

Design and Building of an Inexpensive and Sturdy Pipet Bulb Filler Port

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ABSTRACT: A pipet filler port has been constructed from a 1/4 in. NPT–1/4 in. or –3/8 in. barbed end Kynar plastic male connector fitting and a washer (cut from a latex rubber hose) inserted into the NPT end. The barbed end can secure reliably different sized rubber bulbs such as 1 oz (30 mL pipet capacity) and 2 oz (60 mL pipet capacity) types, and the 1/4 in. NPT end is fitted with a rubber washer that can provide airtight contact with the glass pipet end, permitting suction. This filler port allows for facile suction of a liquid using a pipet and also quick removal of the pipet bulb from the pipet end to permit setting the meniscus level with finger pressure. Existing supplies of rubber bulbs or new ones can be fitted with this filler port at just a few dollars for each bulb, avoiding the expense of purchasing new pipet bulbs with filler ports or thumbwheels. The plastic fitting should last indefinitely, and the rubber washer can be easily replaced if necessary.



KEYWORDS: High School/Introductory Chemistry, First-Year Undergraduate/General, Analytical Chemistry, Hands-On Learning/Manipulatives, Applications of Chemistry

Undergraduate chemistry laboratory students have difficulty controlling the filling of glass pipets and then placing their finger on the pipet end to set the meniscus using a standard rubber bulb. For many years, we have modified rubber pipet bulbs using plastic pipet tips intended for expensive variable volume research quality pipets.¹ However, the tips may not be stable when inserted in an older bulb, either falling off or sometimes being pushed completely into the bulb, and eventually the tips crack or break. Short pieces of polyethylene tubing have been formed into a taper that have a collar securing it to the rubber bulb using “ordinary glass working techniques”.² However, this may take some practice to make. More recently, a plastic desoldering pump has been modified to be a low cost, adjustable from 1 to 10 mL pipet filler.³ However, students often need to use both small volume (1–10 mL) and large volume (particularly 15, 20, and 50 mL) transfer pipets in analytical chemistry experiments. Rubber bulbs modified with plastic filler ports or thumbwheels to make pipet use easier are commercially available but only with a 25 mL pipet capacity and would also likely be too expensive to purchase for high enrollment laboratory classes.

We recently discovered that commercially available 1/4 in. NPT plastic male adapter fittings with barbs of various diameters (available from MSC Industrial Supply Co., Elkhart, IN) can accommodate several different sized pipet bulbs (1 and 2 oz) and remain completely stable when the barb end is inserted into the bulb. A short piece of 3/8 in. o.d., 3/16 in. i.d. rubber latex tubing (available from Amazon through Spearit) is inserted into the 1/4 in. NPT port to provide the seal for the glass pipet end. Figure 1 shows the 3/8 in. and 1/4 in. barbed 1/4 in. NPT plastic fittings as well as top views of the fittings with the inserted rubber tubing washer pieces.

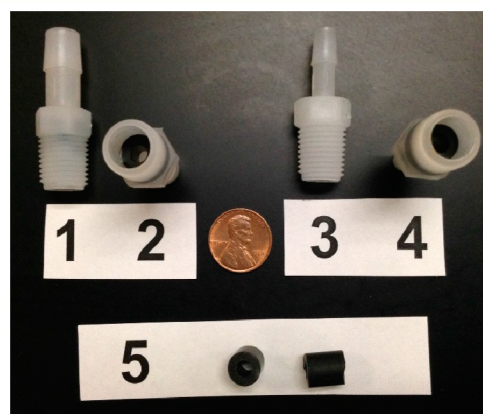


Figure 1. Component 1: 3/8 in. barb–1/4 in. NPT Kynar plastic fitting (MSC part 48728349). Component 2: End view of the 3/8 in. fitting with the cut rubber tubing washer insert. Component 3: 1/4 in. barb–1/4 in. NPT Kynar plastic fitting (MSC part 48728323). Component 4: End view of the 1/4 in. fitting with the cut rubber tubing washer insert. Component 5: Cut rubber tubing washer insert.

Figure 2 shows two different sizes of rubber bulbs and a different make of the larger bulb paired with the appropriate plastic fitting.

