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Thin-layer chromatography in disposable plastic bags for radioactive and non-radioactive substances*

Over the past ten years, a variety of glass developing tanks have been employed for different procedures of thin-layer chromatography to accommodate glass plates or plastic sheets of different sizes, shapes and thicknesses. The tanks most commonly used are standard rectangular chambers. Since the last few years, sandwich-type developing chambers of different designs[1-3] are being used due to several inherent advantages over rectangular tanks. The sandwich-type developing chambers are also utilized for horizontal, descending and continuous flow operation of thin-layer chromatography.

Now, a new approach of thin-layer chromatography (TLC) in an inert, transparent, resistant to most organic solvents, mylar-type polyester plastic bag is described. A wide variety of rectangular and sandwich-type glass chambers employed for TLC can be easily substituted by these plastic bags. The plastic bag can accommodate all types, sizes and shapes of glass plate or sheet for TLC with the use of a plate or sheet holder of appropriate dimension. TLC in a disposable plastic bag is simple, convenient and versatile.

TABLE I

SPECIFICATIONS OF TYPE, SIZE AND COST OF COMMERCIALLY AVAILABLE BAGS

Type	*Size (in.)*	*Cost* (Dollar cents)*
Small	4 × 6	4
Medium	6.5 × 8	5
Large	8 × 12	10
Extra-large	9.5 × 16	20

* Approximate cost per bag.

Materials

Equipment for thin-layer chromatography in bags. A few simple pieces of equipment are needed, *viz.* (a) plastic bags made of "scotchpak" brand heat-sealable polyester film, available commercially (Kapak Industries, Inc., Minneapolis, Minn. 55416), in four different sizes (Table I). Bags of larger sizes are available on request; (b) single or multiple plate or sheet holders made of stainless steel or of heavy duty aluminum foil (a few types of plate holders, Figs. 3 and 4, are available commercially, Kensington Scientific Corp., Oakland, Calif.); (c) "scotch" brand polyester film tape (No. 850, width 1 in., 3 M Co., Minn.); (d) Hemostat-type special forceps (Gavin Miller forceps, No. 10L-430, Lawton Co., New York); (e) a wooden or lucite stand (Fig. 2).

* A preliminary report was presented at the National Meeting of the American Chemical Society, Atlantic City, N.J., September, 1968.

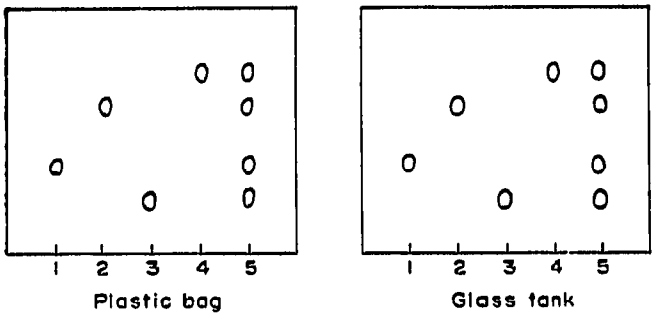

Fig. 1. Comparison of TLC in plastic bag *vs.* glass tank. 1 = Methadone; 2 = methadol; 3 = = normethadol; 4 = acetylmethadol; 5 = mixture of 1, 2, 3 and 4.

Methods

Sandwich-type developing chambers. A single plate holder of appropriate dimension (Fig. 2) is placed into a plastic bag of suitable size. The plastic chamber thus formed is kept upright by placing in the wooden or lucite stand (Fig. 2). The solvent is pipetted into the groove of the plate holder and/or on the bottom of the bag itself. The coated glass plate or sheet with spotted samples is inserted into the plastic chamber with edges resting both sides in the groove of the plate holder. The plastic chamber at the top, now, is sealed either by clamping the open ends between the heated jaws of the forceps for a second, or with the use of scotchpak tape, and the plate is developed in the usual way. (The jaw sections of the forceps are heated intermittently over a bunsen burner roughly to 120–130°C for good sealing. Also the locking mechanism of the forceps is cut out and the slight curve of the jaws is straightened in the machine shop for easy and even sealing.)

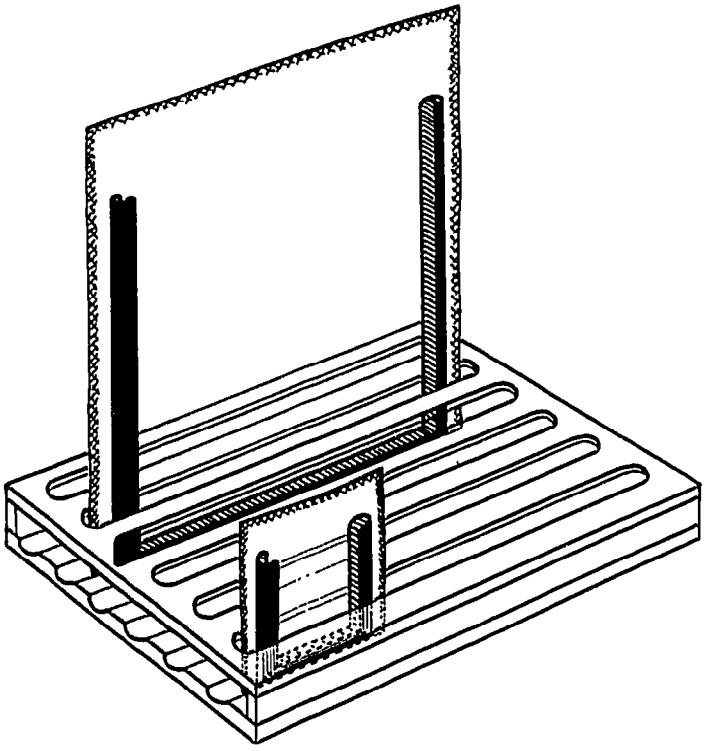

Fig. 2. Lucite stand showing two sizes of TLC plates in plastic bags with stainless steel holders.

