

An Economical, Reusable Extraction Tube for the Determination of Cation Exchange Capacity in Soils

A cost-effective, reusable extraction tube for use with the SampleTek mechanical vacuum extractor has been developed by SampleTek of Mavco Industries (www.sampletek.com) in cooperation with the Soil Survey Laboratory (SSL), USDA. The tube is used for the routine determination of cation exchange capacity (CEC) and extractable cations by standard methods found in Soil Survey Investigations Report No. 42; methods 4B1b1a1a1a-b1 and 4B1a1b1-4a-b1.

Since 1978, the SSL of the National Soil Survey Center has measured CEC and extractable cations using a vacuum extraction protocol. Vacuum extraction was designed to be an efficient, reliable process for execution of certain laboratory production methods involving extraction or selective dissolution.

Vacuum extraction is illustrated in Fig 1. The three main portions of the tube assembly are the extractant reservoir tube, the extraction tube, and the extraction syringe. Both the extractant reservoir tube and extraction syringe are re-usable items. The extractant reservoir tube is filled with the extractant solution, with which the soil will be leached. The extraction tube houses the soil sample, placed on top of the filter material to keep soil from entering the extract. As the plunger of the extraction syringe is slowly withdrawn by the mechanical vacuum extractor mechanism, a negative pressure is created, pulling the liquid from the extractant reservoir tube through the soil in the extraction tube, and then into the extraction syringe.

Since 1996, the SSL has employed a disposable extraction tube, illustrated in Fig 2. Earlier, reusable extraction tubes employing filter pulp were abandoned by the SSL because finding an economical source for sodium-free pulp became increasingly burdensome when traditional sources of sodium-free pulp changed their production processes.

An alternative, re-usable extraction tube has been developed. The advantage of a re-usable extraction tube is that, with exception of the filters, all parts can be re-used, reducing waste and costs.

The reusable SampleTek extraction tube has two main parts: the sample cylinder and filter adapter (Fig. 3). After use, the filter adapter is disconnected from the sample cylinder and the filter pads are discarded; the sample cylinder and filter adapter are washed and dried for re-use with new filter pads. The two filters used with the reusable cylinder and filter adapter are a polyester pad and a polyethylene frit which are similar to those used in the disposable tube. The polyester filter pad provides a distribution space between the sample and the final filtration polyethylene filtration frit, thus minimizing blockage. The pad sits on top of the frit in the filter adapter. The sample cylinder presses down against the pair of filters, holding them in place. Vacuum extraction utilizing the re-usable extraction tube is illustrated in Fig. 4.

Statistical comparison of results from the re-usable versus the disposable extraction tubes revealed no important differences in performance between the two designs, and the SSL has instituted using the re-usable extraction tube for routine determination of cation exchange capacity (CEC) and extractable cations.

Trade names are used in this document solely for the purpose of providing specific information. Mention of a trade name does not constitute a guarantee of the product by the USDA, nor does it imply an endorsement by USDA.

