Risk assessment for the automated Critical Point Dryer (CPD) EM CPD300

Date: 2019-03-01
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1) Review of the machine:
(Description of the machine/process, how it works and the work flow)
The CPD is used to preserve the sample's morphology. Since air drying would cause severe deformation and collapse of structure due to the effects of high surface tension to air, the water in the biological specimen is replaced with a suitable inert fluid ("transitional fluid"-CO_2) which has a lower surface tension to air. This would thus reduce severe structural damages during air-drying.

Because liquid CO_2 is not sufficiently miscible with water, a third medium commonly Acetone or Ethanol is used as "intermediate fluid". The specimen is first dehydrated through varying concentrations of the intermediate fluid and thus completely replacing the water in the specimen. Afterwards, the "intermediate fluid" is replaced with the "transitional fluid" (CO_2) which can then convert from liquid to gas phase without surface tension effects which distort morphology and ultra-structure.

(Wet Specimen) H_2O ➡ Acetone ➡ 30%---100%** ➡ CO_2 ➡ C.P.D. (Dry Specimen)

Reference: **https://www.emsdiasum.com/microscopy/technical/datasheet/critical_drying.aspx**

2) Risk:
(Description of the identified safety issues, does it involve chemicals, high voltage, RF, X-ray, laser, other?)
Chemicals involved:

- Ethanol (CAS # 64-17-5)
- Acetone (CAS # 67-64-1)
- Carbon dioxide (CAS # 124-38-9)

Before starting the process the sample needs to be immersed in a solvent such as ethanol or acetone. This means that for a short while there will be solvent vapours around the machine. The user is advised to use the suction point.

The pressurized CO_2 bottle needs to be secured at all times. In case of emergency it should be removed.

3) Identification

(Identification of the risks involved.)

Ethanol:

Danger

H225: Highly flammable liquid and vapour.

H319: Causes serious eye irritation.

P210: Keep away from ignitions sources . No smoking.

P280: Wear protective gloves/eye protection.

P305+351+338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P337+313: If eye irritation persists: Get medical advice/attention.

Ethanol is an organic solvent and may amplify the effects of other drugs. It must be stored tightly sealed in a well-ventilated chemical cabinet.

Flammable liquid, class

I-2

Acetone:

Danger

H225: Highly flammable liquid and vapour.

H319: Causes serious eye irritation.

H336: May cause drowsiness or dizziness.

EUH066: Repeated exposure may cause skin dryness or cracking.

P210: Keep away from ignitions sources . No smoking.

P280: Wear protective gloves/eye protection.

P305+351+338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Acetone is an organic solvent and may enhance toxic effect of other substances. Diabetes are more sensitive to acetone. It must be stored tightly sealed in a well-ventilated chemical cabinet.

Flammable liquid, class

I-2

Carbon dioxide:

Warning

H280: Contains gas under pressure; may explode if heated.

P410+403: Protect from sunlight. Store in a well-ventilated place.

Pressure cylinders must be handled with care (see section C) and stored on a well ventilated place. Special requirements as to safety notices apply to the storage: Remove pressure cylinders in case of fire.

Precautionary Statement Response

Ethanol:

Precautions :

- Ensure effective process ventilation e.g. fume cupboards, and if not possible, use a respiratory protective device with gas filter A and a particle filter. The choice of filter depends of the work (see Guide D.5.4.). Filtering respiratory protective device must only be used 3 hours a day. Use safety goggles.
- By direct skin contact use recommended disposable gloves from silvershield/4H (PE/PA/PE rubber): Pentration time >3 hours
- If theres only risk of a minor spillage, disposable gloves of nitrile rubber are recommended.
- Emergency showers, eye wash bottles and sink with soap must be easily accessible.
- Flammable substance: never expose or store the substance near open flame. Be aware of the risk of sparking from static electricity. Ensure all equipment is earthed.
- Be aware that working with the substance may generate an explosive atmosphere.
- At assessing the workplace, special attention must be paid as the substance is harmful or suspedted to be harmful to embryo, egg and sperm cells. Moving to another job may be necessary.
- Arrangements must be made to avoid contact with the substance.

