



Fig. 5.

Adsorptionsschicht zusammen. Die Anfärbung erfolgt dann so, dass die Trägerplatte auf eine grössere Glasplatte gelegt, und mit der Deckplatte eingedeckt wird (Fig. 5). Die untere Glasplatte mit der Deckplatte ergibt in diesem Falle eine Reaktionskammer. Diese neue Methode der Anfärbung bringt den Vorteil dass das Adsorptionsmaterial von den Plattenrändern der Trägerplatte nicht abgeschabt werden muss und die ganze Platte zur Chromatographie ausgenützt werden kann.

*Lehrstuhl für Analytische Chemie, Chemische Fakultät der
Slowakischen Technischen Hochschule, Bratislava (Tschechoslowakei)*
*Lehrstuhl für Medizinische Chemie, Komensky-Universität,
Bratislava (Tschechoslowakei)*

L. PORGESOVÁ

E. PORGES

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Thin-layer chromatography of carboxylic acids and keto acids of biological interest*

In conducting some biological investigations with which our institute is concerned¹ we had to tackle the problem of separating and identifying some compounds (amino acids, acids and sugars) present as mixtures in the water-alcohol extracts of plant cells (*Chlorella*).

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Paper and ion-exchange chromatography gave satisfactory results with amino acids, but did not prove as efficient and easy to carry out with organic acids, particularly keto acids, which are of primary importance as amino acid precursors.

The recent extension of thin-layer chromatography to water-soluble substances led us, in view of the favourable results already reported^{2,3}, to try to develop a separation technique for the most important acids and keto acids of biological interest. The results we obtained can be regarded as promising.

Experimental

Suitably sized ground-glass plates washed with acetone were used as supports. The adsorbent layer consisted of silica gel (Kieselgel Merck, also containing CaSO_4 as binder) washed with HCl (1:1), then with water and finally with a 0.1 % w/v aqueous solution of EDTA. This treatment removed from the adsorbent solid iron and other interfering ions. As the CaSO_4 was also removed, it was replaced by adding 13 g of $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ per 100 g of silica gel. After stirring, the mixture was suspended in water (10:35) and poured on the plate (10 mg/cm² of surface). The layer was made homogeneous by means of an electromagnetic vibrator and then dried for about 45 min in an oven at 105°.

Development

The solvents that gave the most satisfactory results for the separation of the compounds and the compactness of the spots were (A) propanol-28° Bé ammonia (70:30) and (B) ethanol-chloroform-28° Bé aq. ammonia-H₂O (70:40:20:2).

After the solvent had travelled 13 cm from the starting line, the chromatoplate was dried by means of an infrared lamp, allowed to cool and finally sprayed with a 0.1 % solution of 2,6-dichlorophenolindophenol in 95 % alcohol. A subsequent short

TABLE I

R_F VALUES FOR CARBOXYLIC AND KETO ACIDS
 Solvent A: Propanol-28° Bé ammonia (70:30)
 Solvent B: Ethanol- CHCl_3 -28° Bé ammonia-H₂O (70:40:20:2)

Acid	$R_F \times 100$ in	
	Solvent A	Solvent B
Adipic	27	16
Lactic	42	35
Succinic	17	9
Oxalic	4	0
Malic	7	4
Glycolic	30	22
Fumaric	20	12
α -Ketoglutaric	17	10
β -Ketobutyric	53	45
Pyruvic	5	3
Dehydroascorbic	55	46
Ascorbic	22	14
Levulinic	50	52

heating brought up all acidic compounds as pink spots on a sky-blue background. If the heating was prolonged and the chromatoplate carefully brought near to the infrared lamp, the pink spots given by keto acids turned white, whereas those given by carboxylic acids remained pink. In this way it was possible to distinguish keto acids from other acids. Exposure of the plate to ammonia vapours for a few seconds resulted in a sharper definition of the pink spots.

Results

Adipic, succinic, glycolic, fumaric, lactic, malic, oxalic, ascorbic, dehydroascorbic, β -ketobutyric, α -ketoglutaric, levulinic and pyruvic acids were subjected to the chromatographic procedure described above.

In Table I are listed the R_F values in the two solvents used.

Experiments are being conducted with the object of extending to other compounds, including sugars, the technique developed in the present work.

*Institute of Agricultural Chemistry,
University of Padua (Italy)*

C. PASSERA
A. PEDROTTI
G. FERRARI

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Ion flotation of inorganic ions

1. The concentration of uranium

Surface active agents may be used for separation processes in a variety of ways such as adsorbing them on solid supports¹, in liquid phases or on a gas-liquid interface².

The possibilities of the last-mentioned, namely ion flotation or froth flotation, have been outlined by several workers³⁻⁶. As in ion exchange processes, however, the adsorption of ions on the surface of the air bubbles formed from an aqueous solution of surface active agents will depend on the ionic state of the ion to be adsorbed, the structure and distribution of the surface active agent (not only on its functional groups) and the pH and ions present in the solution. Thus exact conditions for optimum concentration have to be worked out for each particular case.

In this preliminary communication we wish to describe a typical case, the concentration of UO_2^{++} ions from a solution of ammonium carbonate.

A number of cationic surface active agents was compared in a preliminary study using the apparatus shown in Fig. 1. Optimum results were obtained with benze-thonium chloride. The effects of the carbonate concentration, of the concentration of the surface active agent and of the uranyl ion concentration are shown in Figs. 2 and 3.

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