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OSHA

adds value to business,
work and life.

Diacetyl History and Compliance Issues

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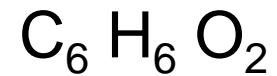
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Objectives

- By the end of this session the learner will be able to:
 - Describe uses and history of diacetyl
 - Explain history of exposures and illnesses related to diacetyl
 - Describe control measures which can be used to eliminate or control exposure to diacetyl
- This will be accomplished through discussion during a power point presentation.

Diacetyl – What is it?



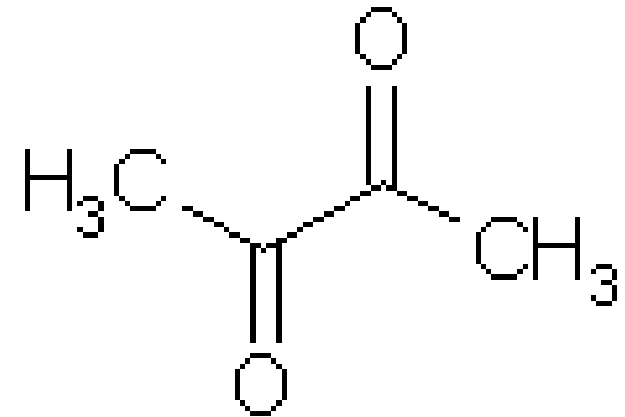
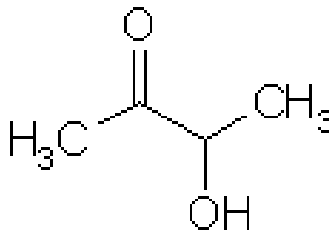
Synonyms: biacetyl, 2,3-butanedione, 2,3-diketobutane, dimethyl diketone, dimethylglyoxal, 2,3 diketobutane

Melting Point – 40° F

Appearance: Pale Yellowish to Colorless as a Solid or a liquid

Fermentation process

Synthetically



Acetoin

Diacetyl – Where is it used

- It makes anything with a butter flavor taste better and improves the overall aroma
- Well known because of Microwave Popcorn
- Also used in: snack foods, pet foods, baked goods, and other food processes

Knowledge of Diacetyl Hazards

- Flavoring and Extract Manufacturing Association (FEMA) provided experts in a 1986 lawsuit.
- 1994 BASF notifies International Flavors and Fragrance (IFF) of a recent study of rats exposed to diacetyl
- 1994 IFF employees required to wear full face APR's and all diacetyl processes isolated
- 1996, Another company reports two cases of illness to FEMA.

NIOSH 2000 Study

- May 2000 an Occ Doc contacts the Missouri Department of Health and Senior Services
- Reporting 8 cases of fixed obstructive lung disease in former workers at a microwave popcorn factory
- Assistance requested from NIOSH

- Plant A was a manufacturer of microwave popcorn.
 - The soybean oil, salt and flavorings are mixed, transported, added to the microwave popcorn bags along with kernels
 - Employees either mix, run the package lines, work in the warehouse, or do other misc. jobs.

Typical Mixing Area



NIOSH 2000 Study

- 8 cases of ex-employees with obstructive lung disease
- Worked at plant 1992-2000
- EE History: 8 months to 9 years
- 4 victims were mixers
- 4 victims were packagers –never did mixing

- Starting with Statistical Analysis
 - 425 current and former employees interviewed and tested
 - 13 were mixers, 276 were packagers and 136 worked in other areas
 - 4 of 13 mixers had disease 31%
 - 4 of 276 packers had disease 1%
 - 0 of 136 other did not have disease 0%

NIOSH 2000 Study Tests

- Pulmonary – 117 current EE's
 - 2-3 times the rates of respiratory symptoms
 - Rate of obstruction 3.3 times higher than expected compared to NA
- Air sampling
 - 100 VOC's sampled and detected
 - GM Diacetyl
 - 18 PPM Mixers
 - 1.3 PPM Packers
 - 0.02 PPM other areas

- Zero exposure is the only acceptable limit

NIOSH 2006 Study Carmi Flavor and Fragrance, CA

- Manufactures liquid and powdered flavoring extracts & syrups, powdered drink mix, and other goods
- Cal/OSHA was conducting an investigation, one employee and potentially a second with bronchiolitis obliterans
- June 11, 2006 NIOSH requested for assistance

NIOSH 2006 Study

- Interviewed workers and measured their lung function with spirometry.
- Measured air concentrations of flavoring chemicals in the production room while workers made liquid and powdered flavorings.
- Measured air concentrations of flavoring chemicals in other areas of the plant.

NIOSH 2006 Study

- Many reports of eye and nasal irritation.
- Respiratory symptoms most common in production workers who made powdered flavorings and in laboratory workers
- Respiratory illness was reported more often by production workers who made powdered flavorings than by other workers
- Two former workers and one current worker who made powdered flavorings have severe fixed obstructive lung disease consistent with bronchiolitis obliterans
- Diacetyl air concentrations were highest in the production room when workers filled boxes with butter-flavored powder

NIOSH 2006 Study Findings – Air Monitoring

Liquid Production:

