

BASE BATH

Best Practices

Base baths are mixtures of an alkali hydroxide (usually potassium hydroxide, KOH), an alcohol (often isopropyl alcohol), and water. Base baths are often made in large containers and are used to clean glassware when the glassware has been contaminated with difficult-to-remove materials, or the glassware must be exceptionally clean for its intended use. The strong base reacts with many materials, removing them from the surface of the glassware, but it will also etch the glass, removing a thin layer and any contamination along with it.

Base baths can be very hazardous. The contents are extremely corrosive to skin, eyes, and metals, with a pH of >14 (see the Why Use Alcohol callout box for an explanation of how the pH is >14). Mixing the large quantities of materials typically used for base baths increases the risk of splashing and thus the risk for exposure. Depending on the concentration of isopropyl alcohol, the base bath may also be flammable. In addition to the chemical hazards, base baths are often very heavy, creating an ergonomic hazard for researchers trying to move them.

This fact sheet will cover base bath alternatives, safe practices for mixing and use, proper PPE, proper disposal, and emergency procedures.

Base Bath Safety

Substitution

Base baths should be used as a last resort for cleaning glassware, not a standard practice. Not only can base baths cause serious injuries to your skin and eyes, the way the base bath works weakens glassware. As mentioned above, the solution etches the glassware, removing layers, which means the glassware will break more easily. When cleaning glassware, do the following:

- Start by using standard cleaning solvents appropriate for the contamination you are trying to remove (e.g., water, ethanol, acetone).
- If normal solvents are ineffective, try using a lab detergent (e.g., Alconox, Sparkleen).
- If detergents are ineffective, try using KOH in just water.

If none of the above work, then you could consider using a base bath.

Personal Protective Equipment

This guidance assumes you are working with 2-3 gallons of base bath in a 5-gallon bucket. For other scales,

Why Use Alcohol?

There are two reasons alcohol is used as a solvent for base baths:

First, alcohols are better at dissolving organic residues that may be released from the glass by the action of the base.

Second, alcohols allow for an even stronger base than water, a phenomenon known as the leveling effect.

In short, the leveling effect describes how the strength of a base is limited by how acidic the solvent is. Since alcohols are weaker acids than water, potassium hydroxide can act as an even stronger base in alcohol than in water!

follow the guidance in the [PPE Assessment Tool](#) or contact EH&S. In addition to PPE, lab-appropriate street attire (i.e., long pants or equivalent, closed toe shoes made of a non-porous material) is required.

- Eyes/Face: goggles and face shield
- Body: flame-resistant lab coat; additional chemical-resistant apron is recommended but optional
- Hands: butyl rubber gloves worn over nitrile gloves; inspect butyl rubber gloves for damage (e.g., cracking, holes) before use

Engineering Controls

Small base baths should be made and used inside a certified chemical fume hood. However, as noted in the introduction, base baths are frequently made at larger scales, often in 5-gallon buckets. This makes working in a fume hood highly impractical, and moving a base bath into or out of a fume hood poses a significant risk of ergonomic injury (not to mention the risk of spills). **If you use a base bath outside of a fume hood, safe work practices and proper PPE usage are particularly essential.** On the other hand, if you use your base bath inside a fume hood, be sure that you can move it without ergonomic injury and be aware that splashes and/or spills are more likely to reach the upper body and face.

Safe Work Practices

This section is broken down into how to safely make, use, store, and dispose of base baths. As with any hazardous chemicals, researchers working with base baths must complete [EHS-1900: Chemical Safety for Laboratories](#).

Making a Base Bath

- Determine what size base bath you need. Use the smallest amount practical. Mix base baths in plastic vessels, not glass or metal.
 - Do not fill the bath vessel more than $\frac{1}{2}$ - $\frac{2}{3}$ of the way.
 - If making a large (i.e., ≥ 1 gallon) bath, contact EH&S before beginning. EH&S can provide buckets designed to transport hazardous liquids, which makes disposal much easier for both researchers and EH&S!
- Pre-label your bath vessel “base bath, contains potassium hydroxide and isopropanol, flammable and highly corrosive”.
- Place your bath vessel in secondary containment.
- Add water to the bath vessel before other components. Ideally use cold water.
- Add your base in portions, stirring thoroughly and allowing the mixture to cool if it has heated above room temperature. The temperature increase occurs because dissolving strong acids and bases in water generates heat.
- Once all your base is added and dissolved and the bath has returned to room temperature, slowly add your alcohol and stir.

