



pronounced resemblance in fine structure of the β -bands indicates a close electronic relationship between the two hydrocarbons; (ii) the very small shift in wave-length of the β -band group of *bis-peri*-phenylenenaphthalene in relation to that of fluoranthene is probably due to almost complete lack of interaction of the π -electrons of one phenylene ring-system with those of the other; (iii) on the other hand, the *p*-bands of *bis-peri*-phenylenenaphthalene are shifted considerably towards the red end of the spectrum.

It is of interest to compare these spectra with that of 5:6:11:12-diphenylenetetracene (II)². The first *p*-band in the spectrum of (II) occurs at 6100 Å., whereas that of *bis-peri*-phenylenenaphthalene (I) is at 4100 Å.; this shift corresponds to an increase of about two anellation units³, thus harmonizing with the relative data for naphthalene and tetracene. It follows that *p*-absorption in *bis-peri*-phenylenenaphthalene and in fluoranthene is located in the naphthalene and in (II) in the tetracene ring system present in these hydrocarbons.

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Permanganate as a Spraying Reagent for Amino-acids on Paper Chromatograms

POTASSIUM permanganate (1 per cent solution, containing 2 per cent sodium carbonate) has been recommended¹ as a spraying reagent for detecting carbohydrates on paper chromatograms. When testing this reagent on a chromatogram irrigated with butanol/acetic acid and carrying amino-acids as well as carbohydrates, an anomalous spot was observed, which was traced to methionine. It has now been found that if a paper chromatogram be lightly sprayed with the permanganate reagent, methionine, tryptophane, tyrosine and (more weakly) proline and histidine immediately appear as yellow spots on a red background. As the paper dries the colour difference tends to disappear, leaving the spots and background different shades of brown. The spots should therefore be marked at once. Cysteine also gives a spot, but does not normally occur on a paper chromatogram². Threonine, hydroxyproline, lysine and glycine show up on standing a few minutes. Other amino-acids normally occurring in protein hydrolysates do not show at the concentrations encountered in paper chromatography.

The reaction is especially sensitive to methionine, and may be of value as a confirmatory test for this amino-acid. The reagent is not applicable when phenol has been used as irrigating solvent.

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Electrolytic Detection of Alkali Salts on Filter Paper

SINCE the work of Lederer¹ and Arden *et al.*², the separation of inorganic cations by paper chromatography has been developed rapidly. The alkali salts, however, do not appear to have been studied, because of the difficulties of detection of alkali cations on the filter paper. We have recently discovered a simple electrolytic method of detecting the alkali and alkaline earth cations, and have studied the paper chromatography of the alkali salts.

The principle of this method is the cathodic production of alkali hydroxides by the electrolysis of aqueous solutions of alkali salts. The procedure is as follows. The paper strip is dried to drive off the developing solvent, and the saturated alcohol/water solution (1:1) of phenolphthalein is sprayed on it. Then the paper is electrolysed by D.C. (6 V., about 5 sec.), being held between flat graphite electrodes (cathode upper). A red spot indicates the existence of alkali salts. The limits of detection with this method are tabulated in the accompanying table.

LIMITS OF DETECTION OF POTASSIUM CHLORIDE

	Developing solvent	Distance of migration	Limits of detection
Before development			$1\gamma/10^{-3}$ ml.
After development	Butanol + ammonia	1 cm.	$5\gamma/10^{-3}$ ml.
	Butanol + acetic acid	6 cm.	$10\gamma/10^{-3}$ ml.

The values in the table show that this method can be applied satisfactorily to the chromatography of alkali salts; but the small amount of acid that cannot be removed by drying the paper reduces the sensitivity.

Some results so far obtained are as follows. (1) Filter paper for qualitative analysis (Tōyō Roshi, No. 2) is unsuitable for the chromatography of alkali salts, because it contains considerable amounts of these salts. For this reason we use quantitative analysis filter paper (Tōyō Roshi, No. 3) in our experiments. (2) Although the lithium ion is easily separated from other alkali ions, the separations of other ions are very difficult with ordinary solvents. (3) Potassium chloride is easily separated from iodide with butanol/acetic acid solvent. Chromatographic analysis of the anions of alkali salts will be possible by selecting suitable solvents.

We are now studying the separations of the alkali cations and various anions with this method.