

Vacuum Trap Assembly, Safeguards and Use Guidance

Basic Trap Design

Vacuum traps are a common sight in laboratories that culture cells and tissues. Waste collected in a basic trap that is not assembled or disinfected properly has the potential to result in the release of or exposure to hazardous biological material. The assembly of an efficient vacuum trap will require several components: vacuum source, HEPA filter, primary receptacle, back-up receptacle, and tubing (Figure 1). An in-line HEPA filter is critical to an efficient Vacuum Trap Assembly as recommended by both the National Institutes of Health (NIH) and Centers of Disease Control and Prevention (CDC). It protects lab personnel and the house vacuum system by preventing the release of aerosolized biological agents from entering the house vacuum system as well as the environment.

Presented in this document are a few examples of how to assemble a complete efficient aspiration system.



Figure 1.¹ Basic Trap Design

A. Flask with disinfectant that will receive aspirated infectious material **B.** Overflow flask to protect vacuum system. The overflow flask should also contain disinfectant at approximately 10-15% of the flask volume **C.** In-line hydrophobic HEPA filter more often available shaped as a disc **D.** Vacuum source

Purchased Biological Vacuum Trap Assembly



One option would be to purchase a vacuum trap pre-assembled thereby reducing the time and effort of purchasing individual components. To view the options available, use the internet search terms, “**Biological Vacuum Trap Assembly**” and assess what is offered. A complete pre-assembled set-up will include an in-line HEPA filter, plastic flasks, vacuum tubing, and stoppers. Often these pre-assembled vacuum traps are contained in a leak proof bin and be set on the floor to conserve space.

Vacuum Trap Set-up Assembled In-House



Another option is to purchase new equipment that will fit your needs regarding size of flasks (polypropylene or glass), PVC vacuum tubing, and rubber or neoprene stoppers. Vacuum trap component specifications can be found in Table 1. Neoprene or rubber stoppers can be obtained previously assembled with a plastic tube inserted. This option mitigates the risk of injury during assembly. Alternatively, a 5ml or 10ml plastic serological pipet (not glass) can be coated with a small amount of glycerol to pass through a 1-hole rubber stopper. The tube should be inserted with a gentle twisting motion and never forced. **Forcing the tube through the hole using your hand or striking it against a countertop are methods that should not be used as they may result in an injury.**

A nested cork borer set could prove useful for the assembly of the tube through the stopper. Insert the cork borer into the rubber or neoprene stopper with the help of silicon grease, 1

size larger than the hole. The serological pipet can then be fit through the cork borer hole. Once the cork borer is removed, the serological pipet will fit in place.

Table 1: Equipment for In-House Set-Up

Components	Options Available	Specifications
In-line HEPA Filter	Vacushield Vent Device	Inlet/outlet: 1/4 to 1/2 stepped barb
	Whatman HEPA-Vent Filter	Inlet/outlet: 1/4 to 3/8 stepped barb
	Millipore Millex-FG	Inlet/outlet: wide variety
Flasks	Polypropylene Vacuum Flask	500 ml, 1000 ml or 1700 ml
	Glass Vacuum Flask	
Tubing	Non-phthalate PVC Vacuum Tubing	Inner Diameter 1/4, Outer Diameter 5/8
	* Tube diameter depends on flask	Inner Diameter 3/8, Outer Diameter 7/8
1-Hole Stoppers	Rubber or Neoprene	Flask 500 ml - Stopper 7
	* Pre-inserted tube optional	Flask 1000 ml-Stopper 8 Flask 1700 ml-Stopper 9

As is often observed in a research laboratory setting, equipment may be reused by laboratory personnel. With the possibility that a glass flask which was previously used for another purpose is going to be used as a vacuum trap component, it is recommended:

1. Never use laboratory equipment not designed for a vacuum system. For example, thin wall glass or round bottom flasks are unacceptable as they are not designed for vacuum systems. Keep in mind an implosion would send glass, disinfectant, and biological material in every direction.
2. Inspect the glassware for cracks, etching marks, deep scoring, or scratches. Glassware with such defects should not be used.
3. It is also recommended that the Pyrex vacuum flask be taped in a criss-cross pattern with filament tape. This reduces the risk of flying glass shards in the case of an implosion due to faulty glass.
4. Under no circumstances should the vacuum flask be on the floor without the protection of a tall plastic pail or other sturdy enclosure. A glass flask sitting on the floor is a spill hazard and has the potential of getting hairline cracks if bumped.

