A Sequential Sampling System For Spectrophotometers

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A simple arrangement is described for filling, emptying, and rinsing an absorption cell without removing it from the spectrophotometer or opening the cell compartment. Specifications required for the cell, tubing, stopper, and valve are presented. Although the installation is described for a Beckman DB spectrophotometer, the device can be used with other instruments.

The frequent handling of absorption cells while making measurements with a series of samples in a spectrophotometer is inconvenient and conducive to errors from marring cell windows, misalignment of cells, or permitting gross temperature changes in the cell compartment. To obviate these problems, a simple system was devised whereby the sample cell could be filled, emptied, and rinsed without removing the cell or opening the cell compartment.

Materials

A diagram of the sequential sampler is shown in Fig. 1 with specifications for the parts required. The tubing first used in the cell was stainless steel hypodermic-needle tubing, 18 gauge, which protruded up through the holes in the stopper and was subsequently joined to the Tygon tubing. The long metal tube was bent to fit against the wall of the cell. This arrangement worked well but use of the system was restricted to solutions which would not react with the metal tubing. Glass tubing small enough to fit through the holes in the stopper would be too fragile to be practical. Although Teflon tubing is inert and simple to install, there is the problem of bringing it to the bottom of
the cell while keeping it out of the light path. This problem was solved by using a small piece of glass tubing bent as shown in Fig. 1. It should be emphasized that the glass tubing is not attached to the stopper; it is merely used as a guide to hold the Teflon tubing in position against the side of the cell. This arrangement permits the system to be used for almost any reagent.

**Procedure**

The system operates as follows: With the valve in Position 1 (Fig. 2) and the sample tube immersed in the sample, the cell fills; the other short tube in the cell acts as an overflow and provides automatic leveling. When the valve is moved to Position 2, a reading may be made. Position 3 results in emptying of the cell with the sampling tube acting as an air intake. The long Teflon tube in the cell should be cut off at an angle and should touch the bottom of the cell; this permits complete and rapid emptying of the cell. With the sampling tube immersed in an appropriate rinse solution, the No. 4 position allows for rinsing.
Figure 3 shows the system installed in a Beckman DB spectrophotometer. The valve was fastened to the instrument case with the mounting assembly provided with the valve plus two 1/4-in. spacers. The sampling tube was brought out through a small hole drilled in the side of the case; it was also found convenient to attach a 10-cm. length of glass tubing, 1-mm. I.D., to the end of the sampling tube. The other tubes exit as shown and the soft bumper under the cell compartment lid acts as a cushion for the tubing while sealing the compartment.

![Sequential sampling cell installed in a Beckman DB spectrophotometer; cell compartment lid open.](image)

The salient points of the system are:
1. It obviates the need for pouring solutions into and out of absorption cells.
2. It eliminates the need for handling cells, thereby reducing breakage and eliminating errors due to improper cell positioning and marring of the optical surfaces.
3. The cell compartment need not be opened during a series of analyses. This is especially advantageous when enzyme reaction rates are being measured and constant temperature must be maintained.