

## Formalin recycling in health care labs

Recovering formalin, used to preserve tissue samples, can decrease the volume of formalin purchased, improve employee safety and reduce regulatory compliance burden.

Formalin, a mixture of formaldehyde, methanol, and water, is used as a fixative to preserve tissue samples in health care laboratories. It is typically diluted with water to 10%.

Recovering formalin, by either distilling or filtering, helps histology laboratories reduce:

- Costs by decreasing the volume of formalin purchased
- Volume of their hazardous materials inventory, increasing employee safety by decreasing the risk of exposure and spills
- Regulatory compliance burden

Low to moderate exposure to formaldehyde can irritate the eyes, nose, mouth, throat, and skin, and can cause headaches. In high concentrations exposure to formaldehyde may be carcinogenic or fatal.

The U.S. Occupational Safety and Health Administration (OSHA) regulate the permissible occupational exposure limit to airborne concentration of formaldehyde to 0.75 ppm as an 8-hour time weighted average (TWA).

Formaldehyde-free products may be appropriate for use in your lab. The Sustainable Hospitals Web site provides a list of formaldehyde-free products at <[www.sustainablehospitals.org](http://www.sustainablehospitals.org)>.

### Formalin Waste

Formalin waste is toxic due to the presence of formaldehyde and methanol. Best management practices call for formalin waste to be recycled. If disposed of waste formalin should be incinerated. If sewerred, the waste should be treated to cross-link the formaldehyde prior to sewerred. The wastewater treatment facility must be notified.

### Formalin Recycling

Formalin recovery is becoming more common. Many health care labs are already recycling ethyl alcohol and xylene, which are also used to prepare tissues for viewing under a microscope.

Recycling formalin requires updating operating procedures and lab emergency plans. Additionally, it is important to train employees on new procedures such as dating and labeling containers of recycled formalin and making chemistry adjustments and transfers under a hood with carbon filters to prevent vapors from dispersing. When trained, non-technical staff can safely operate distillation and filtration equipment, which require little operator time

Although formalin is less expensive to purchase than other commonly used laboratory solvents and fixatives such as alcohols and xylene, recycling is economical when using about five gallons a week, factoring in neutralizer and waste disposal costs.

### Distilling

Distillation recovers 80-90% of the formalin, depending on the contamination level of the waste. The efficiency of the still will determine the purity of the recovered formalin. It is possible to get 100% pure formalin from stills.

After distilling buffer salts are added to the formalin to adjust pH; zinc tablets may be added for zinc formalin, depending on the formalin solution required. Formalin product reclaimed should be tested to determine if more formalin needs to be added to compensate for evaporation.

With technology advances, fractional distillation units are now practical and safer.

Caution: Never distill any formalin waste that may contain either picric acid (trinitrophenol; used in Bouin's Fixative) or colloidin (nitrocellulose) because both are explosive when heated.

### *Ridgeview Medical Center*

Ridgeview Medical Center, a 129-bed hospital in Waconia, purchased a fractional distillation unit that allowed them to distill formalin, as well as alcohol and xylene, from its histopathology lab. The equipment reclaimed 90% of the formalin.

Ridgeview piloted a few equipment models before selecting the one that was easiest to operate and

the most compact. The equipment was on a cart and stored in a housekeeping closet when not in use.

Lab staff members ran the equipment and handled routine cleaning and maintenance, which took about one to two hours a week. The unit generated about 1.5 gallons of waste a week, which had to be managed as hazardous waste. The reclaimed formalin was at 9-10%, no longer requiring dilution from 37%, making working conditions safer for employees.

Prior to purchasing the distillation unit, the lab purchased 128 gallons of bulk formalin per year. In the year following the equipment purchase the lab did not need to purchase any formalin, saving \$3,600 resulting in a payback of 4.5 years.

## Filtering

Filtering recovers 99% of the formalin. Filtration is less complex than distillation. Gravity or a pump pulls the used formalin through a series of filters. Waste is collected in a filter cartridge for disposal. Heat is not used in the filtering process, making the equipment cleaning process simpler than for distillation.

The recovered formalin does not need to be buffered because salts are not removed during filtering. The pH may need to be adjusted by adding water or additional formalin.

### *Methodist Hospital*

The laboratory at Methodist Hospital, a 350-bed hospital in St. Louis Park, purchased two formalin filtering units, one for neutral buffered formalin (NBF) and another for alcoholic formalin. The equipment recovered 100% of the formalin.

Methodist used a large volume of formalin and did not have the space for distillation equipment. Lab staff also preferred the less complicated process. All histology technicians ran the equipment.

In 2002, the lab bought approximately 352 gallons of concentrated NBF. In the first four months of using the filter equipment, the lab decreased the amount of concentrated NBF ordered by 50%. Staff members at the histology lab believe that filtering saves approximately \$5,000 annually.

## Waste from Recovery Methods

Still bottoms, the contaminants remaining after formalin is distilled, and filtration waste contain blood, formalin, reagents, stains, tissue particles and water. This material might be considered hazardous due to the presence of formaldehyde or heavy metals from stains. Check with your local regulatory authority and evaluate your waste. Still bottoms may require disposal as hazardous or solid waste.

## Selecting Equipment

The purity of the recovered formalin, volume of waste produced and the amount of space needed will help determine the type of formalin recovery unit to purchase. The unit should minimize the number of times waste and reclaimed formalin are handled. Waste should accumulate in a container ready for disposal.

When looking for fractional distillation units that recycle solvent as well as formalin, be sure that the units are made of formaldehyde-resistant materials.

Before purchasing new equipment to recycle formalin, evaluate its payback. Equipment vendors can assist with this calculation. Equipment may be available for a free trial period.

## Suppliers of Formalin Recovery Equipment

MnTAP maintains the following list of formalin recovery equipment suppliers solely as a service to Minnesota companies. This is not a complete list of available suppliers and does not represent an endorsement by MnTAP. MnTAP, by providing the list, does not guarantee that the products do or do not comply with environmental and safety laws in any specific application.

Supplier	Notes
B / R Instrument Corp. Easton, MD 800.922.9206 www.brinstrument.com	Simple and fractional distillation 2-10 gallon capacity; manual, semi- and fully-automatic units Floor and tabletop models Units available that distill multiple solvents, including acetone, alcohol, formalin, xylene, and xylene substitutes
CBG Biotech Columbus, OH 800.941.9484 www.cbgbiochem.com	Fractional distillation 2-10 gallon capacity; manual, semi- and fully-automatic units Floor and tabletop models, carts available Units available that distill multiple solvents, including acetone, alcohol, formalin, xylene, and xylene substitutes
Creative Waste Solutions West Linn, OR 888.795.8300 www.cwsincorp.com	Gravity filtration 3 and 10 gallon capacity; three phase: micro- and ultra-filtration and carbon absorption; uses filter cartridges Floor model on cart Removes fats, particles, proteins, and stains Can recycle alcohol and formalin
Triangle Biomedical Sciences Durham, NC Midwest Representative 770.948.6342 www.trianglebiomedical.com	Filtration using a pump system 5 gallon capacity; three phase: micro- and ultra-filtration and carbon absorption Floor model Removes fats, particles, proteins, and stains



## For More Information

MnTAP has a variety of technical assistance services available to help Minnesota businesses implement industry-tailored solutions that maximize resource efficiency, prevent pollution, increase energy efficiency, and reduce costs. Our information resources are available online at <mntap.umn.edu>. Please call MnTAP at 612.624.1300 or 800.247.0015 for personal assistance or more information about MnTAP's services.