Microextraction for Paper Chromatography

The dimensions of plant analysis have changed very much since the invention of paper chromatography [R. Consden, A. H. Gordon, A. J. P. Martin, *Biochem. J.* **38**, 224 (1944)]. This paper describes a microextraction method with which serial extractions can be made from the very small amounts of tissue actually needed for paper chromatography.

An extraction apparatus of the Soxhlet type cannot be made very small because the capillarity of the glass tubing prevents proper working. Figure 1 shows an apparatus that uses the refluxing principle of the Soxhlet; however, the construction of this apparatus is simpler. The condensing solvent causes a continuous flow from the condenser through the side arm that contains the tissue pieces and back to the boiling solvent in the flask. The capacity of the flask is about 5 milliliters. The capacity of the side arm can be adapted to the size of tissue by the choice of the position (Fig. 1). To close flask and side arm, ground glass stoppers are the best; if cork stoppers are used, they must be wrapped with aluminum foil to prevent extraction of material from the cork. To prevent delayed boiling (bumping), the apparatus has to be shaken a little. The flask should contain one glass boiling ball, especially with the use of solvents with a high heat of vaporization such as water.

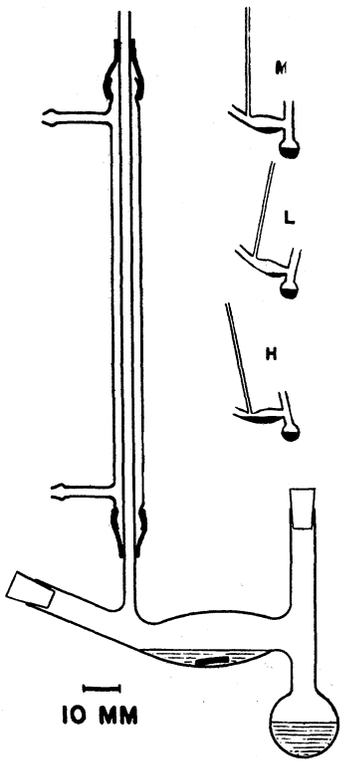

Fig. 1. Extraction apparatus. Positions for medium, low, and high capacity of side arm: *M*, *L*, and *H*, respectively.

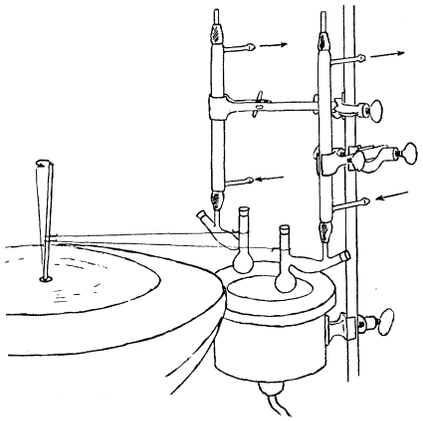

Fig. 2. Assembly for two simultaneous extractions.

Figure 2 shows the assembly for two simultaneous extractions. On the left side there is an old centrifuge running on slowest speed. A wooden stick is mounted slightly eccentric to the axis. The flasks are connected with the wooden stick by a thin wire. The slight back and forth movement of the flasks is actually a rotating one in an arc around the condenser jacket, which is fixed to the support. The flask, the side arm, and the inner tube of the condenser are one piece, the latter being connected with the condenser jacket by short pieces of rubber tubing. Five of these sets, consisting of two extractors with one heater on a support, can be placed around the centrifuge; this permits ten simultaneous extractions.

The whole assembly having been set up, the tissue is introduced into the side arm. Sufficient solvent should be pipetted into the side arm so that it runs over into the flask and fills it to the desired level (Fig. 1).

When the extraction is finished, the solution has to be concentrated either by turning the apparatus into position *H* (Fig. 1) or by taking the solvent out of the side arm with a pipette. The condensing solvent now does not reflux into the flask but stays in the side arm. When the solution in the flask has been concentrated (this moment is very critical), the apparatus is turned around the condenser (condenser jacket fixed) off the heater. Condensation of the solution still vaporized will clean the wall of the flask as soon as the apparatus is removed from the heat. The concentrated solution can now be transferred onto the paper chromatogram. The extractors can then be pulled out of the condenser jackets and replaced by new ones. During the next extraction, the first set can be cleaned. Therefore only one set of condenser jackets, but two sets of extractors, are required for continuous extraction.

We have been using this extraction method for several months in our laboratory to extract sugars with pyridine from 30-milligram (fresh weight) samples of plant tissue for paper chromatographic analysis. Extraction is complete after about 1 hour.

MARTIN H. ZIMMERMANN
Harvard University, Cabot Foundation, Petersham, Massachusetts

11 March 1955

Slide Projection from Lecture Table

For several years in our department, we have employed with satisfaction a device (Fig. 1) that enables a lecturer to project his own slides from the lecture table. Although we have some reservation concerning the originality of this arrangement, we have not seen it described by others. A schematic view of our original experimental installation has been published [*Southern Chemist* **13**, 73 (1953)]. Inasmuch as this device has interested many visitors to our department, we have decided to describe it for a larger audience.

We project the slide to a mirror suspended just below the ceiling of the room, the image being reflected to a screen behind the lecture table. If we employ the standard 3¼ by 4-inch slide in a Spencer delineascope with a lens of 14-inch focal length and with distances between lantern, mirror, and screen as shown, the image on the screen has outside dimensions of 56 by 71 inches. With a good quality plate glass mirror there is no appreciable distortion or light absorption.

The size of the exposed surface of our framed mirror is 24 by 29 inches. Local conditions determine the method of suspending the mirror from the ceiling. In our new building, we were able to obtain an excellent installation by having a gal-

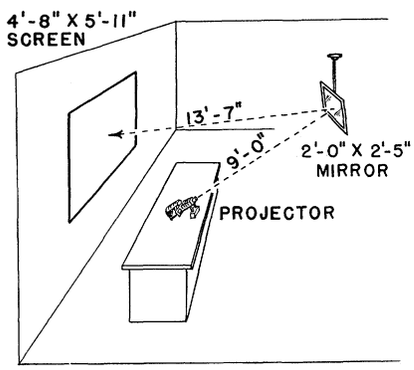

Fig. 1