Stanford | Environmental Health & Safety

Ethanol Factsheet

Despite being a chemical common both at home and in labs, ethanol (also known as ethyl alcohol, absolute alcohol, or EtOH) is a hazardous material. Although commonly consumed in homes, there's a big difference between a 6% alcohol by volume beer or 15% ABV wine and 70% or 100% laboratory-grade ethanol! Numerous incidents involving property damage and injury have occurred in academia as a result of ethanol fires and splashes. Laws are also different for laboratories as opposed to homes so you cannot pour ethanol down the drain in labs as you might in your kitchen.

I. What are the hazards?

Flammability

- Flammability is ethanol's main hazard. There have been numerous ethanol fires at Stanford and other institutions that have resulted in major property damage.
- Ethanol has a flash point of 14 °C (57 °F), meaning it will catch fire at and above that temperature given an ignition source such as an open flame a spark, or even just a hot surface.
    - 70% ethanol in water, a common concentration in labs, has a flash point of 16 °C (61 °F)
- Ethanol vapors will catch fire, so the flammability hazard extends beyond the immediate liquid.

Health

- Ethanol is toxic by ingestion. Symptoms are headache, nausea, vomiting, and intoxication.
- Ethanol is a skin and eye irritant

Environmental

- Some forms of ethanol (e.g., denatured ethanol) are in fact mixtures of ethanol and small quantities of other solvents which are aquatic toxicants.
- Ethanol is toxic to various marine organisms, with sensitivity varying from species to species. It even affects the behavior of some fish!

II. How can I protect myself?

1. Engineering Controls

- Work with ethanol in a chemical fume hood, especially volumes >500 milliliters.
    - Good ventilation removes ethanol vapors, making it less likely that a flammable concentration may build up.

2. Safe Work Practices

- Do not use open containers of ethanol near open flames and other ignition sources (such as hot plates or heated immersion baths).
    - Ethanol flaming is a commonly used sterilization procedure, but there are safer ways, such as a glass bead sterilizer. Contact EH&S for other alternatives.
- If an open flame or other ignition source is to be used on a surface recently decontaminated with ethanol, be sure that the surface has dried completely.
- Routinely check the cords of equipment throughout the lab, as frayed cords have become points of ignition in the past.
    - Pay particular attention to cords that are low to the ground, even if they are distant from the area ethanol is used. Ethanol vapors are heavier than air and can travel away from their point of origin.
- When using ethanol, avoid using open-top containers and place it in a container that exposes the minimum surface area of ethanol possible.
    - The less surface area exposed, the slower the ethanol will evaporate.
- Avoid using metal containers to store and/or transfer ethanol. If there is no practical alternative, the metal containers must be bonded and grounded. Contact EH&S with any questions about bonding and grounding measures.
- Review the safety data sheet for the specific brand and type of ethanol your lab uses. Different manufacturers and concentrations can include different additives, which may change the hazard profile.
- Keep ethanol away from oxidizing materials.
    - Common laboratory oxidizers include bleach (forms chloroform with ethanol) and nitric acid (may explode with ethanol).
- Ethanol cannot be stored in standard refrigerators, only in those listed and labeled by UL or FM for such use.
    - Vapors may reach ignition sources, such as electrical switches and fans in standard refrigerators.

3. Personal Protective Equipment

- Lab appropriate street clothing - long pants and closed-toed shoes
- Lab coat
    - Per the lab hazard assessment tool, if work involves heating ethanol, using ethanol with an open flame, or using >4 liters of ethanol, a flame-resistant lab coat should be worn.
- Safety glasses (or goggles/face shield if there is a splash hazard)
- Nitrile gloves
    - If you get ethanol on your gloves, change them promptly. Ethanol breaks through standard nitrile gloves in under an hour. Furthermore, ethanol can carry dissolved materials with it, so consider the compatibility of all materials involved in an experiment during glove selection.

4. Emergency Procedures

Exposure

- Skin
    - Wash ethanol off skin with plenty of soap and water.
- Eye
    - Go to an eye wash station and rinse for at least 15 minutes.

Spill

- Small spill
    - If you estimate the spill will take <15 minutes to clean, wipe up the spill using absorbent pads from a chemical spill kit. Dispose of any contaminated material and submit an SU-17.
- Large or health-threatening spill
    - If you estimate the spill will take >15 minutes to clean up or you feel it is health threatening, warn others, leave the area, and call (650) 725-9999.

Fire

- If you have received fire extinguisher training and feel it is safe, use a CO_2 fire extinguisher to extinguish the fire, call 911, then contact EH&S.
    - If you have not been trained or do not feel it is safe, **DO NOT** attempt to extinguish the fire. Improper extinguisher usage can worsen the fire.
- If you have not received training or do not feel it is safe, warn others in the immediate vicinity, pull the fire alarm, evacuate the building, call 911, and then call (650) 725-9999. Stay at your emergency assembly point to provide information to emergency services.

5. Waste Management

- **ETHANOL CANNOT BE DISPOSED OF DOWN THE DRAIN AT ANY CONCENTRATION.** It must be collected and disposed of as hazardous waste.
- Intentional dilution or evaporation of ethanol or any other waste as a substitute for proper disposal is illegal.
    - This means that if you dilute a 70% ethanol solution to 20% with water and pour it down the drain, it is still illegal. Likewise, you cannot boil off or evaporate ethanol waste in place of proper disposal.

References

Lab hazard assessment tool: https://ehs.stanford.edu/wp-content/uploads/Lab-Hazard-Assessment-Tool.pdf?1565887017
General use SOP for flammable and combustible liquids: https://ehs.stanford.edu/wp-content/uploads/sops/Flammable-and-Combustible-Liquids.pdf
Prudent Practices in the Laboratory https://www.ncbi.nlm.nih.gov/books/NBK55878/
Intentional dilution regulation: https://www.law.cornell.edu/cfr/text/40/268.3
Palo Alto Municipal Code Chapter 16.09