Using a Base Bath

- Clean your glassware as much as possible before placing it in the base bath. Putting heavily contaminated glassware in the base bath could result in vigorous reactions, causing splashes or sprays.
- Use tongs to place glassware into the base bath and to remove it. Glassware can often be slippery after soaking in a base bath (see the Slippery Glassware callout box for more information), so be sure you

have a firm grip on the glassware with your tongs before removing the glassware.

- Separate glass joints before placing glassware in a base bath, or else the items may become fused together.
- Do not wash any of the following in base baths:
 - Objects made of metal, rubber, or most plastics
 - Glassware contaminated with metals (particularly alkali metals)
 - Delicate or expensive glassware (e.g., volumetric glassware, quartz glassware, glass fritted funnels, stopcock keys)
- Do not let glassware soak in a base bath for more than one night.
- Rinse glassware thoroughly with water after soaking in a base bath. See [Stanford's Wastewater Best Management Practices Fact Sheet](#) for guidance on disposing of rinsate.

Slippery Glassware

Saponification is a reaction in which esters are converted by strong base into carboxylates or alcohols, and is used to make soaps. The saponification reaction products are slippery, so if oil from your skin gets on glassware, it will saponify and make the glassware slippery. Even if you wear gloves while handling all glassware, when the base etches the glass, it forms sodium or potassium silicate, which is also slippery.

Storing a Base Bath

- Store base baths in adequate secondary containment. Secondary containment for large baths (e.g., those in 5-gallon buckets) may be different from what is commonly used in your lab. Contact EH&S if you are uncertain whether the secondary containment you have is adequate.
- Use hand carts to move heavy base baths from storage locations to use locations.

Disposing of a Base Bath

- If your base bath is in a bucket approved for liquids and transporting hazardous materials, secure the lid and affix a waste tag, then move the bucket to your waste pickup location. Consult with EH&S first if you do not know if your bucket is approved for transporting hazardous materials.
- If your base bath is in a bucket that is not approved for liquids and transporting hazardous materials, **do not attempt to pour the bath into a waste container.** The weight and volume of the bath make spills and splashes likely when pouring. Use a siphon pump to transfer the liquid into a [waste carboy](#), or contact EH&S for assistance. Tag the empty bucket as hazardous waste.
- If you have a small base bath that is not in a bucket, you may pour it into a waste carboy directly or use a siphon pump.

Incident Response

If a situation is life- or health-threatening, evacuate and call 911. You can also call EH&S's 24-hour incident hotline at 650-725-9999. Remember to submit the [SU-17 incident report form](#) after any incident.

Exposure

In the event of exposure to a base bath, follow the same steps as for any exposure to a corrosive material. For serious exposures, call 911 or go to the [Stanford Hospital Emergency Department](#). For minor exposures, contact the [Stanford University Occupational Health Center](#) at 650-725-5308. When seeking medical attention, bring the SDSs of all hazardous components of your base bath.

For skin exposures, remove any contaminated clothing, and IMMEDIATELY flush contaminated skin with water for at least 15 minutes. Use a safety shower for any skin exposures to the trunk, legs, or feet. For minor

exposures (e.g., a few drops splashed on bare skin), you may rinse in a sink, but when in doubt, use a safety shower.

For eye exposures, IMMEDIATELY flush eyes with water for at least 15 minutes using an eyewash station.

Spills

Base bath spill response depends on the location and scale of the spill. For small scale spills, particularly if they occur inside a chemical fume hood, use your lab's standard [chemical spill kit](#). Do not add water to the spill, as this will generate heat.

For large spills, especially spills outside of a chemical fume hood, clear the immediate surroundings, block access to the area, and call EH&S's 24-hour incident hotline at 650-725-9999. Do not attempt to clean up large spills by yourself.

Fire

If a base bath ignites, remember, you are never required to fight a fire; you always have the option to evacuate, pull the fire alarm, and call 911.

If you feel confident that you can attempt to extinguish the fire, the best option is to cover the base bath container with a lid, cutting the fire off from oxygen. If this is not feasible, use a fire extinguisher, but be certain to do so from a safe distance. If you are too close when you activate the extinguisher, it may cause the base bath contents to spray, which can lead to chemical exposure and the fire spreading.

If the base bath's container begins to melt, begins to release liquid, or you otherwise feel you cannot safely extinguish the fire, evacuate, pull the fire alarm, and call 911.