NEPHELO-TURBIDOMETRY

When directed through a turbid solution containing suspended solid particles, light is transmitted, absorbed (blocked), and scattered (reflected off the particles). The amount of scattered light depends on the size, shape, and concentration of the insoluble particles in the solution, as well as on the incident wavelength of light.

Nephelometric and turbidometric methods depend on the scattering of light by particle suspended in a liquid. The suspended particles have refractive index values different from the suspending medium. The overall effect mimics Tyndal effect.

Nephelometry is the measurement of scattered light as a function of concentration of suspended particles where the concentration is less than 100 mg/ litre.

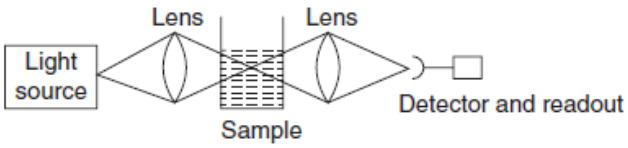
Turbidometry is the measurement of transmitted light as a function of concentration of suspended particles where the concentration is more than 100 mg/litre that is high concentration samples.

PRINCIPLE

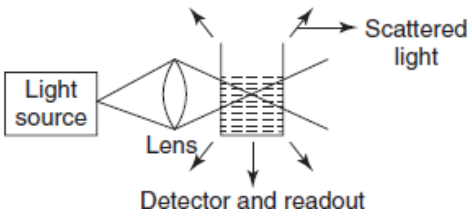
At lower concentration of the suspension uniform scattering of particles is noticed. So the intensity of scattered light is directly proportional to the concentration of solute. The intensity of scattered light can be measured at 45°, 60°, 90° and 135°also.

For higher concentration suspensions scattering is non uniform and light becomes scattered in all possible directions. Hence, it is difficult to measure the intensity of scatter radiation at specific angles. So, the intensity of transmitted light (that is unscattered) direction is measured at 180°.

Turbidimetry:



Nephlometry:



Prepared by,
Kavya M C
ASP,SNSCPHS

The intensity of transmitted light (It) is a function of concentration i.e. when the concentration increases the intensity of transmitted light is less and when concentration is less the intensity in high. Depending on the sample concentration of the suspension either nephelometry or turbidometry is chosen. Suspensions with lower concentration nephelometry and for higher concentration turbidometry are utilised.

- Factors that produce uniform turbidity:

1] Order and rate of mixing of substances

2] Agitation of suspension

3] Temperature; as it affects solubility and viscosity of medium

4] Presence or absence of inert electrolyte and protective colloids such as gelatin, accacia etc.

5] Concentrations of solutions mixed

- Factors that produce scattered radiation:

1] Number of suspended particles

2] Size and shape of particles

3] Wavelength of radiation used

4] Difference in refractive index of particles and medium.

- Factor affecting quantitative measurements:

The amount of radiation removed or deviated from the primary radiation beam depends on the following factors:

1. Concentration

Nephelometry:	Turbidimetry:
Is = Ks Io C Is = scattered intensity Ks= empirical constant Io = Incident intensity C = concentration of suspended material	S = log I/Io= kbc T =Transmittance =I/Io S = turbidence due to scattering k = turbidity constant b= path length c = concentration of suspended material

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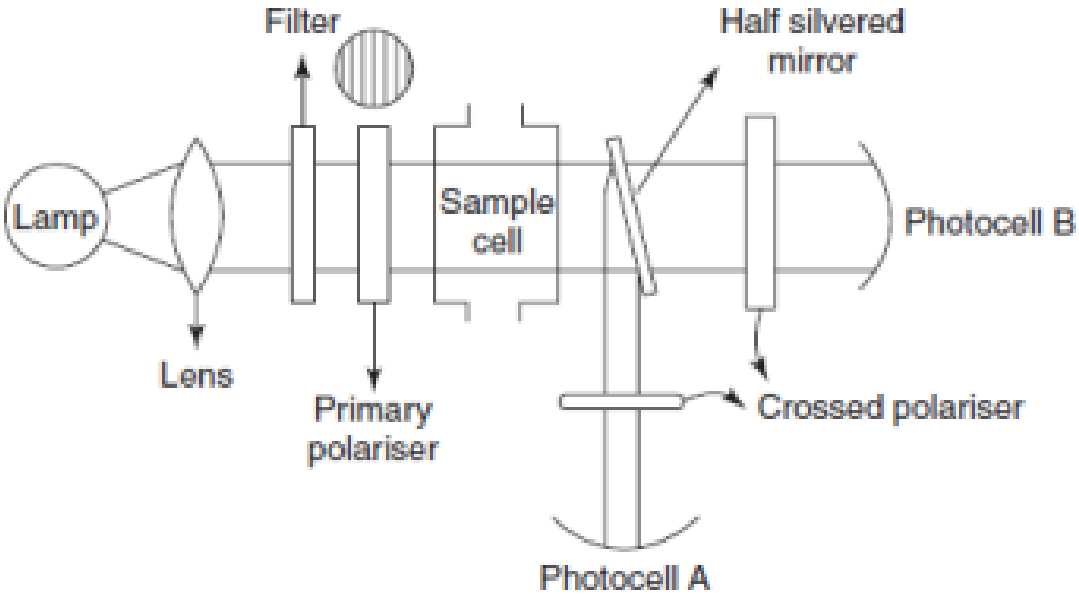
2. Effect of Particle Size on Scattering

Size and the shape of the particles responsible for the scattering

Because most analytical applications involve the generation of a colloidally dispersed phase in a solution, those variables that influence particle size during precipitation also affect both turbidimetric and nephelometric measurements.

INSTRUMENTATION



Instrumentation used in nephelometry and turbidimetry is very similar to spectrophotometer devices.

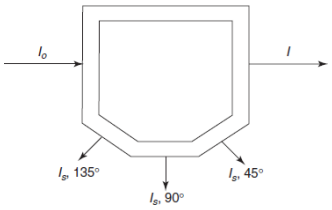
1.Sources:

- Mercury lamp: Under light pressure, the excitation of mercury atoms is done by electric discharge.
- Tungsten lamp: It contains a piece of tungsten wire which is heated in a controlled atmosphere.

2.Filters: Filters will convert the polychromatic light to monochromatic light. Generally filters are used for this purpose. Fitters are of two types:

- Absorption filters
- Interference filters (Refer UV notes)

3.Sample cells: In general, a cell with a rectangular cross-section is preferred, where measurements are to be made at angles other than 90°. Semi-octagonal cells are widely used.



4.Detectors

Most commonly used detectors in the nephelometry and turbidimetry are photomultiplier tubes. In order to obtain greater sensitivity to very weak light intensities, multiplication of the initial photo-electrons by secondary emission is employed. Several anodes at a gradually increasing potential are contained in one bulb.

APPLICATIONS

- Used in the determination of sulphate as barium sulphate.
- Example: Carbonate as BaCO3, Chloride as AgCl, Fluoride as CaF2
- Used in the analysis of water for purity and for the detection of the impurities.
- Used in the determination of CO2.
- Phosphorus can be estimated as a concentration of 1 part in more than 300 million parts of water as a precipitate with strychnine molybdate reagent (mainly used in water treatment plants).
- Used in the determination of turbidity in the sugar products.
- Used in the determination of clarity of citrus juices.
- Used in the determination of benzene percentage in alcohol.
- Used in the determination of amount of amino acids, vitamins and antibiotics.
- Used in the determination of protein.
- Used in the monitoring of the air and water pollution.
- Used in turbidimetric titrations: absorbance versus volume of titrant added is plotted.

REFERENCES.

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