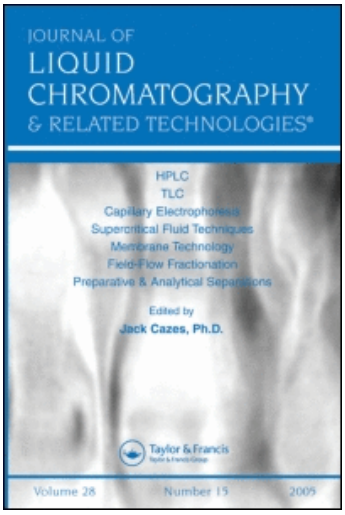

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Analytical Applications of Ion-Exchange Materials. V. Chromatographic Separation of Drugs on Ferric Phosphate Papers

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ANALYTICAL APPLICATIONS OF ION-EXCHANGE MATERIALS-V CHROMATOGRAPHIC SEPARATION OF DRUGS ON FERRIC PHOSPHATE PAPERS.

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Abstract

Chromatography of 14 drugs is performed on papers impregnated with ferric phosphate. Nine solvent systems are used based on aqueous phosphate buffers and mixed organic solvents. The Rf values on plain papers and impregnated are compared. Some important binary separations are practically achieved.

Introduction

Chromatography is used in pharmacy mainly for qualitative, quantitative, in the control of purity of pharmaceutical products and as a step in the structure

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elucidation of unknown compounds. In recent years a great deal of attention is being given to the fate of drugs in living organism and to the toxicological applications. The advantages of both the methods viz chromatography and ion exchange can effectively be combined by the introduction of ion exchange papers. Clean and selective separations were obtained in simple acqueous systems by the use of papers impregnated with inorganic ion exchangers (1-3). These papers can be prepared in the laboratory very easily and the concentration as well as the nature of the ion-exchanger can be varied at will. Chromatography of alkaloids and amino acids on ziroconium phosphate and stannic arsenate (4-6) has been reported in the literature. The use of these papers in the pharmaceutical field is still not studied in details. Ferric phosphate works as a cation exchanger (7) and has so for been applied for various applications (8-11). No studies have been reported on the separation of drugs on ferric phosphate papers. Therefore it was decided to study the movement of drugs on these papers in various solvent systems.

Experimental

Reagents and chemicals :- Ferric nitrate (BDH) and Ammonium dihydrogen orthophosphate (BDH) both of analar grade were used. All other chemicals used were also of analar grade. The different drugs used were in the pure state obtained from various pharmaceutical industries. Test solutions (0.5%)

of various drugs were made in distilled ethanol and its aqueous mixture.

Detection : Iodine was used to detect the spots of various drugs on the paper.

Solvents used for chromatographic development :

The following solvents were used :-

A. Phosphate buffers pH 2.5
B. Phosphate buffers pH 4.5
C. Phosphate buffers pH 6.0
D. Phosphate buffers pH 7.3
E. Phosphate buffers pH 9.1
F. Phosphate buffers pH 9.9
G. Ethanol-Benzene 8:2
H. Ethanol-Benzene 6:4
I. Ethanol (Pure)

Preparation of Ion-Exchange papers

Chromatography was performed on Whatman No.1 paper strips of size 14x3 cm. using 20x5 cm jars of glass. Paper strips were impregnated in 0.1M ammonium dihydrogen orthophosphate solution for 5 secs, removing the excess reagent by placing the strips over a filter paper sheet and allowing to dry for 5 minutes at room temperature. The strips were then dipped in 0.1M. Ferric Nitrate solution for about 5 secs. The excess solution was drained off and strips were dried at room temperature and then washed with distilled

water three times to remove the excess reagent. Finally those were dried at room temperature and used for chromatography.

Procedure

The chromatograms were developed by ascending techniques. The ascent of solvent in each case was 11 cm. To find the position of zones Rf values have been calculated as an average of R_L and R_T where R_L gives the R_F of heading front and R_T gives the R_F of tailing front.

Results and Discussion

The results of the chromatographic studies of drugs show that eighteen analytically and biologically important separations can be achieved using alcohol-benzene mixed solvents. A few examples are aspirin from phenacitin, paracitamol and chlor-phinarmine maleate, Thiamine from p-amino benzoic acid, chlor-phinarmine maleate and phenacitin, calcium lactate from diazepam and matronidizole (Table 1).

The results of R_F of some drugs as a function of pH are given in Fig.1. No peculiar behaviour was observed. The R_f values of Caffeine and paracetamol are independent of pH while that of diazepam and chlor-phenarmine maleate show that R_F is constant upto pH 6 then suddenly decreases as the pH increases.

