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%)

- **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_3)
- **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 ($Ca(OH)_2$)**
- **Lye** (NaOH, KOH, $Ca(OH)_2$)
- **Ammonia** (10%), **Ammonium Hydroxide**
- **Ammonia, anhydrous**; **Ammonia, liquid**
- **Lithium Hydroxide**

C. Halogens, Halogenated Reagents & Acylating Agents

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

- **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**

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**

- **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**

- **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**.

✅ 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, $CaCl_2$)
- 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!