responsible, although it is possible that diacetyl is simply a marker for another causative agent. Workers at the microwave popcorn company experienced normal rates of all-cause mortality but higher rates of chronic obstructive pulmonary disease-associated mortality, especially workers employed before the company reduced diacetyl exposure. According to case reports, lung disease could also arise in the consumers of diacetyl-containing popcorn. ANIMAL STUDIES: Male mice were exposed by inhalation to 200 or 400 ppm DA 6 hr/day for 5 days. 400 ppm caused deaths and acute necrotizing rhinitis, laryngitis and bronchitis (proximal large bronchi). Exposure to 200 ppm caused a few deaths and acute necrotizing rhinitis and erosive or necrotizing laryngitis in all mice. There were no lung or bronchiolar lesions in the DA exposed mice. Chronic bronchitis, laryngitis, and rhinitis were present after 2 and 4 weeks of exposure. In rats diacetyl inhalation increases substance P levels in sensory nerves of airway epithelium. Because substance P release in airways promotes inflammation and activation of sensory nerves mediates reflexes, neural changes may contribute to flavorings-related lung disease pathogenesis. When given i.p. to mice once weekly for 24 weeks, diacetyl (1.70 or 8.40 mg/kg [0.0197 or

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- Aspiration hazard: /LABORATORY ANIMALS: Acute Exposure/ ... The potential use of diacetyl (DA) as a model of chemical-induced OB is ... being evaluated. Male C57BL/6 mice were exposed by inhalation to 200 or 400 ppm DA 6 hr/day for 5 days. 400 ppm caused deaths and acute necrotizing rhinitis, laryngitis and bronchitis (proximal large bronchi). Exposure to 200 ppm caused a few deaths and acute necrotizing rhinitis and erosive or necrotizing laryngitis in all mice. There were no lung or bronchiolar lesions in the DA exposed mice. To reduce the nasal cavity toxicity the daily exposure duration was reduced to 1 hr/day, 5 days/week and the study duration increased to 4 weeks (100, 200, 400 ppm). Chronic bronchitis, laryngitis, and rhinitis were present after 2 and 4 weeks of exposure. The lesion severity was concentration related and ranged from minimal to moderate. Because of the sensitivity of the nasal cavity to inhaled DA, mice (5/group) were administered 100, 200, or 400 mg/kg DA by oropharyngeal aspiration. Two mice in the 400 mg/kg group died 2 days after aspiration. On day 4 after aspiration of 400 mg/kg, foci of fibrosis without inflammation were present at the junction of the terminal bronchiole and alveolar duct in all 3 remaining mice. Similar lesions with mild inflammation were noted in 1/5 mice treated with 200 mg/kg. Although the histological appearance of these lesions is not identical to OB these lesions may progress to OB with continued exposure. In addition to longer exposure durations other DA exposure routes and exposure regimens are being evaluated.

Likely routes of exposure

- IDENTIFICATION AND USE: Diacetyl (DA) is a yellow liquid. It is used as synthetic flavoring substance and adjuvant. Diacetyl has been widely used as a chemical modifier of proteins, combining with arginine residues.

HUMAN EXPOSURE AND TOXICITY: Diacetyl is a diketone flavoring agent that is commonly employed for buttery taste as well as other purposes. Industrial exposure to flavoring agents, particularly diacetyl, has recently been associated with bronchiolitis obliterans, a severe respiratory illness producing fibrosis and obstruction of the small airways. This has been most commonly reported in the microwave popcorn production industry, but it has occurred elsewhere. In addition to bronchiolitis obliterans, spirometry abnormalities (fixed airflow obstruction) and respiratory symptoms have been associated with exposure. A direct effect on the respiratory epithelium with the disorganized fibrotic repair appears most likely as the underlying mechanism. Current data suggest that diacetyl is the agent responsible, although it is possible that diacetyl is simply a marker for another causative agent. Workers at the microwave popcorn company experienced normal rates of all-cause mortality but higher rates of chronic obstructive pulmonary disease-associated mortality, especially workers employed before the company reduced diacetyl exposure. According to case reports, lung disease could also arise in the consumers of diacetyl-containing popcorn.

