

APPENDIX 5

INCOMPATIBLE CHEMICALS, MATERIALS LIABLE TO FORM PEROXIDES IN STORAGE, AND SUBSTANCES OF VERY HIGH CONCERN

A wide variety of chemicals react dangerously when mixed with certain other materials. Some of the more widely-used incompatible chemicals are given below, but the absence of a chemical from this list should *not* be taken to indicate that it is safe to mix it with any other chemical.

* **Acetic acid/ethanoic acid:**

chromic acid, ethylene glycol, nitric acid, hydroxyl compounds, perchloric acid, peroxides, permanganates

* **Acetone:**

concentrated sulphuric and nitric acid mixtures

* **Acetylene:**

chlorine, bromine, copper, fluorine, silver, mercury

* **Alkali and alkaline earth metals:**

water, chlorinated hydrocarbons, carbon dioxide, halogens, alcohols, aldehydes, ketones, acids

* **Aluminium (powdered):**

chlorinated hydrocarbons, halogens, carbon dioxide, organic acids.

* **Anhydrous ammonia:**

mercury, chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid

* **Ammonium nitrate:**

acids, metal powders, flammable liquids, chlorates, nitrites, sulphur, finely divided organic combustible materials

* **Aniline:**

nitric acid, hydrogen peroxide

* **Arsenic compounds:**

reducing agents

* **Azides:**

acids

* **Bromine:**

ammonia, acetylene, butadiene, hydrocarbons

* **Calcium oxide:**

water

- * **Carbon, activated:**
calcium hypochlorite, oxidizing agents
- * **Chlorates:**
ammonium salts, acids, metal powders, sulphur, finely divided organic or combustible materials
- * **Chromic acid:**
acetic acid, naphthalene, camphor, glycerin, turpentine, alcohols, flammable liquids in general
- * **Chlorine:**
ammonia, acetylene, butadiene, hydrocarbons, hydrogen, sodium carbide, turpentine, benzene, finely divided metals
- * **Chlorine dioxide:**
ammonia, methane, phosphine, hydrogen sulphide
- * **Copper:**
acetylene, hydrogen peroxide
- * **Cumene hydroperoxide:**
acids, organic or inorganic
- * **Cyanides:**
acids
- * **Flammable liquids:**
ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
- * **Hydrocarbons:**
fluorine, chlorine, bromine, chromic acid, sodium peroxide
- * **Hydrocyanic acid:**
nitric acid, alkali
- * **Hydrofluoric acid:**
aqueous or anhydrous ammonia
- * **Hydrogen peroxide:**
copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitromethane, flammable liquids, oxidizing gases
- * **Hydrogen sulphide:**
fuming nitric acid, oxidizing gases
- * **Hypochlorites:**
acids, activated carbon
- * **Iodine:**
acetylene, ammonia (aqueous or anhydrous), hydrogen

- * **Mercury:**
acetylene, fulminic acid, ammonia
- * **Nitrates:**
sulphuric acid
- * **Nitric acid (conc.):**
acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulphide, flammable liquids, flammable gases
- * **Oxalic acid:**
silver, mercury
- * **Perchloric acid:**
acetic anhydride, bismuth and its alloys, ethanol, paper, wood
- * **Peroxides (organic):**
acids, avoid friction or shock
- * **Phosphorus (white):**
air, alkalies, reducing agents, oxygen
- * **Potassium:**
carbon tetrachloride, carbon dioxide, water
- * **Potassium chlorate:**
acids
- * **Potassium perchlorate:**
acids
- * **Potassium permanganate:**
glycerin, ethylene glycol, benzaldehyde, sulphuric acid
- * **Selenides:**
reducing agents
- * **Silver:**
acetylene, oxalic acid, tartaric acid, ammonium compounds, fulminic acid
- * **Sodium:**
carbon tetrachloride, carbon dioxide, water
- * **Sodium nitrite:**
ammonium salts
- * **Sodium peroxide:**
ethanol, methanol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulphide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
- * **Sulphides:**
acids

* **Sulphuric acid:**

potassium chlorate, potassium perchlorate, potassium permanganate (or compounds with similar light metals, such as sodium, lithium, *etc.*)

* **Tellurides:**

reducing agents

MATERIALS LIABLE TO FORM PEROXIDES IN STORAGE

The following materials may form peroxides in storage, when in contact with air. Once a container is opened, the chemical should be tested for peroxides not less frequently than once every six months.

