PROPERTIES OF SOLS–THEIR COLOUR

The colour of a hydrophobic sol depends on the wavelength of the light scattered by the dispersed particles. The wavelength of the scattered light again depends on the size and the nature of the particles. This is fully borne out from the following date in case of silver sols.

COLOUR OF Ag-SOL	PARTICLE DIAMETER
Orange-yellow	6×10^{-5} mm
Orange-red	9×10^{-5} mm
Purple	13×10^{-5} mm
Violet	15×10^{-5} mm

The colour changes produced by varying particles size have been observed in many other cases.

OPTICAL PROPERTIES OF SOLS

(1) Sols exhibit Tyndall effect

When a strong beam of light is passed through a sol and viewed at right angles, the path of light shows up as a hazy beam or cone. This is due to the fact that sol particles absorb light energy and then emit it in all directions in space. This 'scattering of light', as it is called, illuminates the path of the beam in the colloidal dispersion.

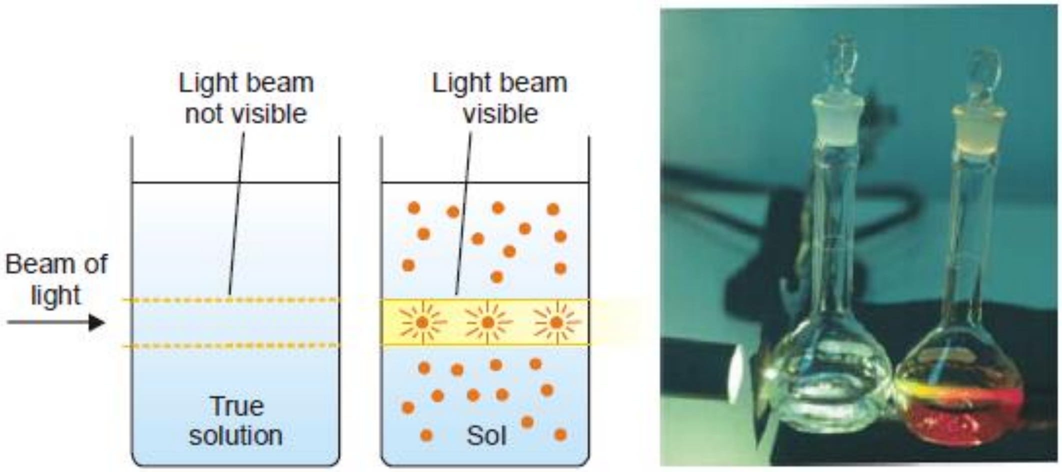
The phenomenon of the scattering of light by the sol particles is called Tyndall effect.

The illuminated beam or cone formed by the scattering of light by the sol particles is often referred as **Tyndall beam** or **Tyndall cone.**

The hazy illumination of the light beam from the film projector in a smoke-filled theatre or the light beams from the headlights of car on a dusty road, are familiar examples of the Tyndall effect. If the sol particles are large enough, the sol may even appear turbid in ordinary light as a result of Tyndall scattering.

True solutions do not show Tyndall effect. Since ions or solute molecules are too small to scatter light, the beam of light passing through a true solution is not visible when viewed from the side.

Thus Tyndall effect can be used to distinguish a colloidal solution from a true solution.



Tyndall effect (Illustration).

Tyndall effect in nature.

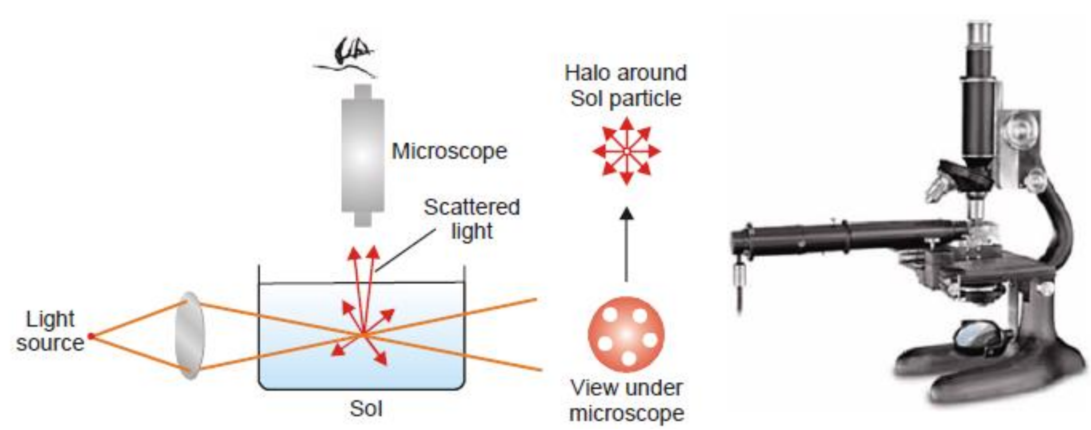
(2) Ultramicroscope shows up the presence of individual particles

Sol particles cannot be seen with a microscope. Zsigmondy (1903) used the Tyndall phenomenon to set up an apparatus named as the **ultramicroscope.** An intense beam of light is focussed on a sol contained in a glass vessel. The focus of light is then observed with a microscope at right angles to the beam. Individual sol particles appear as bright specks of light against a dark background (dispersion medium). It may be noted that under the ultramicroscope, the actual particles are not visible. It is the larger halos of scattered light around the particles that are visible. **Thus an ultramicroscope does not give any information regarding the shape and size of the sol particles.**

(3) Sol particles can be seen with an Electron microscope

In an electron microscope, beam of electrons is focussed by electric and magnetic fields on to a photographic plate. This focussed beam is allowed to pass through a film of sol particles. Thus it is possible to get a picture of the individual particles showing a magnification of the order of 10,000.

With the help of this instrument, we can have an idea of the size and shape of several sol particles including paint pigments, viruses, and bacteria. These particles have been found to be spheriod, rod-like, disc-like, or long filaments.



Principle of the Ultramicroscope.