The results of R_F as a function of alcohol in mixed alcohol-benzene solvent are given in Fig.2 and 3. It was observed that in case of paracetamol, thiamine and

TABLE - 1

Some binary separations of drugs on Ferric Phosphate Paper

Sr.No.	Separation of	R_f	From	R_f
1.	Aspirin	0.10	Diazepam	0.90
2.	Aspirin	0.10	P-Aminobenzoic acid	0.65
3.	Aspirin	0.10	Phenacitin	0.89
4.	Aspirin	0.10	Paracetamol	0.82
5.	Aspirin	0.10	Chlophenarmine	0.77
6.	Aspirin	0.10	Matronidizole	0.86
7.	Thiamine	0.12	Terpenhydrate	0.71
8.	Thiamine	0.12	Phenacitin	0.97
9.	Thiamine	0.12	Paracetamol	0.82
10.	Thiamine	0.12	Diazepam	0.92
11.	Thiamine	0.12	P-aminobenzoic acid	0.47
12.	Thiamine	0.12	Chlorphenarmine	0.82
13.	Calcium Lactate	0.00	Paracetamol	0.83
14.	Calcium Lactate	0.00	Diazepam	0.83
15.	Calcium Lactate	0.00	Matronidizole	0.78
16.	Calcium Lactate	0.00	Phenacitin	0.88
17.	Calcium Lactate	0.00	Chlorphenarmine maleate	0.78
18.	Calcium Lactate	0.00	P-amino benzoic acid	0.56