- * Aldehydes
- * Ethers, especially cyclic ethers and those containing primary and secondary alcohol groups
- * Compounds containing benzylic hydrogen atoms (particularly if the hydrogens are on tertiary carbon atoms)
- * Compounds containing the allylic structure, including most alkenes.
- * Vinyl and vinylidene compounds.

Among the more widely-used compounds which may form peroxides in storage are:

- * Acetal
- * Cumene
- * Cyclohexene
- * Cyclooctene
- * Decalin
- * Dicyclopentadiene
- * Diethyl ether
- * Diisopropyl ether
- * Dimethyl ether
- * Dioxane
- * Ethylene glycol dimethyl ether (glyme)
- * Methyl acetylene
- * Sodium amide
- * Tetrahydrofuran (THF)
- * Tetralin
- * Vinyl acetate

* Vinylidene chloride

Purchases of any of these items should be for small quantities if possible. Any unused stock should be disposed of or transported to avoid long-term storage.

SUBSTANCES OF VERY HIGH CONCERN

In the framework of an authorisation process, competent authorities within any country, or the European Chemicals Agency (ECHA) on request of the European Commission, may prepare Annex XV dossiers for the identification of Substances of Very High Concern (SVHC).

SVHC were therefore originally defined in Article 57 of Regulation (EC) No 1907/2006 (The REACH Regulations), and include substances which are:

- Carcinogenic, mutagenic or toxic to reproduction (CMR), meeting the criteria for classification in Category 1 or 2 in accordance with Directive 67/548/EEC. This Directive was recently replaced by the new EU regulation (EC) No 1272/2008 on classification, labeling and packaging of chemical substances and mixtures (the CLP Regulations). According to the CLP Regulations, these substances shall be classified as 1a or 1b.
- Persistent, bioaccumulative and toxic (PBT) or very persistent and very bioaccumulative (vPvB) according to the criteria in Annex XIII of the REACH Regulations.
- Identified, on a case-by-case basis, from scientific evidence as causing probable serious effects to human health or the environment of an equivalent level of concern as those above (*e.g.* endocrine disrupters)

A comprehensive list is available of candidate substances of very high concern will certainly include:

- Triethyl arsenate
- Anthracene
- 4,4'- Diaminodiphenylmethane (MDA)
- Dibutyl phthalate (DBP)
- Cobalt dichloride
- Diarsenic pentaoxide
- Diarsenic trioxide
- Sodium dichromate
- 5-tert-butyl-2,4,6-trinitro-m-xylene (musk xylene) Bis (2-ethylhexyl)phthalate (DEHP) Alkanes, C10-13, chloro (Short Chain Chlorinated Paraffins) Bis(tributyltin)oxide (TBTO) Lead hydrogen arsenate Benzyl butyl phthalate (BBP) Hexabromocyclododecane (HBCDD) and all major diastereoisomers identified:
- Alpha-hexabromocyclododecane
- Beta-hexabromocyclododecane
- Gamma-hexabromocyclododecane 247-148-4 and 221-695-9

Substances added in 2021

- 2-(4-tert-butylbenzyl)propionaldehyde and its individual stereoisomers
- Orthoboric acid, sodium salt

- 2,2-bis(bromomethyl)propane1,3-diol (BMP)
- 2,2-dimethylpropan-1-ol,
- tribromo derivative/3-bromo-2,2-bis(bromomethyl)-1-propanol (TBNPA);
- 2,3-dibromo-1-propanol (2,3-DBPA)
- Glutaral
- Medium-chain chlorinated paraffins (MCCP)
- Phenol, alkylation products (mainly in para position) with C12-rich branched alkyl chains from oligomerisation, covering any individual isomers and/ or combinations thereof (PDDP)
- 1,4-dioxane
- 4,4'-(1-methylpropylidene)bisphenol

The lists shown in this Appendix are not necessarily definitive, as amendments may have been made since the time of last review or publication, and reference may need to be made to the most authoritative information currently available from the University's Health & Safety Department, School of Chemistry, regulatory authorities, etc.

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