

Ethers - Handling and control of exposure

Diethyl ether (ethyl ether, ether) must be handled in the laboratory using only best practice methodology, these supplemented by additional precautions for the use of extremely flammable substances.

Before using ethers in any work activity, including research activities, a suitable and sufficient assessment of the risk created by the activity, and in particular the use of hazardous substances, to the health or safety of employees, or others, who may be affected by the work must be undertaken. As this is a requirement of UK law work which includes the use of any hazardous or dangerous substance must not be undertaken until the risk assessment is complete and suitable control measures are implemented that ensure adequate control of any identified health or safety risk.

As a result of the health hazards associated with the use of ethers they are classed as 'hazardous substances' under the Control of Substances Hazardous to Health Regulations (COSHH) and because of their associated safety hazards they are classed as 'dangerous substances' under the Dangerous Substances and Explosive Atmospheres Regulations (DSEAR), consequently risk assessment must be undertaken in compliance with both sets of Regulations.

It is however worth noting here that the first and absolute requirement, which has been tested in case law, is that of substitution of a hazardous, or dangerous substance, with one that is non, or less, hazardous, therefore ethers must not be used in research or other work activities if there is available another substance, that will perform the required function and exhibits less hazardous safety or health properties. This is a fundamental requirement of the hierarchical control measures required of both the COSHH and DSEAR Regulations and if you do not first consider this in your risk assessment you are failing to comply with the Regulations. Only if substitution is not open to you should you continue to use ethers and then you must follow and implement the control methods in the hierarchical priority laid out in the Regulations.

Fire, explosion hazard

For a fire to start there requires to be present, an ignition source, fuel, and oxidizers, good laboratory practice in avoiding fire must be based on avoiding the presence one of these components. Dilution of vapours until they are no longer flammable is one of the most effective means of preventing flammable gaseous mixes from forming, thus decanting should always be carried out in a fume cupboard. However as ether has a particularly low flash point, is extremely volatile, and forms explosive mixtures with air in concentrations of as little as 1.9% one must never assume that a particular fume cupboard will dilute vapours sufficiently quickly to avoid hazardous build up.

Whenever possible ether must only be used in areas free from ignition sources, this including hot plates, steam baths, lamps, hot pipes, etc. In instances where this is not possible, or practicable, only the minimal quantities should be worked with and this only after the activity has been subject to rigorous risk assessment in accordance with DSEAR. All decanting from large volume containers into working ampoules must be completed within a fume cupboard prior to the introduction of ignition sources. Where electrical laboratory equipment is to be used in the presence of ethers consideration must be given in any risk assessment to the need for intrinsically safe (spark proof) equipment.

It is a requirement in this University's Health and Safety Policy (Part 5, 3.7 & 3.9) that only minimum quantities of flammable solvents and reagents are used/stored in the laboratory. In use containers kept/used in the open laboratory should not exceed 500ml, for persons experienced in the laboratory techniques of distillation, solvent extraction and solvent evaporation, a limited batch size of 2.5 litres of flammable solvents is suggested; less experienced workers are recommended to use appreciably smaller batches.

Explosion risk may be enhanced in the case of ethers, compared with other solvents, because of their tendency to form unstable peroxides on contact with air. It is suggested that the date of receipt should be marked on the container and again on first opening. Once opened the containers should be tested regularly for the presence of peroxides see 'The Storage of Ethers and the Detection and Removal of Peroxides'. Whilst commercially supplied diethyl ether normally contains additives that inhibit the formation of peroxides; distillation removes these inhibitors and renders the ether more prone to peroxide formation.

Inhalation hazard

Diethyl ether is classed as having adequate warning properties and has been assigned a Workplace Exposure Limit (WEL) of 100ppm Long-Term-Exposure Limit (8hr TWA reference period) and 200ppm Short-Term-Exposure Limit (15 minute reference period) by the Health and Safety Commission in the UK. The LTEL is set at a level which should adequately control the chronic effects of exposure to ethers and the STEL is set at a level to control the acute effects.

In order to control inhalation exposure risk bench top work with ethers should be kept to an absolute minimum and use made of fume cupboards wherever possible although, as stated above, care must be exercised regarding sources of ignition that may be present within the fume cupboard.

Dermal hazard

Gloves are required to protect against the dermal hazard: nitrile, or polyvinyl alcohol (PVA) gloves are suitable for use with ether but it should be noted that because of their lack of thickness disposable gloves are only suitable as splash resistance (circa. 3 minute breakthrough time) and should be replaced as soon as contamination is evident. If immersion protection is required then a thicker re-usable glove should be employed (circa. 120 minute breakthrough).

Ansell Gloves manufacture a 'Barrier Chemical Resistant' glove with a quoted breakthrough time when used with ether of >480 minutes. Ansell also market a nitrile reusable glove 'Virtex' which is slightly thicker than a disposable glove, but not as thick as the normal reusable gloves, thus they claim affording dexterity along with greater breakthrough times. Please note latex/natural Rubber gloves are not suitable for work with ethers.

In the event of skin contact the affected area should be immediately washed with soap and water and any contaminated clothing removed. In the case of eye contact, the affected eye should be subjected to copious irrigation at an eye wash station for 15minutes and medical attention sought.

Ingestion

Ether is mildly toxic by ingestion and should this occur medical help should be sought immediately.