

### C. Cosmetic Dyes

Silica gel 60 plates were used to identify lip cosmetics (57). The  $R_f$  values of some cosmetic dyes obtained from lipsticks are recorded in Table 4 along with their colors. A mixture of 15 mL of ethyl acetate, 3 mL of methanol, and 3 mL of ammonium hydroxide–water (3:7) solvent (a) and dichloromethane solvent (b) were used as the mobile phases. The shiny surface from the rounded end of the lipstick was removed with tissue, and the lipstick was weighed. The TLC plate was activated, and 10–20 mg of lipstick was applied directly to the plate. The plate was developed in two separate steps: oil-soluble, unsulfonated colors (D&C Orange 17 and D&C Red 36) were separated using dichloromethane, and other colors were separated using solvent (b).

Mikami and coworkers (57a) analyzed coal tar dyes used in the cosmetics and food industries by TLC. The dyes were spotted on reversed-phase RP-18 F<sub>254</sub> S plates, and the plates were developed in four solvent systems: acetonitrile–methanol–5% sodium sulfate solution (3:3:10), methyl ethyl ketone–methanol–aqueous 5% sodium sulfate (1:1:1), acetonitrile–methanol–aqueous 5% sodium sulfate (1:1:1), and acetonitrile–CH<sub>2</sub>Cl<sub>2</sub>–aqueous 5% sodium sulfate (10:1:5). The visible absorption spectra of the dyes were measured by scanning densitometry at 370–700 nm.

### D. Acid and 1:1 and 1:2 Metal Complex Dyes

Acid and metal complex dyes belong to different groups of chemical substances. Thirty-eight commercial dyes of these classes were studied on silica gel TLC plates (116). The best results for the separation of acid dyes are shown in Table 5. The data on 1:1 metal complex dyes are recorded in Table 6, and those for 1:2 complex dyes in Table 7. The solvent systems used are given in each table. It was observed that well-shaped spots without tailing were obtained for acid dyes and 1:2 metal complex dyes. The separation of 1:1 metal complex dyes was also clear, but the spots were diffuse and showed tailing. The best solvent systems were S<sub>1</sub> and S<sub>2</sub> for the acid dyes, S<sub>2</sub> and S<sub>4</sub> for the 1:1 metal complex dyes, and S<sub>1</sub> and S<sub>3</sub> for the 1:2 metal complex dyes.

### E. Cyanine Dyes

Precoated 100  $\mu\text{m}$  silica gel plates from Eastman Kodak and precoated 250  $\mu\text{m}$  silica gel sheets from EM Labs were used to separate some cyanine dyes (117). The  $R_f$  values along with mobile

**Table 4** TLC of Organic Colors in Lip Cosmetics<sup>a</sup>

Type of color	Name of dye	Color of spot	$R_f$
Oil-soluble	D&C Red 36	Orange	0.9
Unsulfonated	D&C Orange 17	Orange	0.8
Other	FD&C Red 3	Pink fluorescence <sup>b</sup>	0.25
	D&C Red 21	Pink fluorescence <sup>b</sup>	0.22
	D&C Orange 5	Orange fluorescence <sup>b</sup>	0.14
		Red fluorescence <sup>b</sup>	0.22
	D&C Red 19	Pink fluorescence <sup>b</sup>	0.57
	D&C Red 7 (ca)	Red	0.24
	D&C Orange 4	Orange	0.35
	D&C Red 9 (Ba)	Orange	0.41
	FD&C Violet 1	Blue	0.19
D&C Blue 9	Pink (weak)	0.29	

<sup>a</sup>Dichloromethane is the mobile phase for D&C Orange 17 and D&C Red 36; for the others a mixture of 15 mL ethyl acetate, 3 mL methanol, and 3 mL ammonium hydroxide–water (3:7) was used.

<sup>b</sup>Fluorescence under UV light (254 nm).

Source: Adapted from Ref. 57.