COLORIMETER

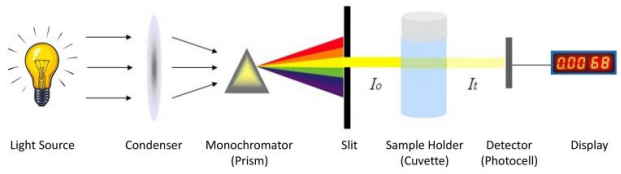
- When a beam of monochromatic light passes through a colored solution, the coloring substances absorbs a portion of the light & the rest is transmitted.
- The colorimeters are highly sensitive devices that can measure the concentration and intensity of a particular color that is used in a product.
- There are mainly two different types of colorimeters that are used in industries the TP 110 portable colorimeter and the Spectrophotometer TP 800.

Working Principle of Colorimeter

- The working of colorimeters is mainly based on the Beer-Lambert's Law. This law states that the light absorption when passes through a medium are directly proportional to the concentration of the medium.
- When a colorimeter is used, there is a ray of light with a certain wavelength is directed towards a solution. Before reaching the solution the ray of light passes through a series of different lenses. These lenses are used for navigation of the colored light in the colorimeter. The colorimeter analyzes the reflected light and compares with a predetermined standard. Then a microprocessor installed in the device is used for calculation of the absorbance of the light by the solution. If the absorption of the solution is higher than there will be more light absorbed by the solution and if the concentration of the solution is low then more lights will be transmitted through the solution.

- When a beam of incident light of intensity I0 passes through a solution, following events occur:
- A part of incident light is reflected. It is denoted by Ir
- A part of incident light is absorbed. It is denoted by Ia
- Remaining incident light is transmitted. It is denoted by It
- As Ir is kept constant by using cells with identical properties, The light that is not absorbed is transmitted through the solution and gives the solution its color. Note that color of the incident light should be complementary to that of color of the solution.
- The ratio of the intensity of transmitted light (It) to the intensity of incident light (I0) is called transmittance (T). Photometric instruments measure transmittance. In mathematical terms,
- T = It÷I0
- The absorbance (A) of the solution (at a given wavelength) is defined as equal to the logarithm (base 10) of 1÷T. That is,
- A = log (1÷T)

Instrumentation of Colorimeter :



1.Light Source:

The light source should produce energy at sufficient intensity throughout the whole visible spectrum (380-780nm). Tungsten lamp is frequently used.

2. Slit:

It allows a beam of light to path and minimize unwanted light.

3. Condensing lens:

Give parallel beam of light.

4. Monochromator:

It is used to produce monochromatic radiation (one wavelength band) from polychromatic radiation (white light) produced from light source. It allows required wavelength to pass through it. Prism, gelatin fibers, grating monochromators or interference filters can be used.

5. Sample Holder (Cuvette):

Must be transparent. Glass or clear plastic cuvettes are preferred.

6. Photo detectors:

Detector of colorimeter basically receives the resultant light beam once it has passed through the sample and converts it into electrical signal. Selenium photocell, silicon photocell, phototube, photomultiplier tube etc are used.

7. Display:

It detects and measures the electric signal and makes visible output.

Applications

In clinical laboratory, colorimeter is used for the estimation of various biochemical compounds in variety of biological samples like blood, plasma, serum, CSF, urine and other body fluids. All those methods which involve the formation of colored product with specific analyte, the analyte can be estimated quantitatively. Colorimeters are also widely used for monitoring the growth of bacterial or yeast cells in liquid cultures.