



Permeation Source MPI

Issue/Version	Date	Author	Details
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1 Note on harmful substances

Using the method described below a wide range of permeation devices can be constructed.



Many of these could, if they burst, release toxic or harmful quantities of the material they contain. For this reason it is essential that the user conduct a **risk assessment** for the substances they intend to use and establish safety protocols that cope with the release of these materials both in normal operation, and in the case of a permeation source bursting and releasing its contents all at once.

These protocols must include suitable installation (e.g. in a fume cupboard, provision of extraction, etc.) and operational procedures to protect the operator.

2 Equipment required

Construction materials:

Extruded PTFE tubing	¼+ diameter, <i>length to suit application</i>
Extruded PTFE rod	5.4mm diameter, 2x 2cm lengths
Owlstone crimps	2x crimps

The Owlstone **Permeation Tube Pack**, catalogue no. 00-0018, provides enough material to manufacture 10x permeation sources.

Tools:

Owlstone crimp tooling
Vice or other clamping tool
Sharp knife or pipe cutters
Ruler

Cleaning materials:

Decon90
Acetone
non . shedding cloth
Oven

The Owlstone **Permeation Source Manufacturing Pack**, part ref. 00-0017, provides enough material to manufacture 10x sources and also includes associated crimp tooling.

3 Permeation source construction

- 1 If not already clean, clean the mild steel crimps with **Decon90** and water, rinse twice with acetone and bake over night at 150°C.
- 2 Wearing gloves and using a ruler, use a sharp knife to cut a length of the ¼" PTFE tubing 4cm longer than the active area needed (as the source will have a 2cm plug at each end). See Figure 1.

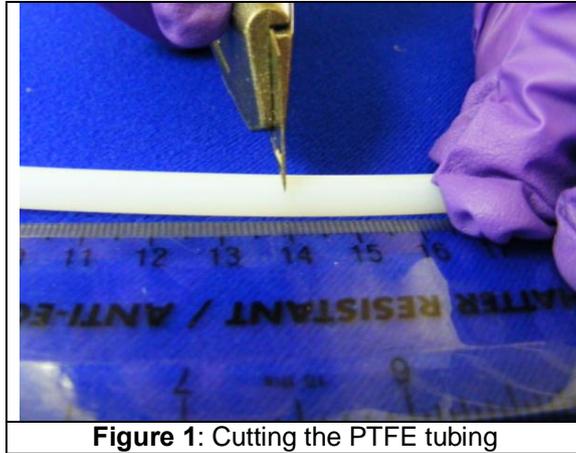


Figure 1: Cutting the PTFE tubing

- 3 Polish the length of PTFE tubing and a section of the PTFE rod with a clean piece of tissue paper (Figure 2).

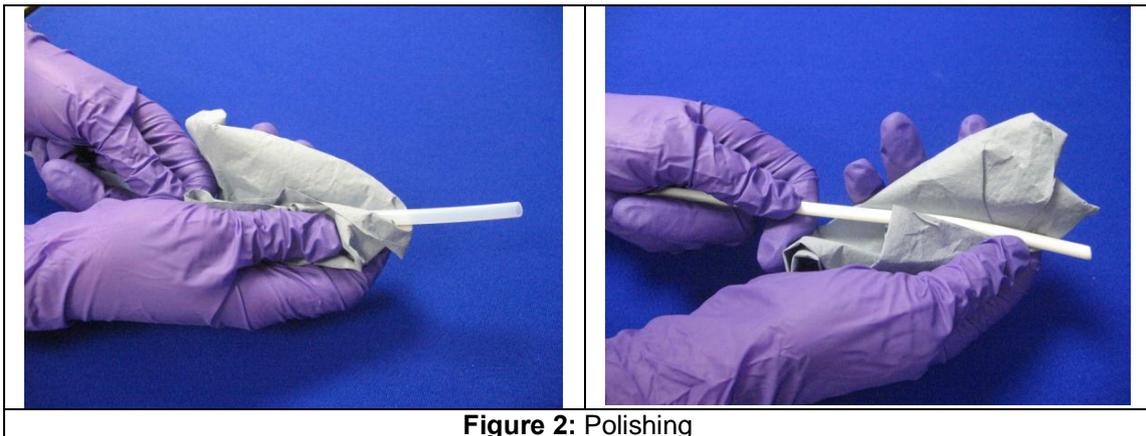


Figure 2: Polishing

- 4 Insert the PTFE rod into the tubing by 2cm (Figure 3).

