Polyamide Mixed Layer Chromatography of Pharmaceutical Phenols

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The separation of phenols by thin-layer of silica gel[1-3], kieselguhr[4] and polyamide[5-7] has been reported and polyamide is considered particulary suitable for this purpose. Recently, polyamide mixed layers chromatography have been successfully used for the identification of several type of compounds, e. g. polyamide-silica gel mixed layer for food preservatives[8] and polyamide-kieselguhr mixed layer for antioxidants[9]. Therefore, in this studies, the mixed layer method was further applied to separate sixteen Pharmaceutical phenols. For comparison, thin-layer chromatography using only polyamide and only kieselguhr was performed under the same conditions. separation on polyamide mixed layers was found to be preferable.

Experimental

Materials. The polyamide chip was Nylon 6, type 1022Bof UBE Industrial Ltd. (Osaka, Japan). The solvents were reagent grade of WAKO Pure Chemical Industries, Ltd. (Osaka, Japan).

Preparation of polyamide-kieselguhr mixed layer. Ten g of polyamide chip were dissolved in 100ml of 90% formic acid. After standing for overnight, a homogeneous solution was obtained; then 50 g of Kieselguhr G (E. Merck) were added and mixed well. Of the previous solution 300ml were poured into a dish (15×20×3cm) into which a glass plate (12×16×0.1cm) was dipped. Both sides of glass were covered homogeneously. The glass plate was hung for 2 min. over the dish to let the excess solution drain off. It was then dried in air for 3 hr. and heated at 100° for 30 min.

Preparation of polyamide-silica gel mixed layer. Before proceeding as described in the previous method, 8 g instead of 10 g polyamide was dissolved then 52 g of Silica gel G (E. Merck) were added.

Preparation of polyamide layer. Dissolve 20 g of polyamide in 90ml of 90% formic acid, then 10ml of distilled water were added. After stirring, a homogeneous solution was obtained. The other steps are like the method described in the preparation of polyamide-kieselguhr mixed layer, but without adding Kieselguhr G.

Preparation of kieselguhr layer. Dilute slurries of Kieselguhr G (45 g to 120ml of water) were sprayed, at 1.5kg/cm^3 pressure from a distance of 20cm onto 8 sheets of glass plate (12×16cm) in a horizontal position, then dried at 100° for 30 min. The thickness of the layer are about 250μ.

Chromatographic procedure. A 0.5% alcoholic solution of these phenolic compounds were

applied to the starting line 1.5cm from the bottom of the layer, and the plate was developed by ascending techniques. The chamber had been equilibrated with the respective solvent system for 30 min. before use.

Visualization. Sulfosalicylic acid, Aspirin (acetyl salicylic acid), beta-naphthol, alpha-naphthol, phenyl salicylate can be recognized under UV light at 254 mμ. Then the layers were sprayed with a 0.07% Rhodamine B alcoholic solution and all the spots could be observed under UV light at 254mμ.

Result and discussion.

Rf values of polyamide-silica gel mixed layers, polyamide-kieselguhr layers, kieselguhr layers and polyamide layers with four solvent systems are given in Table I. It has been found that the results show better separation and sharp spots on the polyamide-silica gel mixed layer with solvent II and the polyamide-kieselguhr mixed layer with solvent IV. Also a 10cm ascent from the originis more rapid using the mixed layers than when polyamide layers are employed. In the mixed layer, polyamide serves as a strong binder and makes the layers very durable and easy to handle.

The following structural features determine the chromatographic behavior of phenols on these layers with nonpolar solvent systems.

1. The R_F values decrease with increasing number of polar groups (-SO_3H, -COOH, -OH) and the hydroxy group are less strongly absorbed than the acid group.
2. Substituents ortho to the hydroxyl group reduce the adsorption affinity (o-cresol, thymol).
3. Esterfication of acid group causes a considerable increase in the R_F vaules. (salicylic acid →phenyl salicylate, methyl salicylate) Also it is interesting to note that the R_F values in the aqueous system (system II) and the non-aqueous system (system I, III, IV) are almost reversed.

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TABLE I

Rf VALUES OF PHENOLS ON DIFFERENT LAYERS

Solvent I: Benzene-ether (1:1); Solvent II: Acetone-water (1:2.2);
Solvent III: Cyclohexane-ether (30:14); Solvent IV: Cyclohexane-ethyl acetate (30:13).
P-S, Rf value on polyamide-silica gel layer; P, Rf value on polyamide layer;
P-K, Rf value on polyamide-kieselguhr layer; K, Rf value on kieselguhr layer.

No. Substance	Solvent I		Solvent II		Solvent III			Solvent IV		
	P-S	P	P-S	P	P-K	P	K	P-K	P	K
1 Sulfosalicylic acid	0.00	0.00	0.75	0.39	0.00	0.00	0.97	0.00	0.00	0.99
2 Pyrogallol	0.08	0.02	0.56	0.36	0.03	0.03	0.80[a]	0.05	0.05	0.94[a]
3 Hydroquinone	0.17	0.05	0.60	0.36	0.02	0.02	0.78	0.07	0.07	0.93
4 Resorcinol	0.24	0.05	0.53	0.33	0.05	0.04	0.88	0.09	0.06	0.80
5 Aspirin	0.35	0.25[a]	0.72	0.41	0.13[a]	0.11[a]	0.75[a]	0.27[a]	0.10[a]	0.88[a]
6 Salicylic acid	0.52	0.28[a]	0.81	0.30	0.09[a]	0.31[a]	0.86[a]	0.13	0.42[a]	0.92[a]
7 Vanillin	0.48	0.30	0.63	0.46	0.28	0.30	0.89	0.54	0.68	0.94

8 β-naphthol	0.60	0.35	0.29	0.11	0.44	0.47	0.95	0.67	0.72	0.95
9 α-naphthol	0.70	0.42	0.24	0.08	0.53	0.57	0.93	0.72	0.76	0.97
10 Phenol	0.71	0.52	0.49	0.28	0.63	0.79	0.99	0.76	0.81	0.99
11 m-Cresol	0.73	0.54	0.39	0.24	0.67	0.74	0.97	0.81	0.82	0.98
12 p-Cresol	0.74	0.53	0.41	0.22	0.66	0.74	0.97	0.78	0.82	0.98
13 o-Cresol	0.77	0.56	0.45	0.16	0.77	0.87	0.96	0.88	0.86	0.98
14 Thymol	0.84	0.84	0.24	0.05	0.92	0.90	0.97	0.94	0.85	0.98
15 Phenyl salicylate	0.97	0.96	0.00	0.02	0.98	0.94	0.96	0.97	0.89	0.97
16 Methyl salicylate	0.93	0.57	0.03	0.00	0.96	0.95	0.95	0.95	0.91	0.98
Time(min)[b]	50	360	150	180	80	330	20	80	290	20

[a] Tailing.

[b] Time required to ascend 10cm from origin.

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中 文 摘 要

酚類藥品之多醯胺薄層分析

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對16種酚類藥品應用 Polyamide-Silica gel 混合薄層，Polyamide-Kieselguhr混合薄層，Polyamide 薄層，Kieselguhr 薄層等四種薄層分析法分別進行鑑別並檢討所得之結果。