The principle of Ultra Violet (UV) Spectrophotometer

Ultraviolet-visible spectroscopy is considered an important tool in analytical chemistry. In fact, this is one of the most commonly used techniques in clinical as well as chemical laboratories. This tool is used for the qualitative analysis and identification of chemicals. However, its main use is for the quantitative determination of different organic and inorganic compounds in solution.

Basically, spectroscopy is related to the interaction of light with matter. As light is absorbed by matter, the result is an increase in the energy content of the atoms or molecules.

The absorption of visible light or ultraviolet light by a chemical compound will produce a distinct spectrum.

When ultraviolet radiations are absorbed, this results in the excitation of the electrons from the ground state towards a higher energy state. The theory revolving around this concept states that the energy from the absorbed ultraviolet radiation is actually equal to the energy difference between the higher energy state and the ground state.

The Basic Principle of UV Spectroscopy:

UV spectrophotometer principle follows the Beer-Lambert Law. This law states that whenever a beam of monochromatic light is passed through a solution with an absorbing substance, the decreasing rate of the radiation intensity along with the thickness of the absorbing

solution is actually proportional to the concentration of the solution and the incident radiation.

This law is expressed through this equation:

$A = \log (I0/I) = ECI$

A stands for the absorbance, I0 refers to the intensity of light upon a sample cell, l refers to the intensity of light departing the sample cell, C stands for the concentration of the solute, L stands for the length of the sample cell and E refers to the molar absorptivity.

Basing from the Beer-Lambert law, it has been established that the greater the number of the molecules that are capable of absorbing light at a certain wavelength, the greater the extent of the absorption of light.

Applications of UV Spectroscopy:

The concept and principle of UV

spectrophotometer have several applications. For instance, this is used to detect a functional group. It can be used to detect the absence or the presence of chromophore in a complex compound.

This can also be used to detect the extent of conjugation in polyenes. When there is an increase in double bonds, the absorption shots to the longer wavelength. In addition, UV spectroscopy may be used to identify unknown compounds. The spectrum of an unknown compound is going to be compared with the spectrum of a reference compound. If both spectrums coincide, this unknown compound will be successfully identified.

UV spectroscopy can also help determine the configurations of a geometrical isomer. It has been established that cis-alkenes are absorbed at a different wavelength compared to trans-alkenes. If one of the isomers comes with non-coplanar structure, it can still be determined by

UV spectroscopy.

Lastly, this tool can determine the purity of a substance. To do this, the absorption rate of the sample solution is going to be compared with the absorption rate of the reference solution. The intensity of the absorption can be used to calculate the purity of a substance.

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