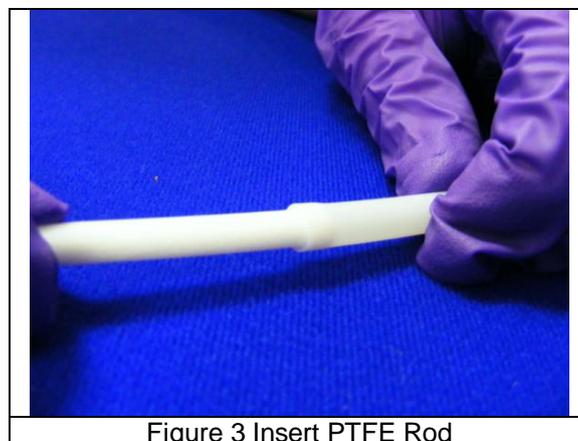


Figure 3 Insert PTFE Rod

- 5 Using a sharp knife cut the rod flush with the end of the tubing (Figure 4).

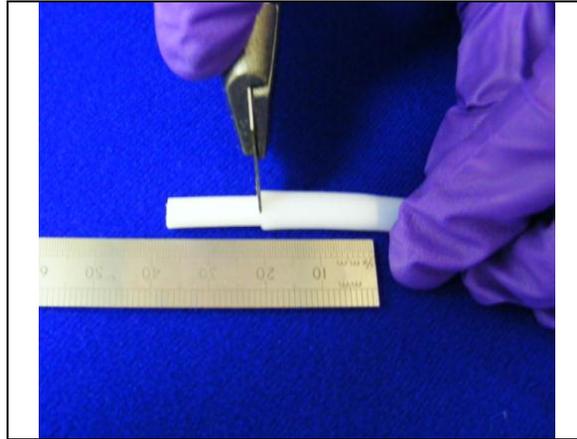


Figure 4: Cutting the PTFE rod

- 6 Insert the PTFE rod into the other end of the tubing by about 2cm and then remove it again. This widens the tube to aid the final sealing (Figure 5).

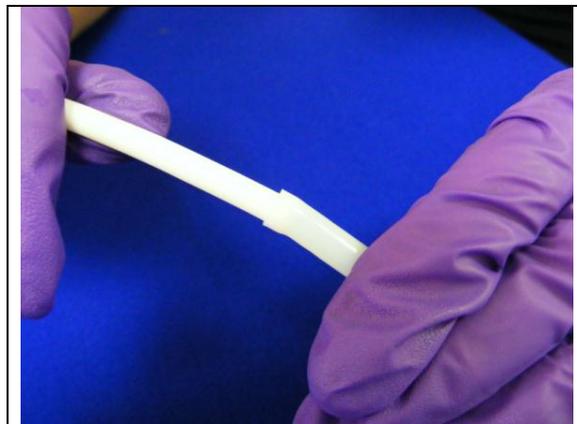


Figure 5: Inserting the PTFE rod.

- 7 Put a crimp on the end of the tubing with the rod inside. The crimps are the same length as the rod, 2cm. Place the assembly into the crimp tooling as shown (Figure 6).

