



## IJSEP Experiment Guide: Materials That Cannot Be Used in Experiments

Some materials can **damage the FME mini-lab** (i.e. the silicone tubes and the plastic bags where they are stored for the flight) or **react dangerously** during the mission. If any of these are included in your experiment, the design **will not be accepted** for flight.

If you think one of these materials is essential, you must contact the IJSEP coordination team **immediately**. A special compatibility test would be needed — but these tests take several weeks and usually **cannot be done in time**, so please choose **safe alternatives**.

### 1. General Rule

Avoid any **corrosive, flammable, acidic, or toxic** materials.

Typical safe materials are **water, saline, simple buffers, sugars, proteins, and non-toxic biological samples**.

### 2. Prohibited or Problematic Substances

Below are examples of **materials that cannot be used** inside the FME mini-lab. They are grouped by type for easier understanding.

#### A. Strong Acids & Acid Mixtures

- **Hydrochloric Acid** (100%, 37%, 20%)
- **Sulfuric Acid** (10–75%, 75–100%, cold concentrated, hot concentrated)
- **Nitric Acid** (20%, 50%, concentrated)
- **Chromic Acid** (5%, 10%, 30%, 50%)
- **Hydrofluoric Acid** (20%, 50%, 75%, 100%)

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- **Phosphoric Acid (>40%), Phosphoric Acid (crude), Phosphoric Acid Anhydride**
- **Sulfurous Acid**
- **Perchloric Acid**
- **Trichloroacetic Acid**
- **Chloroacetic Acid, Monochloroacetic Acid**
- **Formic Acid**
- **Acetic Acid 80%, Glacial Acetic Acid**
- **Aqua Regia (80% HCl, 20% HNO<sub>3</sub>)**
- **Citric Acid**
- **Gallic Acid**
- **Oleic Acid, Palmitic Acid, Butyric Acid**
- **Picric Acid**
- **Fatty Acids**
- **Carbolic Acid (Phenol) / Phenol (10%)**
- **Cresols, Cresylic Acid**

### **B. Strong Bases (Alkalis), Lyes & Ammonia**

- **Sodium Hydroxide (NaOH) (20%, 50%, 80%)**
- **Potassium Hydroxide (KOH)**
- **Calcium Hydroxide (Ca(OH)<sub>2</sub>)**
- **Lye (NaOH, KOH, Ca(OH)<sub>2</sub>)**
- **Ammonia (10%), Ammonium Hydroxide**
- **Ammonia, anhydrous; Ammonia, liquid**
- **Lithium Hydroxide**

### **C. Halogens, Halogenated Reagents & Acylating Agents**

- **Chlorine (dry), Chlorine, Anhydrous Liquid, Chlorine Water**

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- **Bromine**
- **Fluorine**
- **Hydrofluosilicic Acid** (20%, 100%)
- **Acetyl Chloride (dry), Acetyl Bromide, Acetic Anhydride**
- **Chlorosulfonic Acid**
- **Oleum (fuming sulfuric acid)** (100% and 25%)

### **D. Organic Solvents — Hydrocarbons (Aromatics & Aliphatics)**

- **Aromatic Hydrocarbons**
- **Benzene, Toluene (Toluol), Xylene**
- **Naphtha, Naphthalene**
- **Heptane, Hexane, Isooctane, Pentane, Ligroin**
- **Cyclohexane, Cyclohexanone**
- **Mineral Spirits, Stoddard Solvent**
- **Styrene**

### **E. Organic Solvents — Chlorinated / Halogenated**

- **Carbon Tetrachloride** (incl. "dry")
- **Chloroform**
- **Methylene Chloride**
- **Dichloroethane, Ethylene Dichloride**
- **Dichlorobenzene, Chlorobenzene (Mono)**
- **Chlorobromomethane**
- **Ethylene Chloride, Ethylene Chlorohydrin, Ethylene Bromide**
- **Perchloroethylene / Tetrachloroethylene**
- **Tetrachloroethane**
- **Trichloroethane, Trichloroethylene**

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### F. Organic Solvents — Ethers, Ketones, Esters & Others

