SHORT COMMUNICATIONS

Complete Resolution of the Racemic Trisethylenediaminecobalt(III) Complex into Its Optical Antipodes by Means of Electrophoresis

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The racemic $[Co\ en_3]^{3+}$ complex can be resolved into its optical antipodes by way of the diastereomers, *d*-$[Co\ en_3]Cl(d\text{-tartrate})\cdot 5H_2O$, separated as crystals, and *l*-$[Co\ en_3]Cl(d\text{-tartrate})$, remaining in solution. This suggests that the tendency of the *d* and *l* forms of the $[Co\ en_3]^{3+}$ complex cation towards ion-pair formation with *d*-tartrate anion is different. In fact, Ogino and Saito[1] showed that the association constant of the *d*-$[Co\ en_3]^{3+}$-*d*-tartrate system differs from that of the *l*-$[Co\ en_3]^{3+}$-*d*-tartrate system by analyzing the increase in the optical density of the charge-transfer band. On the other hand, Yamatera and Fujita[2] measured the rates of amino-hydrogen deuterium exchange for the *d*- and *l*-$[Co\ en_3]^{3+}$ complex in the presence of *d*-tartrate and found that the rate constant was appreciably smaller for *d*-$[Co\ en_3]^{3+}$ than for the *l*-isomer. This also implies that there is some stereoselective interaction in the solution between the isomers of the $[Co\ en_3]^{3+}$ complex cation and the *d*-tartrate anion. Thus, we can expect the complete resolution of the racemic $[Co\ en_3]^{3+}$ complex into its optical antipodes under appropriate conditions by means of electrophoresis.

We would like to report a successful result obtained by paper electrophoresis. Samples tested were *d,l*-$[Co\ en_3]Cl_3\cdot 3H_2O$, *d*-$[Co\ en_3]Cl(d\text{-tratrate})\cdot 5H_2O$ and *l*-$[Co\ en_3]Cl(l\text{-tartrate})\cdot 5H_2O$. Sodium *d*-tartrate was used as a main component of a background electrolyte solution. For electrophoresis a migration apparatus with multicompartment cells was used so that ten samples could be run at one time. Samples were run for 2.5 hr under a potential gradient 250 V/34 cm, keeping the temperature of the migrating box at 25°C. The spot of the sample was easily identified by the orange yellow color of the complex. By spraying a sodium sulfide solution we could visualize the spot more clearly.

When only sodium *d*-tartrate was used in a background electrolyte, the racemic form of the complex appeared always in one spot, irrespective of the concentration of the background solution. This means that resolution by electrophoresis was not successful. However, when aluminum chloride was added to the sodium *d*-tartrate solution, the racemic form was completely separated into two spots, as can be seen in Table 1. This should be taken as a resolution, because the sample of the *d* form showed only one spot just at the same position as the upper spot of the racemic form, and the *l* form showed only one spot corresponding to the lower spot of the racemic form.

TABLE 1. MIGRATION DISTANCE OF THE $[Co\ en_3]^{3+}$ COMPLEX IN VARIOUS BACKGROUND ELECTROLYTE SOLUTIONS

Sample	Background electrolytes		
	0.18M Na_2-*d*-tartrate	0.18M Na_2-*d*-tartrate 0.12M $AlCl_3$	
d,l-$[Co\ en_3]Cl_3$	41 mm	12 mm	59 mm
d-$[Co\ en_3]Cl$-(*d*-tartrate)	41 mm		59 mm
l-$[Co\ en_3]Cl$-(*l*-tartrate)	41 mm	12 mm	

Migration time, 2.5 hr
Potential gradient, 250 V/34 cm

A detailed discussion of the separation mechanism will be reported elswhere. Extension of our new method of resolution to a variety of racemic compounds is in progress.

1) K. Ogino and U. Saito, This Bulletin, **40**, 826 (1967).
2) H. Yamatera and M. Fujita, *ibid.*, **42**, 3043 (1969).