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Short Communication

New lateral reservoir flash chromatography system for the expeditious preparative purification of organic compounds

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Abstract

A flash chromatography system which incorporates a lateral solvent reservoir attached to the main column is described which facilitates the preparative purification of organic compounds. This apparatus allows introduction of the eluting solvent into the column without dismantling the air-pressure inlet adaptor, and with minimal disturbance of the stationary phase.

1. Introduction

Flash chromatography is presently used routinely in organic chemistry research laboratories for the preparative purification of organic compounds [1]. Essentially it is a medium-pressure short-column chromatography system with moderate resolution, where the pressure is provided by an air-pump or gas cylinder. The main disadvantage of flash chromatography is that the apparatus requires constant disassembly and reassembly of the air-pressure inlet adaptor in order to introduce the eluting solvent into the column, which is both tedious and time consuming since the adaptor, which has to withstand positive air-pressure (ca. 0.5 atm), is commonly held in place with springs, clamps, or screw-thread devices. Furthermore, great care has to be taken when pouring solvent into the top of the column so as not to disturb the bed of adsorbent which forms the stationary phase, otherwise poor resolution results. The need to constantly dismantle the air-pressure inlet adaptor prompted the design of a system which would allow introduction of the eluting solvent without this inconvenience.

2. Results and discussion

The apparatus described here is a refinement of flash chromatography whereby solvent is introduced into the side of the column from a lateral solvent reservoir (Fig. 1). This permits the eluting solvent to be introduced into the column without disassembly of the air-pressure inlet adaptor. Consequently the preparative purification of organic compounds by this system is more operationally convenient and more rapid than conventional flash chromatography. The essential feature of the apparatus is that a solvent reservoir is attached to the side of the column so that the inlet is above the height of the stationary phase, with a tap (T_2) fitted at the

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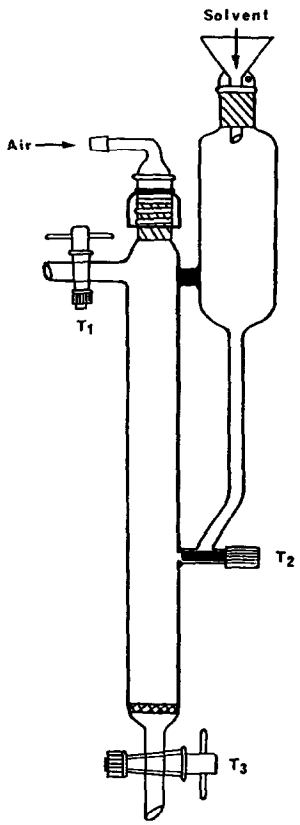

Fig. 1. Lateral reservoir flash chromatography apparatus.

reservoir to column inlet. A tap (T_1) is also required at the top of the column to release air-pressure from the pump. The solvent reservoir is configured so that its header volume is greater than that of the column elution volume to allow sufficient solvent header pressure to refill the column.

An important additional advantage of this means of introducing the eluting solvent from a lateral reservoir is that the Rotaflo side-inlet tap T_2 allows solvent to be introduced into the main column in a controlled fashion. Consequently there is minimal disturbance of the silica bed which forms the stationary phase, and this feature ensures optimal resolution is achieved consistently. In order to further examine this beneficial feature an orange coloured solution of azobenzene in diethyl ether was delivered from the lateral reservoir, after preparing the column using colourless hexane as loading solvent. The orange diethyl ether solution entered the main column as a distinct layer above the hexane, and only marginal mixing of the solvents at their interface was observed.

Gradient elution is also more convenient since the solvent polarity can be easily varied in the solvent reservoir. Variable or fixed aliquots can also be dispensed from the column, as required. Additionally the whole purification can be performed in less time than with conventionally flash chromatography since the next aliquot of solvent is introduced into the reservoir whilst the previous aliquot elutes from the column, and the column is then refilled simply by turning two taps.