Rectangular-type developing chambers. A stainless steel rectangular support rack or multiple plate holder of desired dimensions similar to Figs. 3 and 4 can be made in the machine shop. The support rack or multiple plate holder is placed in large plastic bags of suitable size. The rest of the procedure is similar to the sandwich-type system mentioned above.

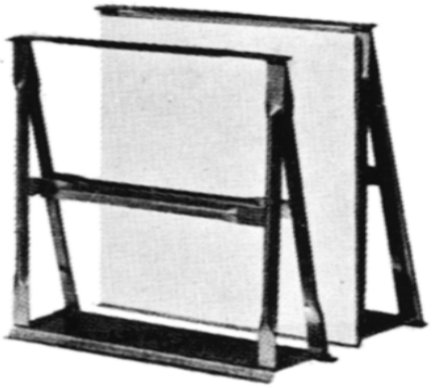

Fig. 3. Stainless steel A-frame rack.

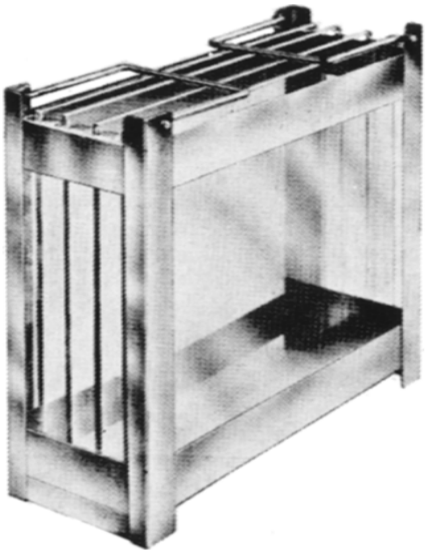

Fig. 4. Stainless steel rectangular rack.

Results and discussion

Thin-layer chromatography of a drug in plastic and glass chambers. Fig. 1 shows TLC of methadone (an analgesic drug) and its derivatives in a solvent system of butanol–ethyl acetate–ethanol–ammonia (7:4:1:0.5), on a 66 × 66 mm square glass plate in two types of chambers. Identical results are obtained in both chambers.

The use of disposable plastic bags has been found to be very convenient for sandwich-type TLC. The principal advantages over conventional all glass or metal sandwich-type chambers are the virtual elimination of costly and complicated glass developing chambers, equipment and accessories.

The use of plastic bags can simplify TLC in serveral aspects, *viz.* (a) it is simple, convenient and versatile in setting up all types of developing chambers; (b) the sandwich-type system in bags is much better than conventional glass chambers by its simplicity, compactness, and its disposal after use; (c) it is equally advantageous for TLC of radioactive and non-radioactive substances because washing, breakage, isotopic contamination, and cross contamination problems of glass chambers do not arise; (d) it is elegantly economical in space and cost.

The work on different designs of sandwich-type (horizontal, descending and continuous flow) and rectangular-type chambers made of disposable plastic bags is in progress. After completion of this work, it will be reported in detail elsewhere.

Note by the editor

Development of *paper chromatograms* in plastic bags is a well known procedure and plastic bags for this purpose are commercially available.

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Sample application to silica gel layers via kieselguhr layers

Manually applying a large sample to a thin layer, as a narrow straight line, is both difficult and tedious. However, the problem may sometimes be alleviated by a simple means. If for example, a proposed separation takes place on a layer of silica gel, which adsorbs strongly, it is expedient to apply the sample quickly and with little care to a band of weakly adsorbing kieselguhr spread next to the silica gel (*i.e.* a silica gel–kieselguhr twin layer) whence the sample is eluted into the silica gel by the developing solvent. Since the sample is adsorbed only weakly by kieselguhr it may well be eluted as a narrow line at the solvent front. Irrespectively, it will condense as a narrow line at the start of the silica gel because it is eluted faster through the kieselguhr than through the silica gel. The sample may be applied quickly and without care to the entire area of kieselguhr (*i.e.* approx. 3×20 cm) and yet the line of sample semi-automatically applied to the silica gel is narrower and more even than can ever be achieved by manual application.

The technique depends on the contrast in adsorbing powers of the two media, and therefore to achieve maximum effect the adsorption by commercial kieselguhr was minimized through treatment with hydrochloric acid to remove iron and calcium sulphate binder. The method is illustrated by the separation of Stahl's dye mixture on kieselguhr–silica gel twin layers.

Experimental

To remove the iron (about 0.05 % by weight) and binder from Merck Kieselguhr G 500 g were mixed with 1 l of 18% HCl and the mixture was allowed to stand for a few hours. The residue was separated from the yellow-green supernatant liquid in a Buchner funnel and washed with distilled water until neutral. It was then washed successively with 300 ml ethanol and 300 ml benzene and dried at 120° (ref. 1).