

## Base Baths – Preparation, Use and Disposal

Laboratory glassware is valued for its strength, inertness, transparency and for providing a simple, clean surface for chemical manipulations. Lab glassware must be appropriately cleaned as residual impurities can adversely affect chemical reactions. Solid deposits are often the most difficult impurities to remove from the glass surface.

A concentrated solution of potassium hydroxide (KOH) in isopropanol (IPA) is a powerful cleaning solution to remove grease and other contaminants from glassware. The KOH/IPA solution is commonly referred to as a “base bath”. Laboratory “glass” is a polysilicate solid that can include other oxides in lesser amounts for specialized uses (boron is included in Pyrex®) and sodium or potassium ions are generally present in all glasses. The silica surface layer often has bound hydroxyl and oxide functional groups, which can bind strongly to various contaminants. To remove difficult contaminants, the outer silica layer of the glass is cleaved using a base bath.

When using a base bath, glassware is soaked in the bath for a sufficient period (overnight) before rinsing and cleaning with your usual detergent. The base bath will dissolve the glass after some time, so there is a balance between soaking the glassware long enough to remove the outer layer without leaving it in the solution too long and destroying the glassware. The base bath should not be used on ground glass joints as this may alter their size. Fritted glass is particularly sensitive, as the alkali solution will slowly dissolve the sintered bonds and increase the pore size or even cause the pores to crumble. Quantitative glassware, e.g., pipets and volumetric flasks, should not be cleaned using the base bath as the etching process will adversely affect the glassware internal volumes.

### Preparing a 5 L Base Bath

Portion wise add 200 – 300 g of KOH pellets to 1.0 L of DI water (**the dissolution is highly exothermic!**) in a hard bucket or other appropriate container (HDPE or Nalgene) with a top (Fig. 1).



Fig. 1: A Base Bath Near a Sink

The KOH dissolution generally takes between 30 minutes to an hour. If necessary, stir the mixture with a glass rod. All dissolution and mixing should be carried inside a chemical fume hood. After the aqueous solution has been prepared and allowed to cool to room temperature, add 4 L isopropanol. Stir the solution with a plastic/glass stirring device. Seal the bucket/container with its top and label the container with “BASE BATH” in large, legible writing and specify that the solution contains potassium hydroxide and isopropanol.

## Health Hazards



### Hazard Statements

Base bath contents are extremely corrosive and may result in a skin burns, or eye/respiratory tract irritation.

### Additional notes on chemical-specific hazards

**Potassium hydroxide (CAS# 130 – 58 – 3):** Harmful through inhalation or skin absorption. Destructive to the tissue or the mucous membranes and upper respiratory tract. Causes burns to the skin and eyes. Toxic through ingestion.

**Isopropanol (CAS# 67 – 63 – 0):** Highly flammable; causes serious eye irritation; specific target organ toxicity; causes drowsiness or dizziness.

**Hexanes (CAS# 110 – 54 – 3):** Highly flammable and toxic liquid.

**Acetone (CAS# 67 – 64 – 1):** The primary hazard encountered while working with acetone is that it is highly flammable. Acetone's flash point is  $-20^{\circ}\text{C}/-4^{\circ}\text{F}$ . If chemical is improperly handled in conditions above the flash point, acetone will vaporize into the air and can potentially cause an explosion of flash fire.

## Safe Handling

WARNING! Base baths pose a substantial splash hazard of corrosive liquids and it is therefore critical that extreme care be taken when preparing, using, and disposing of the material.

- Based on the desired amount of the base bath, do not fill beyond 2/3 of the container capacity.
- Before working with the base bath, be sure that your gloves are in good condition. Replace them if you have any doubt as to their condition.
- All contaminated glassware should be prewashed with appropriate solvent to get the glassware as clean as possible. Collect the solvent used to wash the glassware in a container and dispose of it properly.
- Clean excess grease from glassware using hexanes wipe. The use of hexanes and other solvents should be done inside a chemical fume hood.
- While wearing proper PPE (goggles with splash shield, neoprene gloves and a lab coat), glassware should be gently placed into the base bath using tongs allowing the solution to completely fill the glassware. Care should be taken when placing glassware into bath solution to prevent any splash.

