

## Using of organic solvents in freeze dryers

Our pilot and laboratory freeze dryers are generally used for aqueous solutions. Nevertheless, with regards of corrosion resistance, the use of some organic solvents, in aqueous solutions with low concentrations is acceptable.

### Corrosion resistance

The freeze dryer is designed to be chemically resistant to most compounds that are commonly used in freeze drying processes. However, by necessity, the freeze dryer is comprised of several different materials, some of which may be attacked and degraded by certain chemicals. Sugars and proteins typically will have negligible negative effect on any of the materials of construction. In the difference to that, chemicals can attack e.g. plastic materials in several ways. The methods of fabrication and/or conditions of exposure of an acrylic chamber, as well as the way the chemicals are applied, can influence the results. Some of these factors are listed below:

- Fabrication: Stress generated while sawing, sanding, machining, drilling, polishing, and/or forming.
- Exposure: Length of exposure, stresses induced during the life of the product due to various loads, changes in temperatures etc.
- Application of Chemicals: by contact, rubbing, wiping, spraying etc.

The following table can be used as a general guide for the expected degradation during normal freeze-drying processes of organic solvents with a total max. concentration of 10 vol-% in aqueous solutions:

	Acrylic	Stainless Steel	Silicon Rubber	EPDM
Acetic Acid 20%	+	+	+	o
Formic Acid up to 10%	+	o	o	-
Trifluoroacetic Acid (TFA)	-	+	o	+
Calcium Chloride	+	+	+	+
Sodium Phosphate	+	+	-	+
Acetone	-	+	+	+
Acetonitrile	-	+	-	o
Carbon Tetrachloride	-	+	-	-
Cyclohexane	+	+	-	-
Dioxane	-	+	-	o
Methyl-t-Butyl Ether	+	+	o	-
Pyridine	-	+	-	o
Methanol	-	+	+	+
Ethanol	o	+	o	+
Tert. Butanol	-	+	-	o
DMSO	-	+	-	+

### Legend:

- + No degradation to be expected
- o Moderate degradation; limited use
- Severe degradation; infrequent use recommended; immediate thorough cleaning required

The chemical attack on devices/accessory components can be significantly reduced by immediate cleaning after the end of operation. The user must regularly check whether parts of the freeze dryer that were in contact with the product, e.g. acrylic hoods (risk of implosion), are attacked. In principle, components that are in contact with liquid solvents are exposed to a much stronger attack than components that only in contact with gaseous solvents. It is the responsibility of the customer to replace damaged components in good time.

Most common compounds used in freeze drying processes, if allowed to enter the vacuum pump, will degrade the oil and cause damage to the vacuum pump. The oil in the vacuum pump should be checked often. It must be changed if it is cloudy, shows particles or is discoloured. The useful life of vacuum pump oil can be extended if the vacuum pump is operated for an extended period after a freeze dry run with open gas ballast valve. This allows contaminants to be purged from the hot oil. Further details can be found in the manual of the vacuum pump.

#### **Safety aspects for the use of solvents**

In addition to corrosion resistance, other safety aspects, e.g. with regards to flammability, must also be considered. The generally applicable regulations for handling flammable substances in laboratories/workplaces must also be observed for freeze-drying. Hazardous materials such as strong acids or bases, radioactive substances and volatile organics must be handled carefully and promptly cleaned up if spilled. If a sample is spilled in the ice condenser chamber it must immediately be cleaned up.

Use extreme caution and keep sources of ignition away from solvents. When using flammable or hazardous solvents, the vacuum pump must be vented to or operated inside a fume hood. The appropriate safety precautions must be observed during sample preparation, loading and unloading of samples and defrosting. Depending on the used solvent, hot gas defrosting of the ice condenser should be avoided. H- and P-statements of the used chemicals should be considered. Please observe the generally accepted rules for the use of solvents in laboratories.

#### **Solvent Safety Precautions**

Operation of the freeze dryer with concentrated solvents is not permitted. For these applications we recommend our model Alpha 3-4 LSCbasic. This model was specially developed for use with organic solvents in aqueous solutions.

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