The 1 oz (30 mL pipet capacity) bulb 1 (140 mm length × 64 mm o.d.) and the 2 oz (60 mL pipet capacity) bulb 2 (178 mm length × 83 mm o.d.) in Figure 2 can be fitted with a 1/4 in. barb–1/4 in. NPT fitting (3 in Figure 1) while the 3/8 in. barb–1/4 in. NPT fitting (1 in Figure 1) is a better, tighter fit for bulb 4 (also 178 mm length × 83 mm o.d.) in Figure 1. The

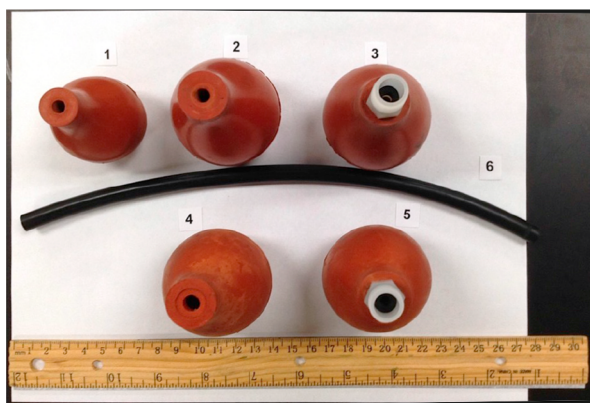


Figure 2. Component 1: Small rubber bulb (140 mm length $\times$ 64 mm o.d.), 1 oz (30 mL pipet capacity). Component 2: Large rubber bulb (178 mm length $\times$ 83 mm o.d.), 2 oz (60 mL pipet capacity). Component 3: Bulb 2 with the 1/4 in. barb–1/4 in. NPT fitting with rubber washer insert. Component 4: Large rubber bulb with same dimensions as bulb 2 but larger diameter hole. Component 5: Bulb 4 with the 3/8 in. barb–1/4 in. NPT fitting with rubber washer insert. Component 6: Piece of 3/8 in. o.d., 3/16 in. i.d. rubber latex tubing from Spearit Company.

3/8 in. fitting should be used for even larger bulbs or those with worn holes. Top views of the 1/4 in. NPT fitting end with the inserted black rubber washer (5 in Figure 1) cut (about 3/8 in.) from the piece of tubing (6 in Figure 2) are shown as 2 and 4 in Figure 1. The inner diameter of the fitting is not made narrower by the rubber washer (Figure 1). Figure 3 shows that the pipet does not have to be pressed exactly vertically onto (not into) the tubing washer to make tight contact and allow the bulb to provide suction.

The compatibility of these filler ports is excellent with transfer pipets from 0.5 to 50 mL all accommodated by the 1/4 in. NPT end with the larger bulb. The smaller bulb with the 1/4

in. fitting worked fine with pipets 20 mL and smaller. In general, students quickly learn how tightly to press the pipet to the rubber washer to get good suction and become adept in filling the pipet. The student can then quickly withdraw the bulb fitting and hold the solution volume with finger pressure before setting the meniscus at the mark. Some representative student comments follow: “The pipet bulbs were sometimes worn and the plastic pipet tips were loose”; “The plastic tips were often bent and would not fit the smaller pipets”; “The new bulbs work quite nicely with the smaller pipets and allow for better suction”. The Kynar plastic fittings are inexpensive (around a few dollars each), are inert, and will not break; the rubber tubing to make the washers is also only a few dollars a foot and can be easily replaced when necessary in the fitting.

We expect that many universities, colleges, and high schools still have a stockpile of glass pipets and rubber bulbs. This easily modified fitting in particular should make this equipment useful again in facilitating the teaching of analytical chemistry quantitative and instrumental analysis as well as selected first year chemistry experiments.

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Notes

The authors declare no competing financial interest.

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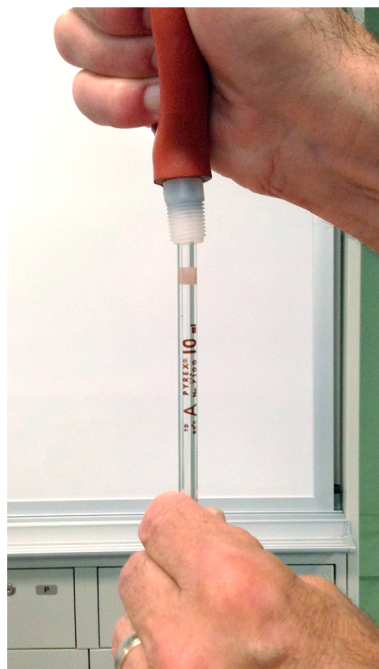


Figure 3. Use of the 2 oz (60 mL pipet capacity) pipet bulb with the NPT filler port and a 10 mL transfer pipet.