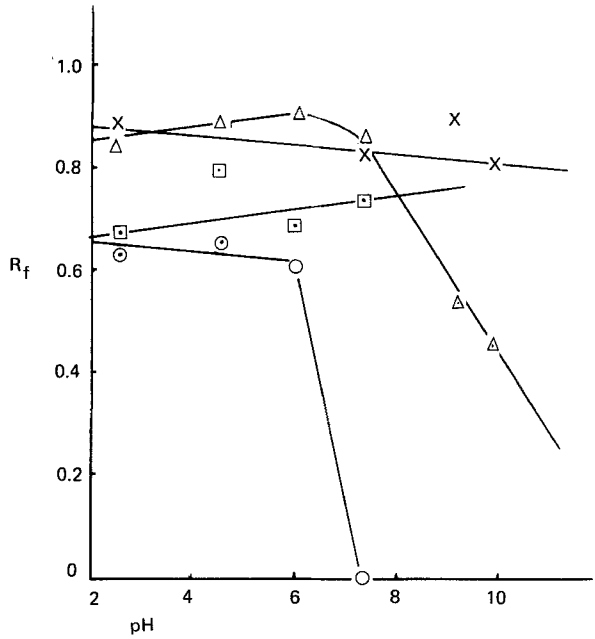

FIGURE 1 R_f as a function of pH

⊡ Paracetamol ⊙ Diazepam × Caffeine △ Chlorphinaramine maleate

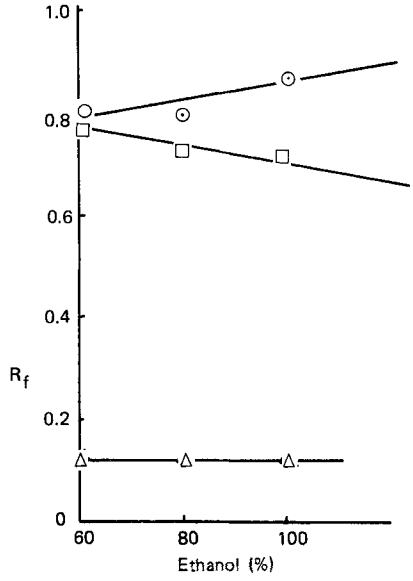

FIGURE 2 R_f as a function of % Ethanol

⊙ Paracetamol △ Thiamine ⊡ Chlorphinarmine Maleate

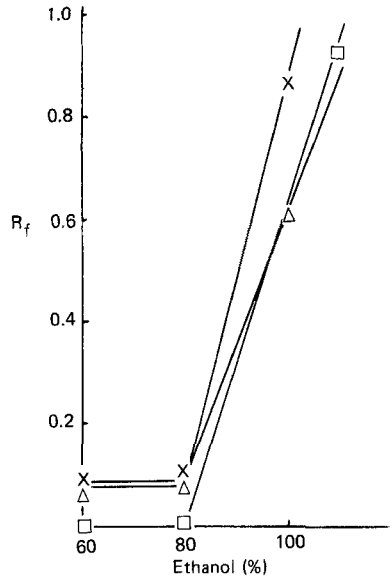

FIGURE 3 R_f as a function of % Ethanol

X Aspirin ▲ Ascorbic Acid ⊡ Calcium Lactate

chlorphenarmine maleate, the R_F is almost constant as per centage of alcohol increases (Fig.2). But the R_F values of aspirin, ascorbic acid and calcium lactate show different behaviour i.e upto 80% alcohol the R_F is constant then as the % age of alcohol increases there is sudden increase in R_F values Fig.3.

A comparison of R_F values of drugs on impregnated papers (R_{FT}) and on plain papers (R_{FP}) shows that the ferric phosphate papers are selective for aspirin, thiamine and calcium lactate. It is therefore useful to define a property

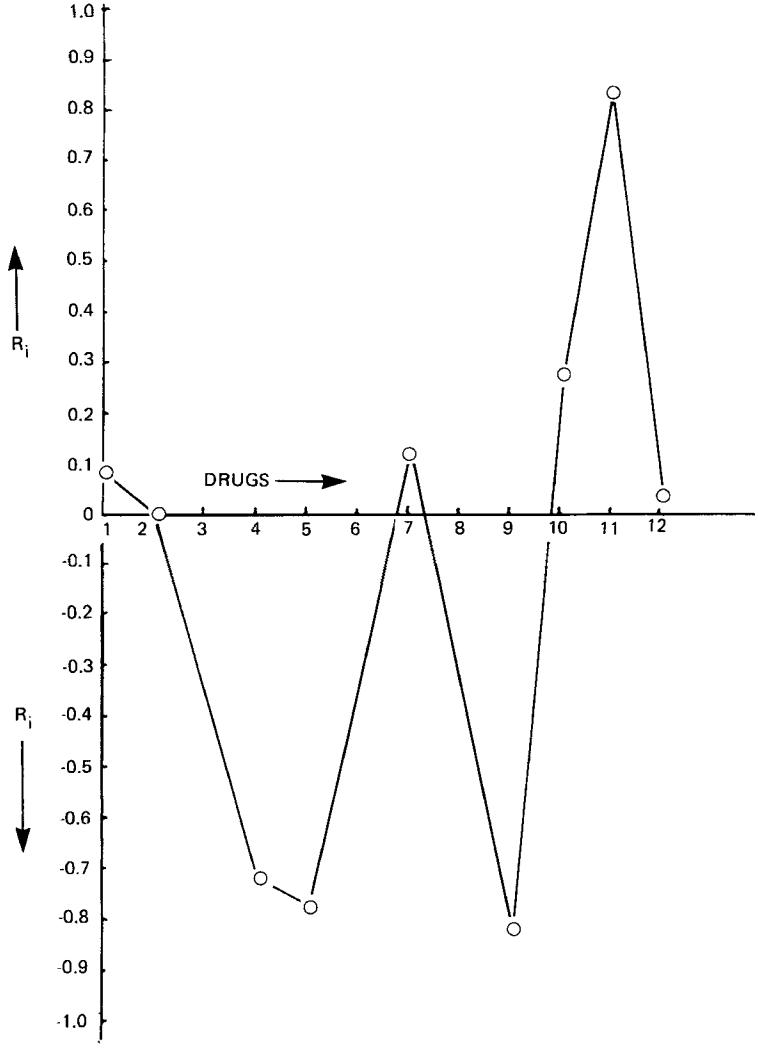

FIGURE 4 R_i as a function of Drugs

TABLE - 2

R_i values for different drugs

Sr.No.	Name	R_i
1.	Paracetamol	+0.083
2.	Diazepam	0.000
3.	Phenacitin	-
4.	Chloramphenicol	-0.723
5.	Aspirin	-0.773
6.	Thiamine	-
7.	Chlorphenarmine maleate	-0.121
8.	Chloramphenicol Palmitate	-
9.	Caffine	-0.814
10.	Calcium Lactate	+0.269
11.	Matronidizole	+0.829
12.	Ascorbic Acid	+0.028

$$R_i = (R_{FP} - R_{FT})$$

R_i is a measure of ion-exchange effect. The results of R_i as a function of various drugs are given in fig.4. These results show that almost all the drugs have different R_F values on ferric phosphate as compared to plain papers. The values of R_i values are summerized in Table-2.

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