Disinfectant

There are many options to be made regarding the type of disinfectant to be used in flasks (Figure 1.) Please consult your biosafety protocol to see the approved disinfectant for your materials.

Fill the vacuum flask A (Figure 1.) with disinfectant to approximately 10-15% of the flask volume. Be aware that once the bleach is diluted with water it will begin to degrade within 24 hours³. Be certain to reference your biosafety protocol, other disinfectants can also be used according to the details specified in the biosafety protocol. For further questions regarding disinfection, please contact the Office of Biological Safety (biosafety@fpm.wisc.edu / phone (608)-263-2037).

Maintenance

Taking care of a vacuum trap is critical to optimal function. Guidance given by the BMBL⁽¹⁾ regarding in-line HEPA filters states that filters should be replaced as needed or on a replacement schedule determined by a risk assessment. To perform a risk assessment, the amount of use should be considered as well as usage recommendations from the manufacturer. Once a new HEPA filter has been placed in-line, it is a good idea to write the date on the outside of the HEPA filter with a permanent marker. If the vacuum lines are routinely used, the HEPA filter may need to be replaced every 6 months. Whereas if the lines are used periodically, the HEPA filter may need to be replaced annually. If the liquid from the overflow flask comes in contact with the HEPA filter, the filter will need to be replaced immediately. If the HEPA filter becomes clogged, the filter should be changed immediately. **Maintaining the disinfectant in the vacuum flasks is also important to prevent organic buildup of residue within the flasks. This is especially the case where bleach is used as a 10% solution of bleach starts losing effectiveness after 24 hours and is no longer effective after 1 week.**

Disposal

Ideally, the flasks should be disinfected, and contents disposed of as soon as you are done or daily. Flasks should never be more than 2/3 full. Prior to disposal, add fresh disinfectant to the waste to achieve the manufacturer's recommended concentration. More information on disinfectants can be found at the EPA² and CDC³. With the flask in the BSC, open the top and add fresh disinfectant to achieve the recommended concentration. For instance, if bleach is used, add bleach to the waste to achieve 10% of the final volume. Gently swirl the flask and allow contact time as per your biosafety protocol. You may also allow the flask to sit overnight and dispose of the waste the following day.

If there is radioactive material contact: <https://ehs.wisc.edu/labs-research/radiation-safety/>

If there are hazardous chemicals, contact

<https://ehs.wisc.edu/labs-research/chemicalsafety/>

Decontamination Efficacy Check

If you would like to ensure that the biological materials are effectively decontaminated, an efficacy check can be performed. To do this, turn off the vacuum when the material is ready for disposal. Take a 50 ul aliquot and add it to 3-5 mls sterile media. Check for growth and document your findings in a notebook. If no growth occurs in the fresh media, the biological materials are decontaminated and ready for disposal. More detailed information regarding efficacy checking and decontamination can be found in the UW-Madison Researchers' Biosafety Manual⁴.

Training

Hazard communication and training are valuable tools for every researcher working in the laboratory. A periodic review of biological safety training programs, records, plans, and priorities as needed, help ensure optimum personal safety for everyone handling a vacuum aspiration assembly. Items to be aware of include:

- Placement, use, removal, and disposal of biological materials
- Decontamination of equipment
- Accidental exposure
- Emergency response procedures
- Hazard communication for material handled

References

1. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention (CDC) and National Institutes of Health (NIH) - Biosafety in Microbiological and Biomedical Laboratories (BMBL), current version.
<https://www.cdc.gov/labs/BMBL.html>
2. <https://www.epa.gov/pesticide-registration/selected-epa-registered-disinfectants>
3. <https://www.cdc.gov/infectioncontrol/guidelines/disinfection/disinfection-methods/index.html>
4. The UW-Madison Researchers' Biosafety Manual, UW-Madison, Office of Biological Safety, current version found on the UW EHS: Manuals, Guidance and Policies page (<https://ehs.wisc.edu/ehs-manual/>)