3. Experimental

The apparatus consists of a column which incorporates an integral lateral reservoir as shown in Fig. 1, fitted with a Rodaviss air-pressure inlet adaptor and vented solvent filling funnel[a]. Air-pressure is provided by a Hi-Flow piston air-pump, obtainable from Merck (BDH Laboratory Supplies) or Fisons Scientific Equipment.

3.1. General procedure, column preparation

The bottom tap T_3 can be left open during the entire operation. With taps T_1 and T_2 closed, and the top of the column open, the main column is prepared in the usual fashion [1]. Typically, for a normal-phase purification using silica gel as the stationary phase (preferably Merck 15111), this is done by adding the silica gel through the top of the column as a slurry in a non-polar loading solvent, so that the final height of the compressed silica bed is at least 1 cm below T_2. This is then followed by the material to be purified, which is usually preadsorbed onto

[a] The complete apparatus is available as the Quick-Sep System from Radleys, Shire Hill, Saffron Walden, Essex CB11 3AZ, UK, under licence from Cancer Research Campaign Technology Ltd.

silica by evaporation from dichloromethane and then also added as a slurry in the loading solvent. The Rodaviss air-pressure inlet adaptor is then fitted, the air-pump switched on, and the loading solvent is eluted from the column down to tap T_2, then tap T_1 opened to release the air-pressure. As with conventional flash chromatography the top of the silica bed should not be allowed to run dry.

3.2. Column refilling

The lateral reservoir is filled with eluting solvent, and tap T_2 opened. The eluting solvent then enters the main column from the lateral reservoir, under gravity pressure, until it reaches just below the height of T_1, then T_2 is closed (Fig. 2).

3.3. Column elution

As soon as T_1 is closed the pump air pressure forces solvent through the stationary phase and the eluent collected in a receiver flask. Once the solvent reaches the level of T_2 the tap T_1 is opened to release the air-pressure, and the column is refilled again as previously described. Whilst the solvent from the main column is eluting the lateral reservoir is conveniently refilled, changing the solvent polarity as required, ready for the next refill. The column refill/elution modes are then repeated until the desired component elutes from the column. With practice these operations are performed swiftly and easily.

In summary, a new flash chromatography system that allows the eluting solvent to be introduced into the column without dismantling the air-pressure inlet adaptor and with minimal disturbance of the stationary phase is described which facilitates the preparative purification of organic compounds.

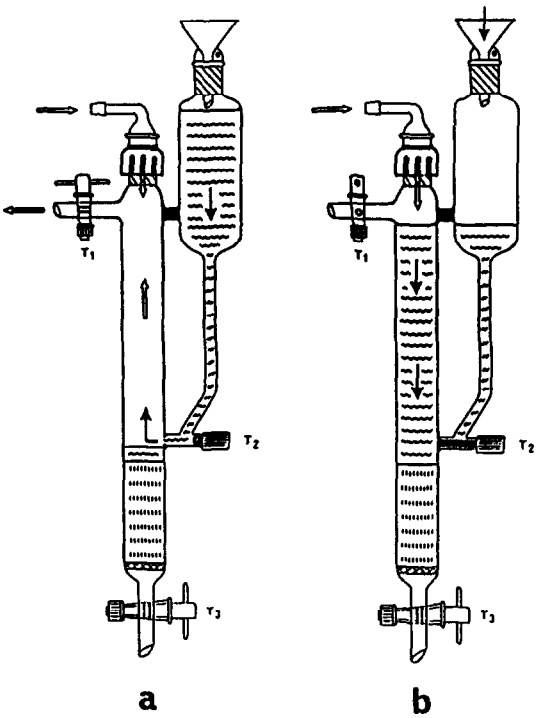

Fig. 2. Column operation; (a) refill mode and (b) elution mode.

References

[1] W.C. Still, M. Kahn and A. Mitra, *J. Org. Chem.*, 43 (1978) 2923.