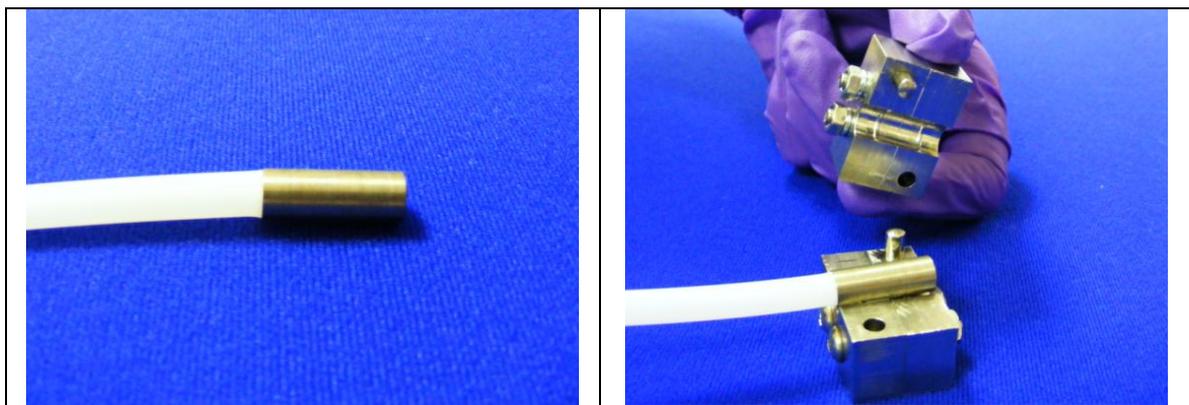


Figure 6: Putting on the crimp

- 8 Put the crimp tooling into a vice and tighten as much as possible. The two blocks of the crimp tool, shown in the red circle, must touch in order to get a satisfactory crimp (Figure 7).

- 9 Inspect the crimp for any damage (Figure 8)

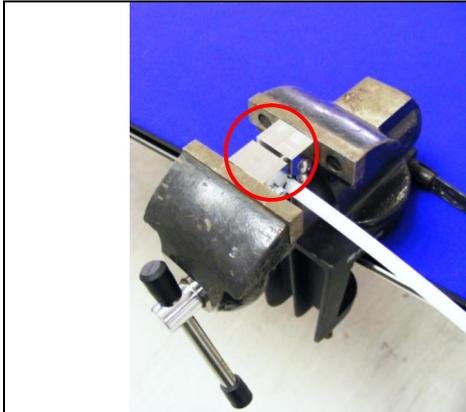


Figure 7: Putting the crimper into the vice

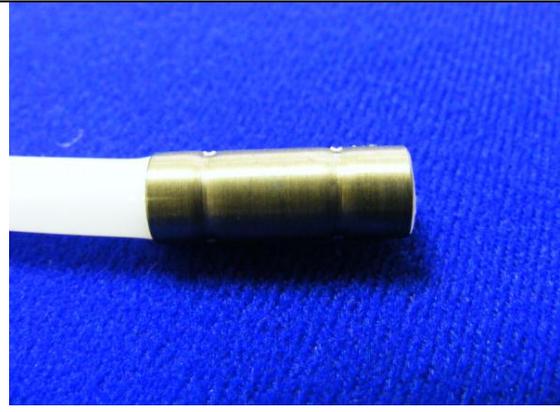


Figure 8: After crimping

- 10 Dependent on whether the choice of chemical is in the aqueous or solid phase at room temperature either measure 1ml or 1g respectively and place this in the permeation source (Figure 9 shows an aqueous example)

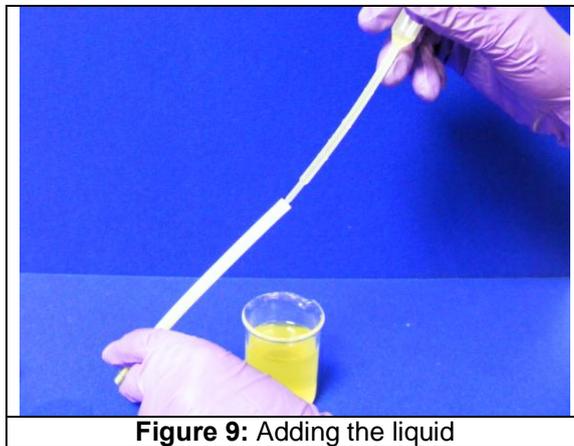


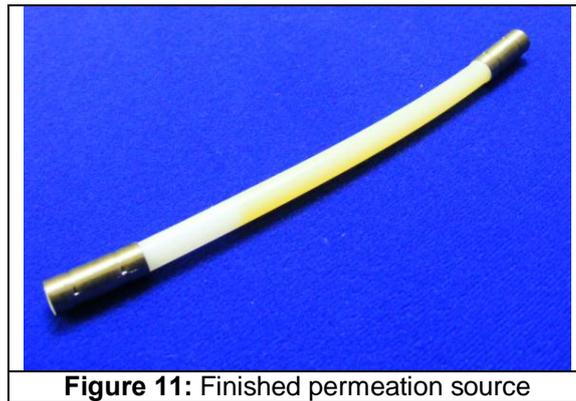
Figure 9: Adding the liquid

- 11 Clean the open end of the tubing and the PTFE rod, and insert the rod 2cm into the end of the tubing. As before, cut the rod flush with the end of the tubing using a sharp knife (Figure 10).



