

Separation of Ni, Mn, Co, Cu, Fe and Zn by Thin-Layer Chromatography

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*Dünnschicht-chromatographische Trennung von Ni, Mn, Co,
Cu, Fe und Zn*

Trenn. von Nickel, Mangan, Kobalt, Kupfer, Eisen, Zink;
Chromatographie, Dünnschicht.

In this work the separation of the above cations by thin-layer chromatography on layers of cellulose and silica gel was investigated; successful separation was attained only on cellulose.

Experimental

For the preparation of thin layers the microcrystalline cellulose for thin-layer chromatography (E. Merck) was used. The suspension of cellulose in water (1:3.5) was spread by manual technique onto glass plates (10 × 15 cm). The thickness of the wet layer was adjusted to about 0.2 mm. The layers were dried at room temperature. As samples for investigation water solutions of the chlorides were used (5–10 mg/ml). The sample solutions were spotted by means of glass capillaries or micropipettes at the height of 1.5 cm from the lower edge of the plate. The development was carried out over 10 cm (the distance between start and level amounted at least to 0.5 cm in a glass chamber of 12 × 8 × 18 cm) without a previous saturation according to the ascending technique, at room temperature. Detection was made by spraying with 1% solution of diphenylcarbazide in ethanol and (if necessary) exposing the plates to NH₃ vapours.

Results and Discussion

Complete separation was achieved with the solvent-system acetone/conc. HCl/water (86:8:7). R_f-values increase in the following order: Ni, Mn, Co, Cu, Fe, Zn. The spots are small and limited (without tails), except in the presence of great quantities of Ni and Mn, when they are extended in the direction of the movement of the developer and in such a case they

Table 1. R_f-values and spot colours

	R _f -values	Spot colours
Ni ²⁺	0.09	dark-violet
Mn ²⁺	0.20	red-violet
Co ²⁺	0.34	yellow (edges violet)
Cu ²⁺	0.60	white
Fe ³⁺	0.83	dark-violet
Zn ²⁺	0.94	violet
Al ³⁺	0	—
Cr ³⁺	0	—

can touch each other. The spot of iron is on the second front, and that of zinc between the developer front and the second front. Above the zinc spot a thin line can be observed, due probably to some element which is present either in the developer or in the cellulose. It has been also noticed, that another spot appears above the copper spot behaving analogously to copper, i.e. in the course of the development it has a brown colour, whereas at detection it is white. It has not been established whether this is another complex of copper (perhaps of Cu⁺) or another element (ingredient), behaving in the same way as copper.

The acetone system of solvents must be prepared immediately before use (exactly in the quoted ratio and well homogenized by stirring), as otherwise insufficient results will be obtained.

Detection is very simple, as all investigated cations can be detected by diphenylcarbazide. As a freshly prepared alcoholic solution of this reagent does sometimes not react with the investigated elements, it is recommended to prepare it two days before use. This solution is stable for a long time. The colour of the spots and the R_f-values may be seen from Table 1.

Al and Cr were found to have R_f-values of zero in the above solvent system. Their spots were mixed with the Ni spot and they could not be detected by diphenylcarbazide.