Safety Module

Safety Topic: Osmium tetroxide

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OsO₄ (CAS 20816-12-0)

- **Purpose** – Osmium tetroxide (OsO₄) is a highly toxic compound used most prevalently for the dihydroxylation of alkenes to syn-diols. It is commonly supplied as a pale yellow solid in a glass ampule, as a 4 wt % solution in water, or as a 2.5 wt % in t-BuOH. The compound has an acrid, “chlorine-like” odor.

- **Toxicity** – OsO₄ is a severe irritant to the eyes, respiratory tract, skin, kidneys, and liver. Exposure to OsO₄ can lead to damage and staining of the cornea and subsequent blindness as OsO₄ can react with the multiple double bonds in retinal. Exposure of volatile OsO₄ to the eyes results in tears, “a gritty feeling in the eyes”, and the appearance of rings around lights. In addition, high levels of exposure can lead to pulmonary edema (fluid accumulation in the lungs), and consequently death. Contact with the skin can cause skin burns, and the appearance of black staining arising from the conversion of OsO₄ to osmium dioxide (OsO₂). The LD₅₀ of OsO₄ is 14mg/kg in rats, and 162 mg/kg in mice.

- **Handling** – Due to its high toxicity and volatility, OsO₄ should be handled in a fume hood, with full PPE including a buttoned labcoat with the sleeves rolled down, safety goggles, and double Nitrile gloves. If solid OsO₄ is used, it must be weighed in a fume hood.

- **Storage** – OsO₄ is commonly supplied as a solution, and should be stored in glass under refrigeration, as it can penetrate plastic.

- **Waste handling** – All glassware that has contacted OsO₄ should be decontaminated by rinsing with corn oil (whose double bonds will react with the excess OsO₄) or sodium sulfite (which will reduce OsO₄ to less toxic forms).

- **For more information see** –
  - E-eros page for OsO₄
  - UCLA SOP
    https://www.chemistry.ucla.edu/sites/default/files/safety/sop/SOP_Osmium_Tetroxide.pdf

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