- Keep the glassware in base bath tanks several hours or overnight.
- While wearing safety goggles and neoprene gloves, remove glassware from the base bath allowing as much of the solution to drain as is possible.
- Rinse the base bath solution from the glass with tap water. Make sure to first turn on the water, and then place the glassware under the stream making sure not to splash any on you.
- Rinse with distilled water.
- Rinse with acetone and place on the drying rack before drying inside an oven (if necessary).
- **Cautions:** Glassware can be etched from prolonged exposure to the basic solution. Quartz glassware is too expensive to routinely expose to base baths.
- DO NOT put any of the following items into the KOH/IPA bath - volumetric glassware, stopcock keys, glass frits/filters, rubber items, IR or UV cells or NMR tubes, fragile or broken glassware - glassware that still has grease or bulk dirt on it - anything with mercury, sodium, potassium metal.
- The base bath should be stored in secondary container, a plastic tray to eliminate spills and always covered when not actively adding or removing the glassware.
- **Maintenance:** Base baths should be disposed of upon losing effectiveness and replaced with new base/alcohol.

## Personal Protective Equipment

**Face:** Chemical splash goggles with face shield.

**Body:** Impervious smock or apron with long sleeve (to the wrist).

**Gloves:** Thick neoprene or butyl.

## Exposures to Base Bath Solutions

- **Skin Exposure:** Flood the skin with water. Remove and isolate contaminated clothing. Gently and thoroughly wash all affected skin areas with soap and water. Call a doctor if symptoms such as redness or irritation develop.
- **Eye Exposure:** Flush eyes for 15 minutes and immediately and seek medical attention.
- **Inhalation:** Leave the contaminated area immediately and take deep breaths of fresh air. If symptoms such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest develop, seek medical attention.

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## Spill Clean-up and Decontamination

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**Small Spills:** When the base bath mixture spill is small and manageable, lab personnel should:

- Alert personnel in the immediate area.
- Use appropriate PPE described in the PPE section.
- Use a base spill neutralizer to neutralize the spilled solution and use suitable adsorbent material. Finally, the material should be placed in a sealed, compatible bag or container and disposed of through the EH&S chemical disposal route.
- Clean the area with soap solution, finally with water and ethanol.
- For a large spill, call EH&S immediately, and the area should be evacuated.

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## Training

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Before using the base bath, the Principal Investigator (PI) or lab manager must provide training to laboratory personnel specific to the hazards involved with safe use, work area decontamination, and emergency procedures.

**NOTE:** UW – Environment Health & Safety (UW– EH&S) is available to assist in the education and training of personnel concerning safe work practices.

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## Storing Base Bath

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Baths should be located by lab sinks where glassware will be rinsed to minimize the transport of wet items. Baths should be positioned at a height that enables comfortable access to the shortest user. Stepstools, or other devices, should not be used. Ensure baths do not block aisle or create tripping hazards. Ensure that an emergency eyewash, and drench shower are accessible within 50 ft. of the bath. Keep the bath away from potential sources of ignition.

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## Disposal

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Dispose of the unused base bath when they lose cleaning ability.

Using PPE described above, position an adequately sized plastic waste container in secondary containment next to the base bath. Cautiously use a beaker, or another appropriate container, to transfer the bath contents to the waste container in small aliquots. Never attempt to pour a full base bath. Other methods of emptying the bath should only be approved after an appropriate risk assessment. Please contact EH&S should you have any questions. Once the volume of bath remaining in the tub is a few hundred milliliters or less, the remaining solution can be poured into the waste container by using a large funnel.

## References and Important Links

1. Betherick's Handbook of Reactive Chemical Hazards, 8th Edition, **2017**.
2. Prudent Practices in the Laboratory. Handling and Management of Chemical Hazards. National Academy Press: Washington, DC, **2011**.
3. Base bath SOP: <https://ehs.umass.edu/sites/default/files/Base%20Baths%20SOP.pdf> (accessed on November 17, 2021).
4. <https://ehs.wisc.edu/wp-content/uploads/sites/25/2017/01/GlasswareCleaning.pdf> (accessed on November 17, 2021).
5. Preparing acid and base baths, The Berry group, Chemistry, UW-Madison. <https://berry.chem.wisc.edu/sites/berry.chem.wisc.edu/files/15%20-%20Preparing%20Acid%20and%20Base%20Baths.pdf> (accessed on November 17, 2021).

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