Area Sample	GM	0.02 PPM
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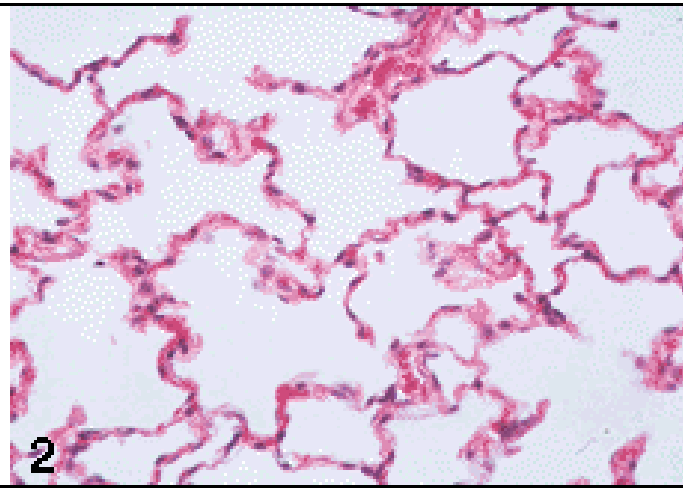
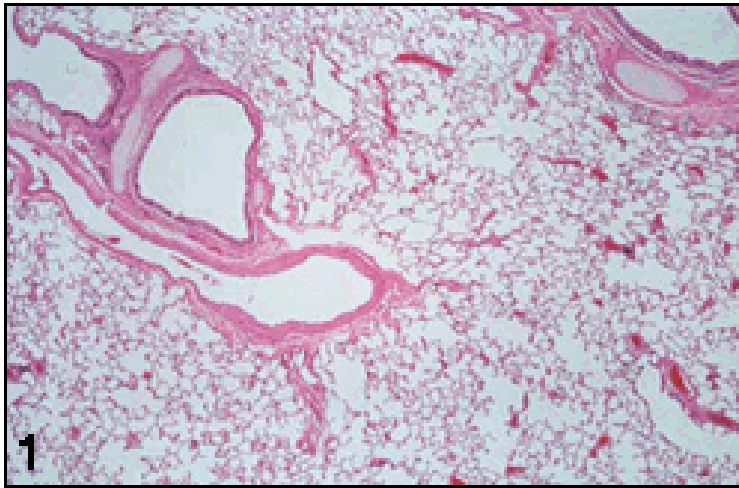
Powder Production

Area Sample	GM	12.5 PPM
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Min/Max	2.5 -47 PPM
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Personnel	GM	7.7 PPM
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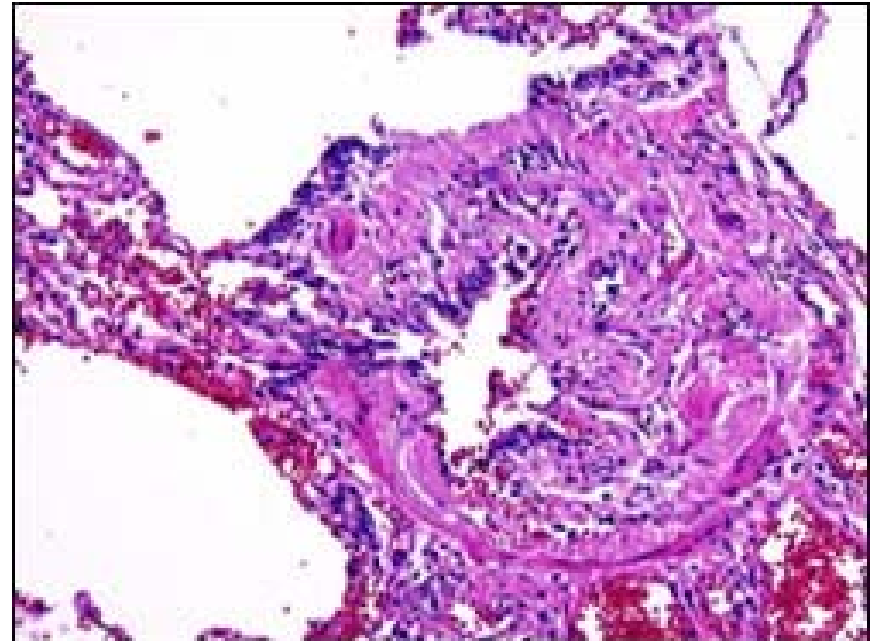
Min/Max	6.9-8.7
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Healthy
Lung

Diacetyl reacts with the amino acid arginine and inhibits enzymes containing arginine that are important for protecting cells from oxidative damage.

Bronchiolitis obliterans: small airways become inflamed and scarred, resulting in thickening and narrowing of the airways



Small airway obstruction

How can you get Bronchiolitis Obliterans?

- Having connective tissue disorders –
rheumatoid arthritis and lupus
- Respiratory infection caused by
viruses/bacteria
- Certain medications
- Exposure to
 - Irritant gases – Cl_2 , NH_3 , SO_2
 - Flavorings

Bronchiolitis Obliterans - Symptoms

- Persistent dry cough
- Wheezing
- Shortness of breath upon exertion
- Asthma
- Symptoms don't go away after long weekend or after lengthy vacation
- Fixed airway obstruction in spirometry

Diacetyl – Exposure Determination

- Do any products contain Diacetyl?
- Air monitoring
 - Method 1013
 - Two silica gel tubes in series – light sensitive
 - 180 min at 0.05 L/min (9 L) (TWA)
15 min at 0.2 L/min (3 L) (short term)
 - Reliable quantitation limit: 0.012 ppm
 - GC using FID
 - Protect samples from light

Diacetyl Exposure Control Measures

- Elimination
- Isolation
- Engineering Controls
 - Local and general ventilation
- PPE
- Or combination of all

Isolation / General Exhaust



Diacetyl PPE for Mixers

- Half or full APR with organic vapor cartridge with particulate filter, PAPR is preferred in hot environment
- Gloves and Apron
 - Butyl Rubber, Teflon or Tychem effective in reducing skin exposure with ketones
 - Chemical resistant gloves and sleeves for those who handle liquid, paste or powdered flavor ingredients
- Goggles/Face Shield

Diacetyl – Other Necessary Items

- Employees need to know the hazards associated with the chemicals in the workplace. Implementation of a Hazard Communication Program is necessary for all employees in the plant
- PPE assessment and documentation should be kept on file.

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