can deal with more than 1 g of a single substance. Using a nominal 5 % nitrogen in argon as an example of a mixture, our limits of detection of a single substance are about 0.5 mg to 100 mg under the experimental conditions given for Figs. 1 and 2. The exact amount increases with the retention time.

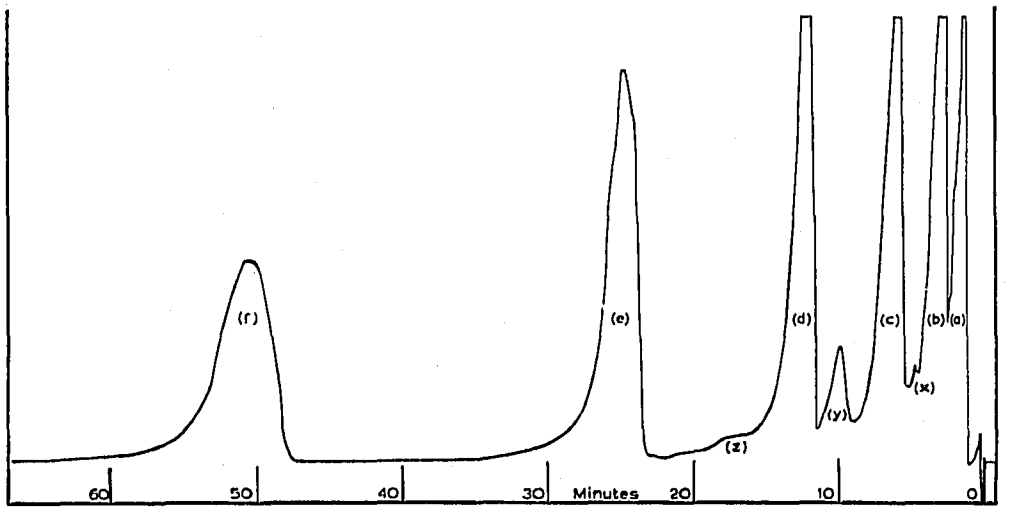

Fig. 2. Chromatogram of a 110 mg mixture of normal alcohols. (a) *n*-propanol; (b) *n*-butanol; (c) *n*-pentanol; (d) *n*-hexanol; (e) *n*-heptanol; (f) *n*-octanol; (x), (y) and (z) impurities.

Fig. 2 shows a separation of a 110 mg mixture of equal quantities of *n*-propanol, *n*-butanol, *n*-pentanol, *n*-hexanol, *n*-heptanol and *n*-octanol. The carrier gas contained a nominal 5 % of nitrogen in argon.

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Paper chromatography of *Withania somnifera* alkaloids

Although *Withania somnifera* have been previously studied[1–3] no simple method has been reported in the literature for the detection and separation of its alkaloidal components.

In a previous paper we already showed the possibility of this separation, by employing a circular chromatographic technique, with which at least five of the alkaloidal components could be detected[4].

On the basis of these results and by employing paper disks with suitable diameter, we succeeded in separating and observing all eight components at the same time.

With our technique it is sufficient to work with 50 g of powdered roots which is the part of the plant richest in alkaloids.

The roots were extracted by percolation with distilled water, until the test with Dragendorff's reagent was negative. The brownish percolate was concentrated and adjusted with aqueous ammonium to a high alkaline pH value. The free bases were extracted with chloroform in a separating funnel and the chloroform solution was then evaporated to dryness.

The bases were again extracted as hydrochlorides by means of butanol saturated with 10% HCl/H_2O (v/v), and placed on the centre of a Whatman No. 1 paper disk with a diameter of 30 cm, after which the solvent was evaporated.

The developing solvent that gave the best results was water-saturated butanol–ethanol (95:5 v/v), which was carried to the centre of the disk by means of a clean wool thread.

After development, the dried paper chromatogram was sprayed with Dragendorff's reagent. In this way, the alkaloids appear in the form of eight concentric

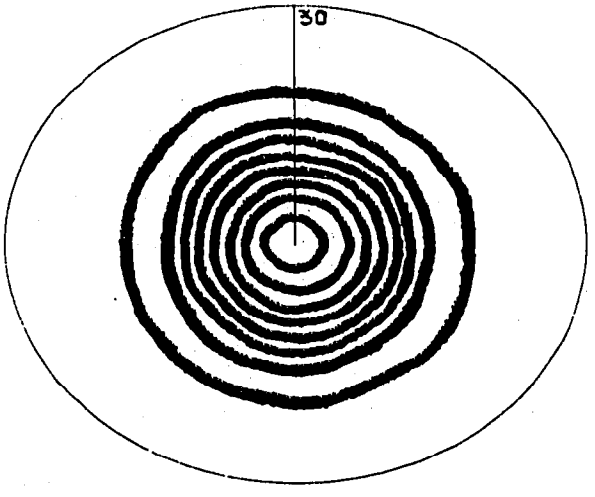

Fig. 1. Circular chromatogram of the eight alkaloidal components.

TABLE I

Hydrochloride of alkaloid	R_F
I	0.67
II	0.49
III	0.40
IV	0.35
V	0.30
VI	0.26
VII	0.20
VIII	0.10

rings with red colours of varying intensity on a pale orange background. A map of this chromatogram, is shown in Fig. 1. The R_F values are given in Table I.

Further studies indicated that this very simple technique can be employed for the separation and detection of the alkaloidal constituents of other plant extracts.

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