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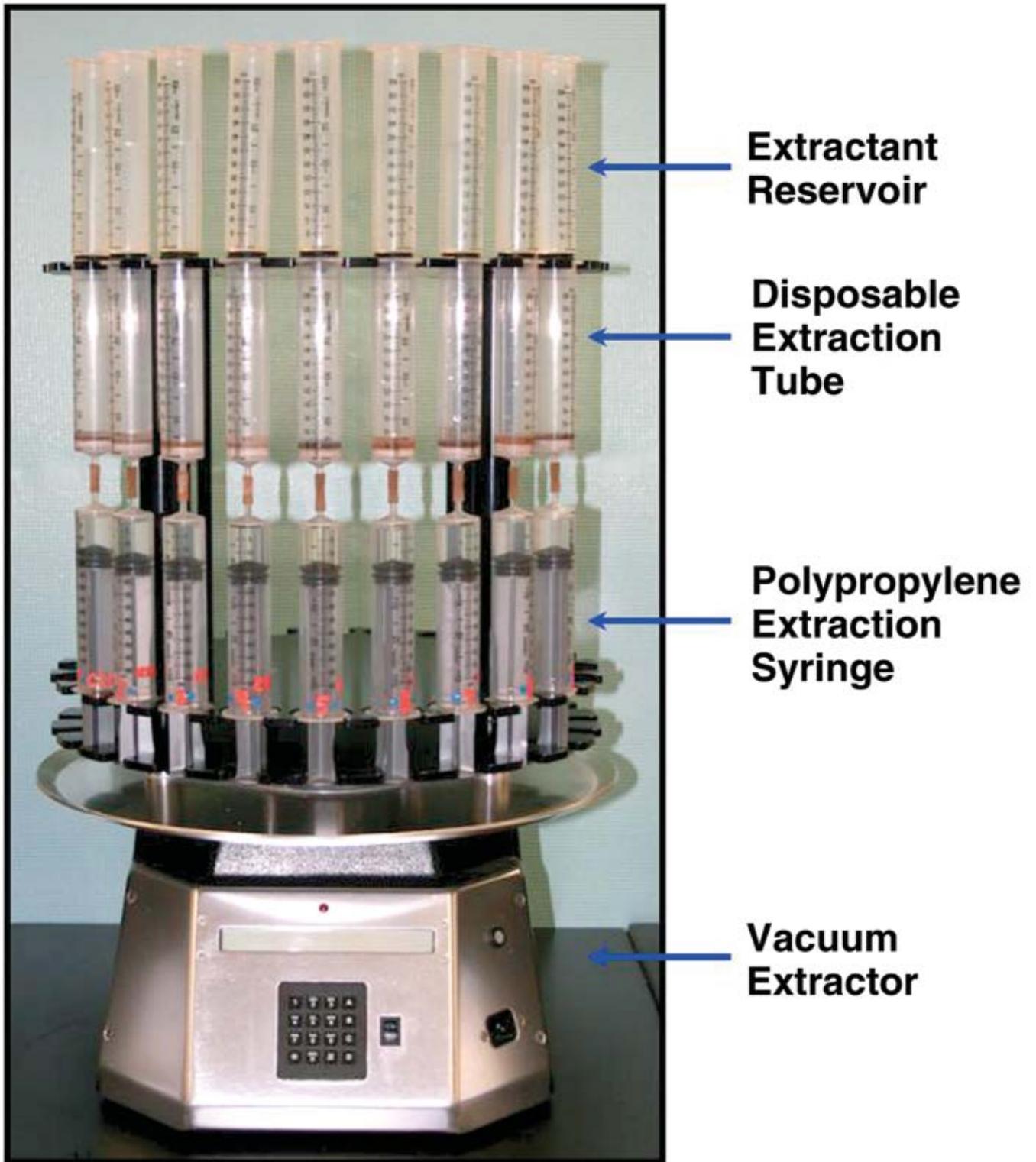
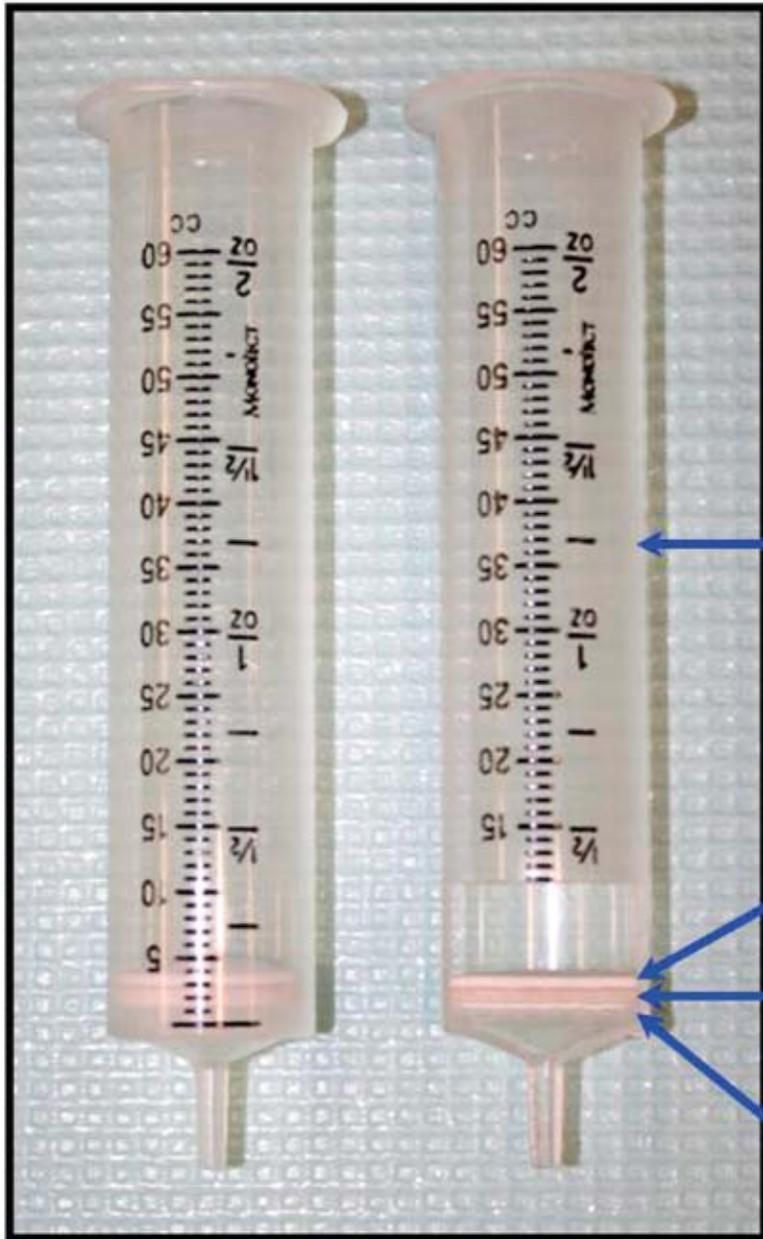