- Ether, Ethyl Ether, Diethyl Ether, Isopropyl Ether, Butyl Ether
- Methyl Ethyl Ketone (MEK), Methyl Isobutyl Ketone (MIBK), Methyl Butyl Ketone
- Diacetone Alcohol
- Acetone
- Ethyl Acetate, Amyl Acetate, Vinyl Acetate
- Ethyl Benzoate
- Dimethyl Formamide (DMF)
- Methyl Cellosolve
- Tetrahydrofuran (THF)
- Ketones (general)
- Lacquer Thinners, Lacquers

### G. Alcohols (listed as problematic)

- Alcohols: Amyl
- Alcohols: Diacetone
- Alcohols: Benzyl
- Amyl Alcohol

### H. Fuels, Fuel Additives & Greases

- Gasoline (high-aromatic, leaded, unleaded)
- Diesel Fuel (incl. Oils: Diesel Fuel 20/30/40/50)
- Fuel Oils
- Jet Fuel (JP3, JP4, JP5)
- Kerosene
- Grease, Lubricants, Petrolatum, Petroleum

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- **Varnish, Turpentine**

### **I. Compressed/Reactive Gases & Small Molecules**

- **Methane, Ethane, Ethylene Oxide**
- **Propane (liquefied), Propylene, Butane, Butadiene, Acetylene**

### **J. Aromatics, Amines, Nitriles & Related**

- **Aniline, Aniline Hydrochloride**
- **Amines** (general)
- **Diethylamine, Dimethyl Aniline, Morpholine, Pyridine**
- **Acrylonitrile**
- **Benzaldehyde**
- **Nitrobenzene, Nitromethane**

### **K. Oils (including essential oils)**

- **Oils: Aniline, Oils: Cinnamon, Oils: Creosote, Oils: Orange, Oils: Pine, Oils: Rapeseed, Oils: Olive, Oils: Turbine**

### **L. Inorganics, Salts & Other Lab Reagents**

- **Barium Hydroxide, Barium Nitrate, Barium Sulfate**
- **Calcium Bisulfate, Calcium Bisulfite, Calcium Hypochlorite**
- **Copper Cyanide, Copper Nitrate**
- **Ferrous Chloride**
- **Sodium Acetate, Sodium Nitrate**
- **Sodium Peroxide, Sodium Polyphosphate, Sodium Sulfide, Sodium Thiosulfate (hypo)**
- **Sodium Hydroxide, Potassium Hydroxide, Calcium Hydroxide**
- **Nickel Nitrate**

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- Urea
- Sodium Hydroxide (20% / 50% / 80%)

### M. Halocarbon Refrigerants (Freons)

- Freon 113, Freon 12, Freon 22, Freon TF, Freonr 11

### N. Resins, Asphalt & Miscellaneous Organics

- Furan Resin
- Furfural
- Resins (phenolic/furan context)
- Asphalt
- Gasoline, unleaded/leaded (*also listed in Fuels*)

### O. “Household/Everyday” Substances that still damage materials

- Detergents, Soap Solutions
- Mayonnaise

### P. Mercury & Other Hazardous Elements

- Mercury

## 3. Packaging Compatibility

Both **silicone tubes** and **polyethylene heat-sealed bags** can be damaged by the substances above. Even small amounts can make the FME **leak, swell, or fail**.

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## ✓ 4. Recommended Safe Materials

When designing your IJSEP experiment, try to use:

- Water (distilled or sterile)
- Saline or phosphate buffers
- Sugars (glucose, sucrose)
- Simple salts (NaCl, KCl, CaCl<sub>2</sub>)
- Non-toxic biological materials (plant extracts, seeds, cell-free fluids, etc.)

## 💡 5. Summary

| ✓ Safe Examples                   | ⊘ Unsafe / Problematic Examples   |
|-----------------------------------|-----------------------------------|
| Water, saline, sugar, mild buffer | Acids, bases, alcohols, solvents  |
| Non-toxic biological samples      | Fuels, oils, or chemical reagents |
| Plant or cell extracts in water   | Corrosive or flammable substances |

## ⚠ Remember:

If you are unsure about a material, ask your teacher or the IJSEP team **before including** it in your proposal.

Safety comes first — both for your experiment and for the International Space Station!