ANIMAL STUDIES: Male mice were exposed by inhalation to 200 or 400 ppm DA 6 hr/day for 5 days. 400 ppm caused deaths and acute necrotizing rhinitis, laryngitis and bronchitis (proximal large bronchi). Exposure to 200 ppm caused a few deaths and acute necrotizing rhinitis and erosive or necrotizing laryngitis in all mice. There were no lung or bronchiolar lesions in the DA exposed mice. Chronic bronchitis, laryngitis, and rhinitis were present after 2 and 4 weeks of exposure. In rats diacetyl inhalation increases substance P levels in sensory nerves of airway epithelium. Because substance P release in airways promotes inflammation and activation of sensory nerves mediates reflexes, neural changes may contribute to flavorings-related lung disease pathogenesis. When given i.p. to mice once weekly for 24 weeks, diacetyl (1.70 or 8.40 mg/kg [0.0197 or 0.0976 mmol/kg]) did not induce any lung tumors. Groups of hamsters, mice, and rats were given a solution containing 90% diacetyl by gavage on days 6-10 of gestation for hamsters and days 6-15 of gestation for mice and rats. The doses for all species were 16, 74, 345, or 1600 mg/kg bw per day. No effects were seen on maternal survival, weight, or reproductive parameters or on fetal survival or microscopic appearance of external, skeletal, or soft tissues. Diacetyl induced mitotic chromosome loss in *Saccharomyces cerevisiae* in the presence of propionitrile. In several bacterial assays, diacetyl generally showed mutagenic activity in *Salmonella typhimurium* strains TA100, 102, and 104 with and without metabolic activation but none against strain TA98. Conflicting results were obtained in *Escherichia coli* strain WP2 uvra, but nonmutagenicity was demonstrated in the SOS-chromotest using *E. coli* PQ37. Diacetyl was also negative in a micronucleus test using mouse bone marrow cells.

Symptoms related to the physical, chemical and toxicological characteristics

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SECTION 12: Ecological information

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12.1 Toxicity

- No data available.

12.2 Persistence and degradability

- No data available.

12.3 Bioaccumulative potential

- No data available.

12.4 Mobility in soil

- No data available.

12.5 Results of PBT and vPvB assessment

- Not available.

12.6 Endocrine disrupting properties

- No data available.

12.7 Other adverse effects

- No data available.

SECTION 13: Disposal considerations

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13.1 Waste treatment methods

Product:

- Dispose of contents/container in accordance with local/regional/national/international regulations.
- Do not discharge to drains.

Contaminated packaging:

- Dispose of as unused product.

Waste code:

- Not available.

SECTION 14: Transport information

SECTION 14: Transport information

14.1 UN number

- Not available.

14.2 UN proper shipping name

- Not available.

14.3 Transport hazard class(es)

- Not available.

14.4 Packing group

- Not available.

14.5 Environmental hazards

- Not available.

14.6 Special precautions for user

- Not available.

14.7 Maritime transport in bulk according to IMO instruments

- Not available.

SECTION 15: Regulatory information

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

- Not available.

SECTION 16: Other information

SECTION 16: Other information

Product identification:

- Product name: 2,3-Butanedione
- Catalog no.: CS-T-09179
- CAS no.: 431-03-8
- Synonyms: 2,3-Butanedione; 2,3-Dioxobutane; Butanedione
- Supplier: Clearsynth Labs Ltd., Mumbai, India
- Emergency phone: +91-22-245045900

Disclaimer:

- The information provided is believed to be accurate but is not exhaustive and is intended only as guidance for safe handling, use, processing, storage, transportation, disposal, and release.
- Not available data indicates information was not provided.

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