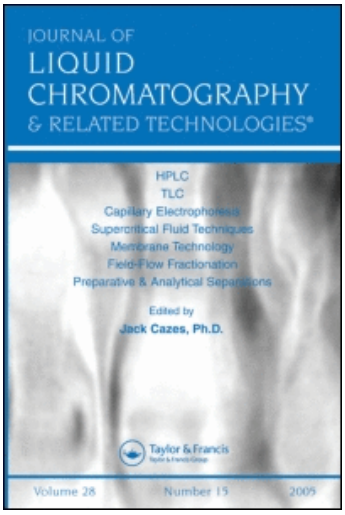

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Thin Layer Chromatography of Some Metals on Silica Gel Layers Impregnated with Phenolic Acids

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THIN LAYER CHROMATOGRAPHY OF SOME METALS ON SILICA GEL LAYERS IMPREGNATED WITH PHENOLIC ACIDS

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ABSTRACT

Thin layer chromatography of metals was performed on silica gel impregnated with phenolic acids. The results obtained can be used to gain a better insight into the behaviour of metals under the proposed chromatographic conditions and as an additional system for their separation.

INTRODUCTION

Recently, greater attention has been paid on using ligands as impregnants for improving the separation of metal ions by thin layer chromatography.8-Hydroxy quinoline, dibenzoyl methane, nitriloacetic acid, sulphagua-

nidine, 2,2-dipyridyl and iminoacetic acid were applied as impregnants of silica gel by Srivastava and coworkers (1-4).

Takamatsu and coworkers (5) have studied the metal-humic acid interaction by paper chromatography on humic acid impregnated papers. Similar experiments were made to learn more about the movement of trace metals in soil, using thin layer chromatography of metals on soil and modified soil (6).

Phenolic acids are known to form the complexes with different metals. Some of them as salicylic acid, 4-hydroxybenzoic acid, 3-hydroxybenzoic acid, vanillic acid, syringic acid, etc were found as degradation products of lignine and humic acids, respectively (7,8). The chromatographic behaviour of the above cited phenolic acids on silica gel impregnated with Fe(III)-nitrate was examined in our previous papers (9,10).

In the present work the impregnation of thin layers of silica gel was accomplished with: salicyclic acid, 4-hydroxybenzoic acid, vanillic acid and syringic acid in order to study the behaviour of some heavy metals and their separation under these chromatographic conditions.

MATERIALS AND METHODS

Chemicals

Phenolic acids were purchased from Fluka A.G. Switzerland, Merck Germany and B.D.H. England. All other chemicals were of analytical grade.

Abbreviations

Sac (Salicyclic acid)	2-Hydroxybenzoic acid
4-OHBac	4-Hydroxybenzoic acid
Vac (Vanillic acid)	4-Hydroxy-3-methoxy-benzoic acid
Syrac (Syringic acid)	4-Hydroxy-3,5-dimethoxy-benzoic acid

Sorbent layers

Precoated plates of silica gel 60 F_{254} (Merck), plain and impregnated with phenolic acids (by sparaying a 5% ethanolic solution) were used.

Solvent systems

I Methanol-benzene-acetic acid (20:10:15) v/v (4)

II Ethanol-1M HCl (90:10) v/v (11)

III Isopropanol-ethyl acetate-dimethyl formamide-acetic acid-water (60:30:5:5:10) v/v (3)

IV Isoamyl alcohol-water-acetic acid (20:10:10) v/v (4)

V Ethyl acetate-formic acid-water-pyridine (30:10:10:5) v/v (1)

Detection

Detection of the metals was performed by spraying with dimethyl glioxime (saturated ethanolic solution containing 25% of ammonia) and 0.05% solution of dithizone in carbon tetrachloride.

Procedure

The chromatograms were developed by the ascending technique. The ascent of solvent was 8-11 cm. R_f values were determined using the arithmetic mean of 2-5 runs.

RESULTS AND DISCUSSION

The metals investigated were chromatographed on phenolic acid impregnated layers in several solvent systems; most of them have already been applied for thin layer chromatography of metals on silica gel impregnated with different organic compounds (1,3,4,11). From the data of R_f values presented in Table 1. it can be seen that all metals can be separated by the use of suitable impregnant and solvent system. The comparison of R_f values on impregnated with those on plain plates show that the impregnation gives better separation. Hg(II) exhibits the greatest mobility in all solvents and on all impregnants but it is smaller than on plain plates; contrary to Cu(II) whose movability is rather poor, especially in the solvent system III. In the solvent system V all metals have in general the greatest mobility, what may be explained by the influence of competitive complexation with pyridine. Considering the alcoholic components of the solvent systems used, it can be deduced that with the elongation of their side chain the solvent system becomes less polar and consequently the R_f's are smaller. It has been observed that there are no differences

TABLE 1

R_f x 100 Values of Metals on Silica Gel Thin Layers Impregnated with Phenolic Acids

Metal	Impregnant				Plain	Solvent system
	Sac	4-OHBac	Vac	Syrac		
Cu	28	06	04	06	27	I
	23	09	00	12	05	II
	00	00	00	00	08	III
	21	08	03	06	15	IV
	29	25	35	59	37	V
Cr	63	28	25	39	45	I
	60	27	40	27	16	II
	43	20	23	17	14	III
	17	12	08	09	22	IV
	06	29	31	36	15	V
Co	63	40	49	35	51	I
	66	34	23	36	28	II
	50	21	15	11	18	III
	25	20	16	14	27	IV
	07	46	42	58	19	V
Fe	29	23 54	25 54	24 47	26	I
	19	18 58	14 67	15 44	15	II
	14	13 54	10 54	09 21	08	III
	08	10	12	18	08	IV
	20	21	26	26	15	V
Ni	28	16	00	14	58	I
	53	11	21	21	19	II
	12	00	04	02	07	III
	27	12	10	06	22	IV
	17	44	35	50	25	V
Hg	69	83	89	75	97	I
	84	80	84	73	93	II
	87	71	88	74	98	III
	82	66	76	67	91	IV
	83	81	94	96	98	V

in mobilities among the impregnated plates with 4-OHBac, Vac and Syrac, while the impregnation with Sac causes mostly greater R_f's. Concerning Fe(III), the phenomenon of splitting into two spots was observed in solvents I, II and III on plates impregnated with 4-OHBac, Vac and Syrac, respectively.

It can be concluded, besides the observations of their different behaviour on impregnated plates, that described chromatographic conditions can be used for improving the separation of the metals under investigation.

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