Long-term exposure can cause damage to reproduction, cutaneous disease such as Dermatitits and is also suspected to cause damage to genetic material (Mutagenic).

Acetone:

Precautions :

- Ensure effective process ventilation e.g. fume cupboards, and if not possible, use a respiratory protective device with gas filter AX and a particle filter. The choice of filter depends of the work (see Guide D.5.4.). Filtering respiratory protective device must only be used 3 hours a day. Use safety goggles.
- By direct skin contact use disposable gloves: Butyl rubber, Barrier® (PE/PA/PE).
  Penetration time: >3 hours.
- If theres only risk of a minor spillage, disposable gloves of nitrile rubber are recommended.
- Disposable nitrile gloves have a short penetration time for most substances. In case of spillage on the glove, it is immediately renewed. Wash your hands thoroughly with soap and water.
- Emergency showers, eye wash bottles and sink with soap must be easily accessible.
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Carbon dioxide:

Precautions :

- Ensure effective process ventilation e.g. fume cupboards, and if this is not possible use self containing respiratory protective device with filter. Self-containing respiratory protective device can be used for 6 hours.
  Use safety goggles.
- In case of unavoidable skin contact, use disposable gloves. Be aware that the glove used is marked as applicable to the work according to the ISO EN374 standard. If necessary, seek information from the glove supplier. The application time can in practice be considerable in shorter than the breakthrough time, which is measured according to the standard, due to several influencing factors (eg temperature, thickness)
- Emergency showers, eye wash bottles and sink with soap must be easily accessible.
- Pressure cylinders must be handled with care, stored and transported with proper protection against knocks, jolts, direct sunlight and heat.
  When in use, cylinders must be upright and clamped to non-combustible material.
  When the cylinder is not in use the screw cap (cap nuts) and protective cover must be used.
  Remember safety notice: Trykflasker fjernes ved brand (remove pressure cylinders in case of fire).
- At assessing the workplace, special attention must be paid as the substance is harmful or suspedted to be harmful to embryo, egg and sperm cells. Moving to another job may be necessary.

To both Acetone and Carbon dioxide, long-term exposure can cause damage to reproduction and organs such as lung, liver and kidney.

4) Procedures-Consequences

(Describe, how we avoid to be exposed to any danger from this equipment/process, during maintenance and normal use. And if this is not possible, then how we protect our self.)

Ethanol:

Inhalation:

- The person should be taken into the fresh air, kept quiet and under supervision. If there is a risk of loss of consciousness the person should be placed in the recovery position and kept warm. If the person stops breathing, artificial respiration should be given.

Skin:

- Rinse thoroughly with water, remove contaminated clothing and any jewellery.

Eyes:

- Rinse immediately with water. Hold the eye wide open. Remove contact lenses. Continue to rinse with water until treatment is taken over by doctors.

If swallowed:

- Immediately rinse the mouth out and drink water or milk. Do not give liquids to the unconscious. Do not cause vomiting.
- If discomfort persists consult a doctor, taking along these instructions.

Burns:

- Rinse immediately with water and continue until pain disappears.
- While rinsing with water, remove clothing which is not burnt on the skin.
- Go to emergency department at nearest hospital and continue to rinse with water en route.

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5) Waste treatment

(What to do with the waste (if any))

Ethanol:

Evacuate the area as necessary. Switch off all apparatus. Prevent further spreading and ventilate the area.
Avoid contact with the substance. If appropriate, use gloves and breathing equipment with a combination filter (Type ABEK-P).
Soak up any spillages with vermiculite or sand and discard as chemical waste.
Clean the area after clearing up the spillage.
Inform the municipal authorities and those responsible for the environment in the workplace of any major discharge into the surroundings.

Waste group:	Class:	Class. Code:	PG:	UN no:
C	3	F1	II	1170

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Waste group:	Class:	Class. Code:	PG:	UN no:
C	3	F1	II	1090

Carbon dioxide:

Evacuate the area as necessary. Prevent further spreading and ventilate the area.
Avoid contact with the substance. If appropriate, use gloves and self-containing breathing apparatus.

Waste group:	Class:	Class. Code:	PG:	UN no:
X	2	2A		1013