Working with organic dyes and solvents

Dangers and precautions

Motivation

- A number of laser dyes is expected to be mutagenic and may be carcinogenic as well.
- The solvent in which the dye is dissolved plays an additional major role in the hazards.
- The way dyes and solvents are used in dye laboratories not always gives the impression that this is also known.

Outline

- Laser dyes
- Solvents
- Work procedure
- Personal protective equipment
- Discussion

Laser Dyes

- A laser dye is a complex fluorescent organic dye dissolved in an organic solvent.
- For most laser dyes, little or no toxicology information is available.
- From the few dyes that were tested a number (particularly IR dyes) was found to be mutagenic.

Laser Dyes

- p-Terphenyl (340 nm)
- QUI (380 nm)
- Polphenyl 1 (380 nm)
- Stilbene 1 (410 nm)
- Stilbene 3 (430 nm)
- Coumarin 2 (450 nm)
- Coumarin 47 (470 nm)
- Coumarin 102 (480 nm)
- Coumarin 30 (515 nm)
- Rhodamine 6G (590 nm)
- Rhodamine B (610 nm)
- DCM (650 nm)
- Rhodamine 700 (700 nm)
- Oxazine 1 (725 nm)
- Styryl 9 (840 nm)
- HITCI (875 nm)
- IR140 (960 nm)

Laser Dyes

„In most cases the exact toxiticity of laser dyes is not well known, but they should, like all chemicals, be considered dangerous until proven otherwise.“

(Manual Laser Dyes Lambda Physik)

Three stages: Dye powder – Dye solution – Dye waste.

Laser Dyes

- Dye powder is dangerous when inhaled. As a solid powder it can easily become airborne.
- Dye solution is flammable, toxic, and dangerous when solvent has the ability to carry their solutes through the skin.
- When spilled (and not cleaned) dye is easily spread around.

Solvents

Apart from water nearly all solvents in which dyes are dissolved are

- flammable,
- highly toxic (irritants, narcotics and/or anestetics, carcinogen [dioxane])
- and some solutions are dangerous by skin contact by expediting the movement of dye through the skin [DMSO].

Solvents

- Methanol
- Ethanol
- Ethylene Glycol
- DMSO (!)
- Dioxane (!)
- Benzyl alcohol (!)
- Cyclohexane
- Hexane
- Toluene
- Dichloromethane
- Dichoroethane

Solvents

- Check the freezing point.
- Be careful with non-polar and hence non-conductive solvents. Circulated at high speed in a dye circulator, the pump unit can act as a van der Graaf generator, producing up to 100 kV static voltage. Sparks may ignite the solvent. Therefore, always use grounded cables inside the dye circulator.

Work procedure

- Weight out the amount of dye and transfer it into a glass bottle (500 – 1000 ml).
- Make sure that the entire dye stuff is transfered to the bottle.
- Be careful not to spill it; most errors occur at this stage.
- Fill the glas bottle with the appropriate solvent.
- Use an ultrasonic bath when necessary.

Work procedure

- Work in the dye laboratory; restrict the area where dyes in powder form are used to one place.
- Use the hood.
- Take care of personal protection (fine dusk mask, safety glasses, laboratory coat, gloves).
- Use mechanical pipetting aids when handling dye solutions.
- Keep the work area where dyes are used clean !

Work procedure

- Clean up (well !) after preparing a solution.
- When dye is spilled (both powder and solution) clean up immediately.
- Keep containers of solvents and dye solutions closed.
- Label containers clearly with the name of the dye and solvent and its concentration.
- Wash hands after handling laser dyes/solutions.
- Do not eat, drink, smoke or store food or beverages in work areas where dyes are in use.

Personal protective equipment

- Use a fine dusk mask.
- Use a laboratory fume hood or glove box.
- Use safety eye wear.
- Use a laboratory coat.
- Use impervious (butyl) gloves when handling dye solutions.

Summary

1) Powered laser dyes should never be handled where the airborne dust could be breathed.

2) The proper protective equipment should always be used by the person handling the dye.

3) The gloves being used should be resistant to the solvent being handled.

4) Any spills or leaks should be cleaned up immediately.

5) Avoid breathing fumes from the solvent being used.

6) Wash your hands well after handling dyes.

Please remember

You are responsible for your own safety AND for the safety of your colleagues.

More info available from

Environment, safety and health

http://www.llnl.gov/es_and_h/esh-manual.html

Risk assessment; use of laser dyes and dye solutions

Lambdachrome & Laser Dyes, U. Brackmann, Lambda Physik,

laser dye handbook.