EFFECT OF PARTICLE SIZE ON THE COLOURING PROPERTIES OF ALUMINIUM LAKES

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F.D. & C. aluminium lakes have been increasingly used for several years in for example the colouration of tablets by surface coating, as well as in edible pharmaceutical inks but little has been published about the effect of particle size on their colouring properties. In contrast to dyes that colour objects through their absorption or attachment from solution to the material being coloured, lakes like other pigments, impart colour by dispersion in the medium to be coloured. Usually a powdered pigment exists in a highly flocculated form, being composed of agglomerates, aggregates and primary particles (Gerstner 1966). The dispersion process usually breaks down the agglomerates but not the aggregates (Honigmann 1967).

In the present work dispersions of F.D. & C. Red No. 40, Yellow Nos. 5 and 6, and Blue No. 2 lakes were produced in an ethanolic shellac medium by grinding for ½ to 85 hours in a paint conditioner (Red Devil Inc.). The particle size and corresponding colouring properties were determined as the grinding proceeded. A counting method using scanning electron micrographs was used for sizing and was direct, absolute and proved the absence of flocculation. Reflectance values were measured from "drawdown" films produced by reducing the lake dispersion with titanium dioxide in the same dispersion medium. The colour strength, k/s, was calculated from the reflectance, at the wavelength of maximum absorption for the lake concerned, by the Kubelka-Munk function (Judd & Wyszecki 1975). Typical results are shown in Fig. 1.

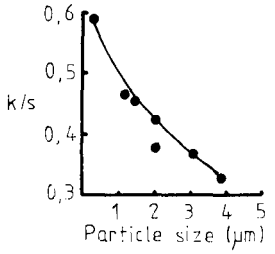

Fig. 1. Colour strength of F.D. & C. Red No. 40 lake dispersion against the surface-volume mean diameter of the lake particles.

Since the human eye does not see a narrow waveband (as the k/s function suggests) but over the whole visible spectrum, another more sophisticated approach using trichromatic colorimetry to calculate the CIELAB colour difference, ΔE, was attempted and similar results were produced together with information regarding hue.

The results clearly show that the colouring properties of lakes are related to the surface area of lake that is wetted by the medium and resemble results obtained in paint systems (Carr 1971). The sub-micron particles are especially important and contribute greatly to the colour strength. The results also agree with theoretical predictions based on certain assumptions for the refractive index of the lakes (Brockes 1964).

(One of us (L.L.S.W.) gratefully acknowledges the award of a Colorcon Studentship).

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