Figure 10: Inserting the PTFE rod

12 Follow steps 7, 8 and 9 (Figures 6, 7 and 8) to fit the second crimp onto the tube.



13 The permeation source is then finished (Figure 11).

4 Permeation Source Calibration

Permeation sources are calibrated gravimetrically.

After construction they are weighed ($n=3$) using an analytical 5 point balance. The source is then incubated in an **Owlstone Vapour Generator** at the required temperature and periodically weighed after an initial 3 day stabilisation period.

This process is repeated until enough data points are acquired to provide a good calibration. Depending on the permeation rate this process may take between two weeks and six months.

An example of a Toluene permeation source calibration is shown in Figure 12, this plots time in minutes vs. cumulative mass loss in ng. The slope of the fitted line is equal to the permeation rate in ng min^{-1} .

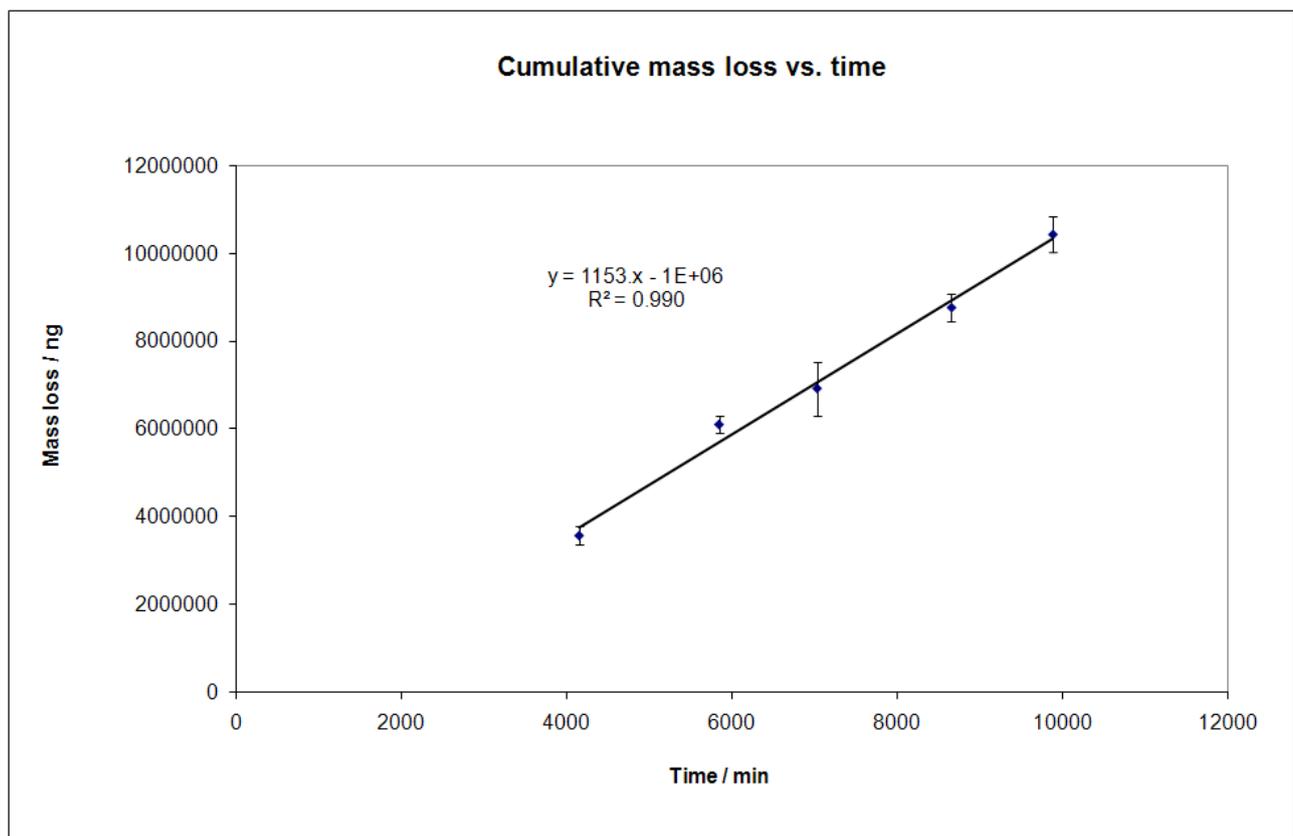


Figure 10: Permeation source gravimetric calibration, the slope is equal to the permeation rate in ng min^{-1}