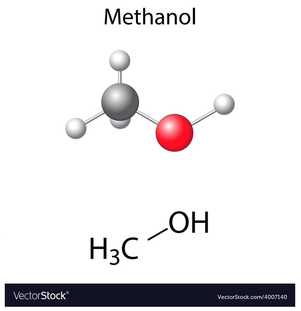
Methanol

Anna Stone
Environmental Health Student

EHST 3700: Industrial Hygiene
Environmental Health Sciences Program
Department of Health Education and Promotion
East Carolina University
Greenville, North Carolina

- Methanol: clear liquid chemical
- Used in everyday products: plastics,
- paints, cosmetics, fuels
- Energy resource: marine, automotive, electricity sectors
- Figure 1: (Molecular structure of Methanol)
- https://cdn1.vectorstock.com/i/1000x1000/71/40/structural-chemical-formula-and-model-of-methanol-vector-4007140.jpg



Occupational Uses

- Industrial solvent for inks, resins, adhesives, and dyes
- Solvent in pharmaceutical manufacturing for cholesterol, vitamins, hormones, and other drugs
- Antifreeze for automotive radiators
- Ingredient in gasoline for anti-freezing and octane boosting
- Fuel for picnic stoves
- Ingredient in paint and varnish removers
- Alternative motor fuel

Occupational Exposure

- Approximately 50,000 workers exposed to methanol yearly in the US
- Primary industries using methanol:
- Manufacturing: Production of chemicals, pharmaceuticals, plastics, etc.
- Construction: Use in paints, varnishes, adhesives, solvents
- Other workers exposed to methanol:
- Laboratory: Research, testing, analysis
- Automotive: Manufacturing, maintenance, repair
- Printing: Use in inks, solvents, cleaning agents

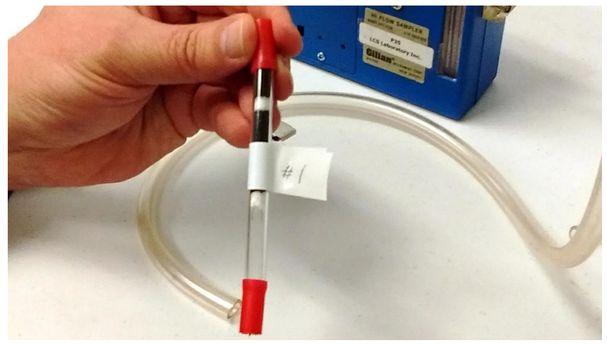
Toxicological Data

- Methanol is a poisonous substance absorbed through eyes, skin, lungs, and digestive system
- Overexposure can be fatal
- Harm depends on dose, duration, and work type
- Chronic exposure affects the central nervous system, liver, and kidneys
- Acute poisoning via ingestion, inhalation, or skin absorption
- Symptoms: headache, dizziness, nausea, vomiting, abdominal pain, visual disturbances, death
- Long-term exposure or ingestion leads to Optic nerve damage, blindness, Neurological disorders, and Organ damage

Sampling Methods

- Methanol: Method 2000 (NIOSH) Method 1660 (OSHA)
- Sampler: Solid Sorbent Tube (silica gel, 100/50 mg)
- Flow Rate: 0.02 to 0.2 L/min (NIOSH) 0.05 L/min (OSHA)
- Technique: Gas chromatography

Figure 2: https://www.lcslaboratory.com/downloads/sampling/air-sampling-vapours/ (Absorbent Tube)



Analytical Methods

- Samples collected and brought to lab.
- Lab prepares samples by diluting with water to detect methanol.
- Before dilution, samples treated with nitric acid and hydrochloric acid to break down stuff.
- Analysis done using flame or flameless spectroscopy.
- Analytical Determination done with gas chromatography or direct injection with detector.

Epidemiological Studies

- Manufacturing workers exposed to methanol may experience adverse health effects such as irritation of the respiratory system, skin, and eyes.
- Methanol poisoning is very serious and can cause severe harm or even death.
- Quick treatment is crucial to prevent complications and permanent damage.

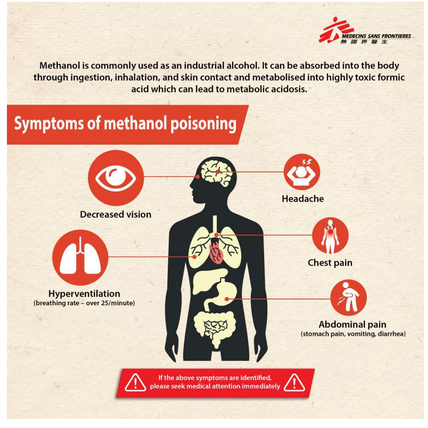


Figure 3: (Symptoms of Methanol Posioning) https://msf.hk/sites/default/files/methanol_EN_1.png

Occupational Exposure Limits (OELs)

- **OSHA Permissible Exposure Limit (PEL):**
  - 8-hour Time-Weighted Average (TWA): 200 parts per million (ppm)
- **NIOSH Recommended Exposure Limit (REL):**
  - 8-hour Time-Weighted Average NIOSH REL TWA 200 ppm
- **ACGIH Threshold Limit Value (TLV):**
  - 8-hour TWA: 200 ppm
  - Short-Term Exposure Limit (STEL): 250 ppm

Case Study

- 46-year-old male consumed Sterno.
- Presented to ER 7 hours later.
- Symptoms: vision loss, abdominal and back pain.
- Physical findings: tachypnea, tachycardia, hypertension, hypothermia.
- Lab results: severe metabolic acidosis, serum osmolality 465, serum methanol level 493 mg/dl.
- Treatment: ethanol drip, bicarbonate, hemodialysis.
- Patient survived, regained eyesight despite high methanol level.

Figure 4: (Sterno handy fuel) https://cdnimg.webstaurantstore.com/images/products/xxl/158961/1992775.jpg

Control Measures

- Engineering controls: Enclosure and isolation, Ventilation, Substitution, and Process modification.
- Administrative control: Work practices, Job rotation, and Limiting exposure time.
- PPE: Respiratory protection (respirators), Eye protection (goggles), and Skin protection.

References

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