

Optical behaviour of protein solutions

A very remarkable increase in light-scattering power is exhibited by gelatine solutions when the hydrogen-ion concentration approaches the value (about pH = 5) corresponding to the iso-electric point. This effect, which appears to have been known for some time, has been recently studied in detail by Kraemer and his co-workers, who give interesting curves showing the manner in which the Tyndall effect varies with pH and temperature (Colloid Symposium Monograph, 4, and *J. Phys. Chem.* May 1927).

The phenomena are scarcely intelligible on the view commonly adopted that the Tyndall effect in a colloidal solution is simply proportional to the number of scattering particles of the same kind present in it. Their explanation becomes clearer if we apply to colloidal solutions the general thermodynamic theory of light-scattering, in which the Tyndall effect is regarded as due to local fluctuations of optical density in the medium. According to the latter theory, the scattering power of a colloidal solution would be connected with the osmotic pressure P of the particles, by the relation

$$\frac{\pi^2 RT}{2N\lambda^4} \frac{k(\partial\epsilon/\partial k)^2 \rho/m}{\partial P/\partial k}, \quad (1)$$

where k is the concentration of the dispersed material, ϵ is the optical dielectric constant of the solution and ρ/m is practically unity for a dilute solution. It is well known from the work of Jacques Loeb that the osmotic pressure of a gelatine solution alters in a notable manner with pH, becoming very small at the iso-electric point. Equation (1) then enables us to see at once why the Tyndall effect becomes very large under the same conditions.

A detailed discussion of colloidal optics on the basis of the thermodynamic theory of light-scattering will be published in the *Indian J. Phys.*

C V RAMAN