Figure 1 Vacuum extraction utilizing disposable extraction tube



Polypropylene Syringe Barrel

Polyethylene Frit

Polypropylene Depth Filter Pad

Polypropylene Membrane

Figure 2 Disposable extraction tube

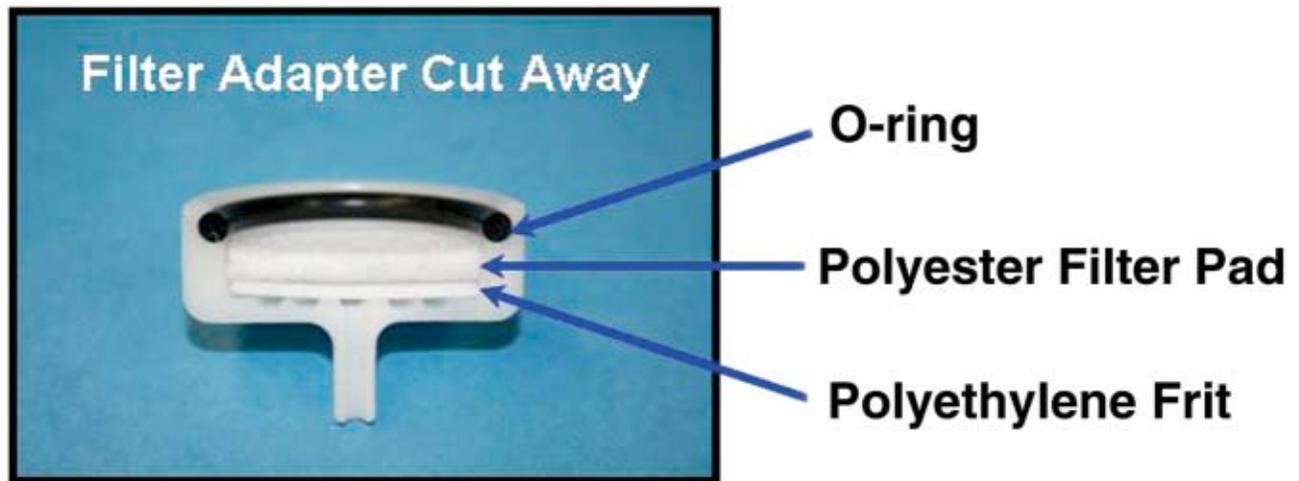
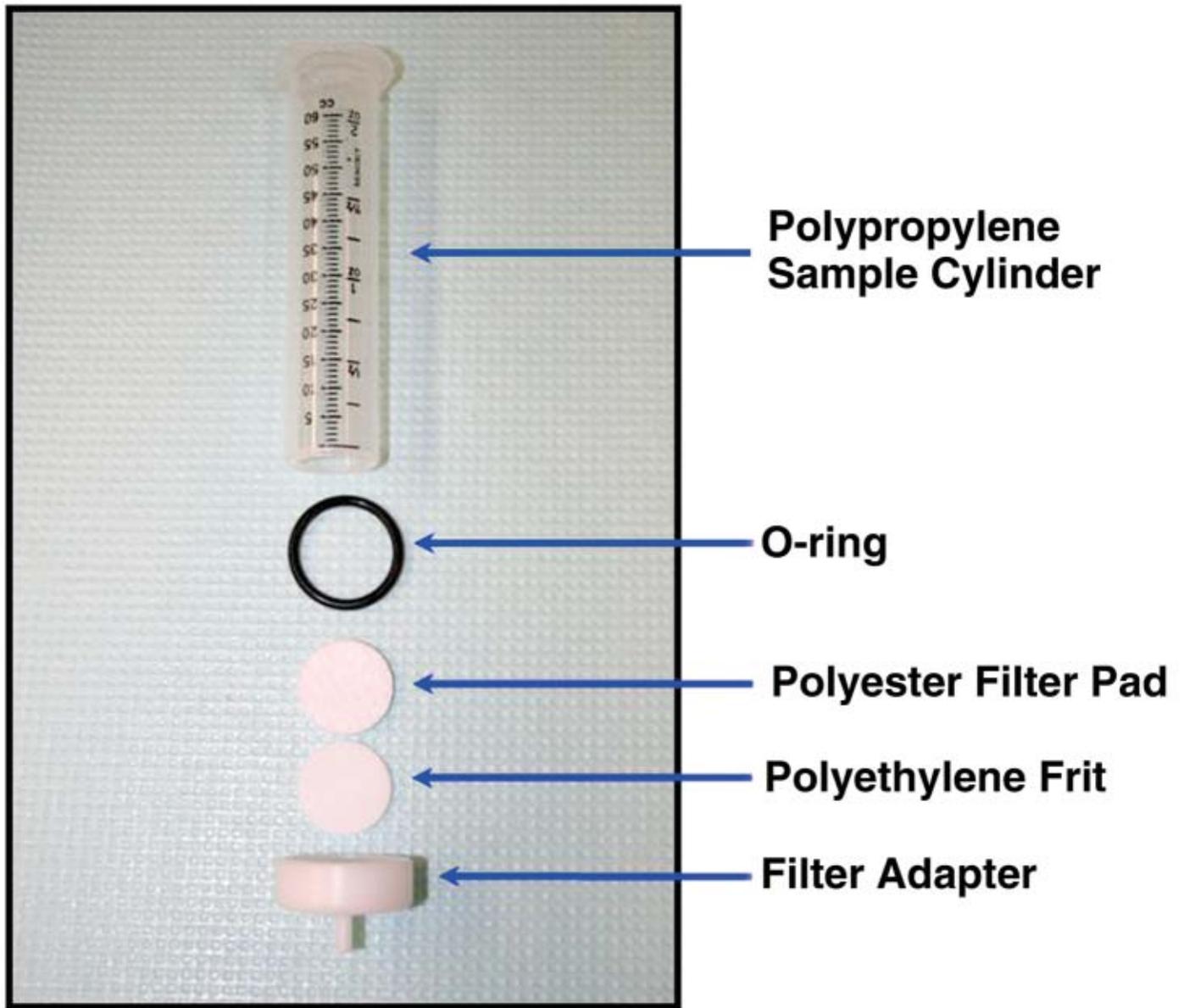


