

WATCH/14/2004

Item 9ii

General Description

Synonyms: Biacetyl; 2,3-Butanedione; 2,3-Butadione; 2,3-Diketobutane; Dimethyldiketone; Dimethylglyoxal; Glyoxal, dimethyl-

OSHA IMIS Code Number: D740

Chemical Abstracts Service (CAS) Registry Number: 431-03-8

NIOSH, Registry of Toxic Effects (RTECS) Identification Number:
[EK2625000](#)

Chemical Description and Physical Properties: Green-yellow liquid

molecular formula: C₄H₆O₂
molecular weight: 86.09
boiling point: 88°C
vapor pressure: 178 mm
melting point: -3°C

Potentially hazardous incompatibilities: strong oxidizers, bases, reducing agents, metals

Health Factors

Potential symptoms: Eye, mucous membrane, respiratory system, skin irritation; persistent cough, phlegm production, wheezing, dyspnea (shortness of breath); unusual fatigue; episodes of mild fever or generalized aches; severe skin rashes.

Health Effects: Irritation-Eyes, Nose, Throat, Skin (HE15); Suspected cumulative lung damage---bronchiolitis obliterans (HE10)

Affected organs: : Eyes, respiratory system, skin

Notes: 1) No IDLH has been established. One of four rats died after a 6-hour exposure to vapors from heated (55°C) artificial butter flavoring containing 285 ppm diacetyl (~64% of total VOCs), but no deaths occurred among groups of six rats exposed to 203 ppm diacetyl (~68% of total VOCs) or 352 ppm diacetyl (~61% of total VOCs) (Hubbs et al., 2002). 2) A cause-effect relationship between diacetyl and bronchiolitis obliterans has not been established, as food-processing workers with this lung disease were also exposed to other volatile food-flavoring agents (Kreiss et al., 2002). 3) Diacetyl is known to react with the amino acid arginine in proteins (Riordan, 1979) and inhibits enzymes that are important for protecting cells from oxidative damage, such as superoxide dismutase (Borders et al., 1985) and glutathione reductase (Boggaram and Mannervik, 1982).

Date Last Revised: 06/19/2003

Literature Basis:

- (occupational reports)
Kreiss, K., Gomaa, A., Kullman, G., Fedan, K., Simoes, E.J. and Enright, P.L.: Clinical bronchiolitis obliterans in workers at a microwave-popcorn plant. *New Eng. J. Med.* **347**(5): 330-338, 2002.
- Lockey, J., McKay, R., Barth, E., Dahlsten, J. and Baughman, R.: Bronchiolitis obliterans in the food flavoring industry [abstract]. *Am. J. Respir. Crit. Care Med.* **165**: A461, 2002.

- Parmet, A.J. and Von Essen, S.: Rapidly progressive, fixed airway obstructive disease in popcorn workers: a new occupational pulmonary illness? [Letter] *J. Occup. Environ. Med.* **44**(3): 216-218, 2002.
- (inhalational toxicology in rats)
Hubbs, A.F., Battelli, L., Goldsmith, W.T., Porter, D.W., Frazer, D., Friend, S., Schwegler-Berry, D., Mercer, R.R., Reynolds, J.S., Grote, A., Castranova, V., Kullman, G., Fedan, J.S., Dowdy, J. and Jones, W.G.: Necrosis of nasal and airway epithelium in rats inhaling vapors of artificial butter flavoring. *Toxicol. Appl. Pharmacol.* **185**: 128-135, 2002.
- (possible mechanisms of toxicity)
Boggaram, V. and Mannervik, B.: Essential arginine residues in the pyridine nucleotide binding sites of glutathione reductase. *Biochim. Biophys. Acta* **701**(1): 119-126, 1982.
- Borders, C.L. Jr., Saunders, J.E., Blech, D.M. and Frovich, I.: Essentiality of the active-site arginine residue for the normal catalytic activity of Cu,Zn superoxide dismutase. *Biochem. J.* **230**(3): 771-776, 1985.
- Riordan, J.F.: Arginyl residues and anion binding sites in proteins. *Mol. Cell. Biochem.* **26**(2): 71-92, 1979.

Monitoring Methods used by OSHA

Laboratory Sampling/Analytical Method:

sampling media: Two Silica Gel Tubes in series (150/75mg sect., 20/40 mesh)

analytical solvent: 95:5 ethanol:water

maximum volume: 3 Liters **maximum flow rate:** 0.05 L/min

current analytical method: Gas Chromatography; GC/FID

method reference: OSHA Manual of Analytical Methods ([OSHA PV2118](#))

method classification: Partially Validated

sampling media: Anasorb CMS tubes

analytical solvent: 99:1 acetone:methanol

maximum volume: 10 Liters **maximum flow rate:** 0.2 L/min

current analytical method: Gas Chromatography with flame ionization detector; GC/FID

method reference: NIOSH Manual of Analytical Methods (NIOSH 2557)

method classification: Validated

note: Samples must be refrigerated immediately after sampling and shipped to lab as soon as possible.

analytical condition: 30-m Stabilwax DA (0.32mm ID; 1µ film thickness)

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Revised: 29 October 2003