Figure 3 Re-usable extraction tube

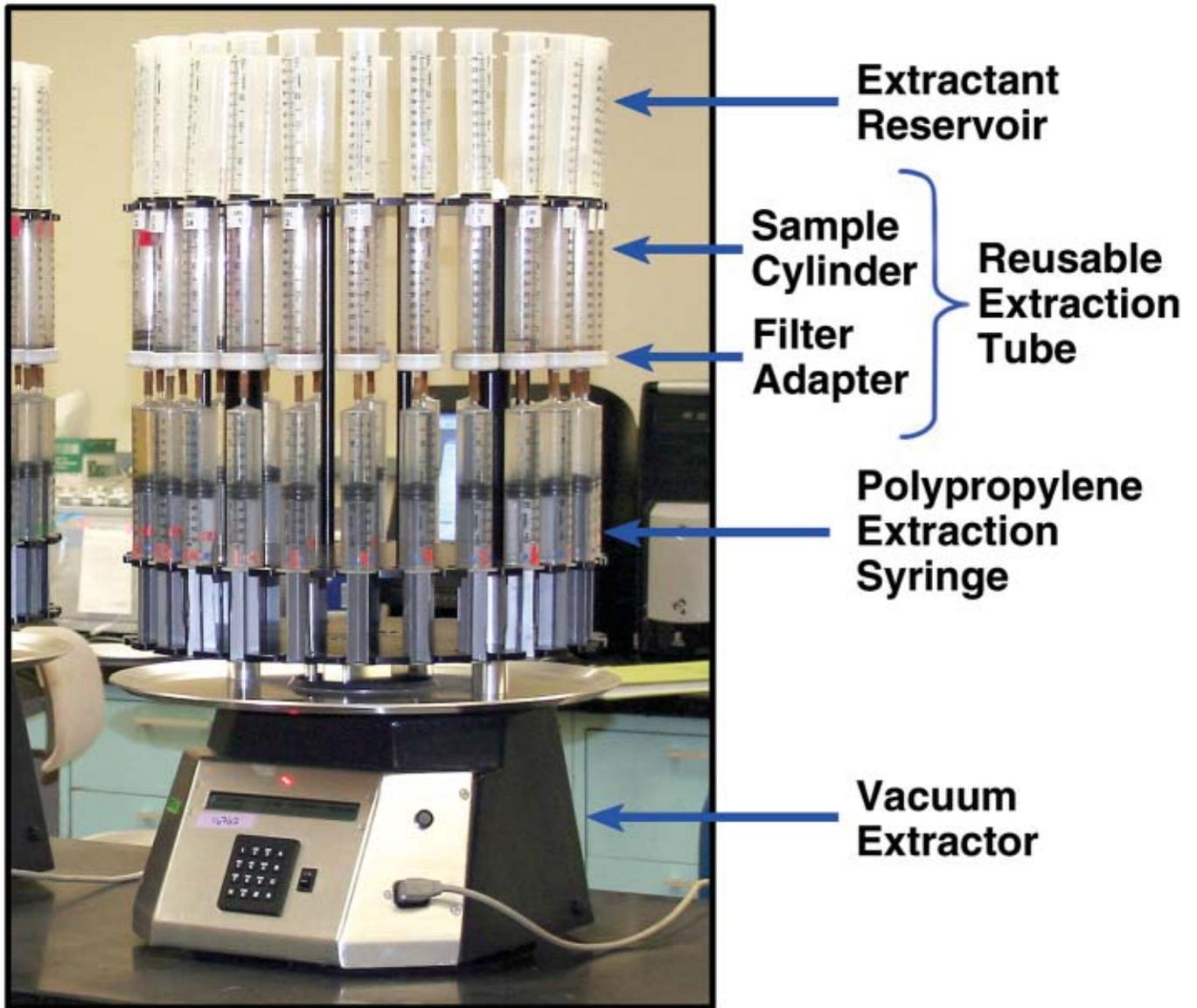


Figure 4 Vacuum extraction utilizing re-usable extraction tube

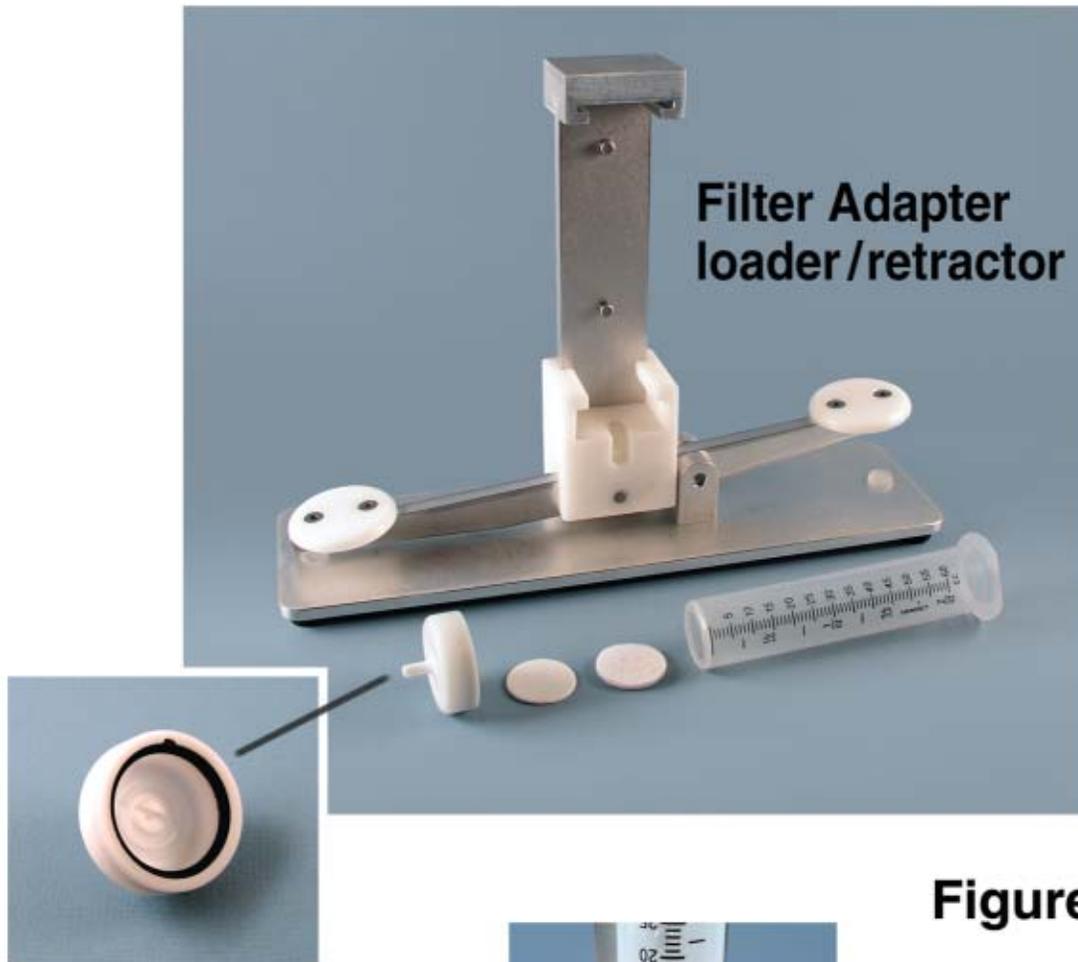


Figure 5



Adaptor Loaded



Adaptor Retracted