International Journal of Pharmaceutical Research and Applications
Volume 10, Issue 2 Mar – Apr 2025, pp: 904-908 www.ijprajournal.com ISSN: 2456-4494

A Review on Analytical Process of Ultraviolet Visible Spectrometry

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Date of Submission: 25-03-2025 Date of Acceptance: 05-04-2025

ABSTRACT:
The targets of current research are analytical approach development, validation and the value effective. The method of analysis is primarily based on measuring the absorption of monochromatic mild by means of pattern in near ultraviolet route of spectrum. The drug used to be analyzed using ultraviolet or visible spectrophotometric approach was validated in the terms of the linearity, accuracy, precision, specificity, limit of detection, restriction of quantitation and range. UV spectrophotometer analytical technique for detection and quantitative evaluation of drugs.
The photometric method of evaluation is based totally on lamberts-beers law which mounted that the absorbance of answer is directly proportional to awareness of analyte.
The pharmaceutical analysis consists the technique integral to decide identify, strength, pleasant and purity of such compound. It also consists of the evaluation of raw cloth and intermediate at some point of manufacturing process of drugs. The crucial most important of spectrophotometer covering U.V region consist in that mild of definite wavelength passes via solvent and fall on photoelectric cell and it seriously change the radiant energy into electrical strength which is measure via galvanometer.
Keyword- analytical chemistry, U.V spectroscopy, lambert-beers law, spectrophotometric method.

List of abbreviation:

Sr.no	Name of abbreviation	Abbreviation
1	UV	Ultraviolet
2	ICH	International Council for Harmonization
3	USP	United States Pharmacopeia
4	IUPAC	International Union of Pure and Applied Chemistry
5	LOD	Limit of Detection
6	LOQ	Limit of Quantitation

I. INTRODUCTION:

U.V Visible spectroscopy is an analytical technique that measure the amount of discrete wavelength of U.V or Visible light that are absorbed by transmitted through sample in comprise on to reference sample.

The beers lambert law state that the absorbance of solution directly proportional to concentration of the absorbing species in solution and fixed path length. The absorbance of sample is rapidly changes with the concentration of the sample.

The U.V-Visible region of energy for electromagnetic spectrum covers 1.5 to 6.2 EV which relates to wavelength ranges of 200-800nm. The beers lambert's law equation [a] is the principle behind the absorbance spectroscopy.
All of these instrument have the light source which is mainly deuterium or tungsten lamp, sample holder and the detector but some have filter for selecting one wavelength at time.

The single beam instrument has filter or Monochromotor between the source and sample to analyzed one wavelength at time.

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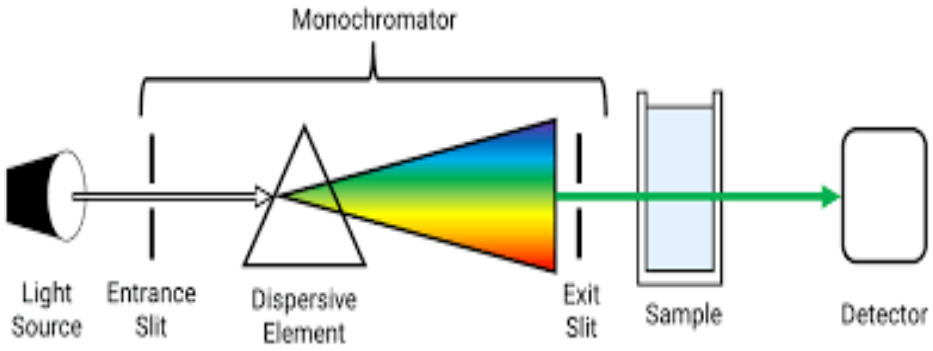

UV-Visible Spectroscopy

NEED OF STUDY:

It refers to technique used of detection, identification, characterization and quantification of chemical compound. The pharmaceutical analysis consists the procedure necessary to determine identify, strength, quality and the purity of such compound.

It also includes the analysis of raw material and the intermediate during manufacturing process of drugs. Analytical chemistry is the science that seek ever improved means of measuring the chemical composition of natural and artificial.

OBJECTIVE:

The objective of this dissertation work as follow –
Aims of present work is to develop some new analytical method for the estimation of drug.

1. To develop rapid, sensitive and selective method.
2. Economic and accurate method.
3. Method validation according to ICH guideline.

ANALYTICAL CHEMISRTY

Analytical chemistry refers to technique used of detection, identification, characterization and quantification of chemical compound. The pharmaceutical analysis consists the procedure necessary to determine identify, strength, quality and the purity of such compound.

It also includes the analysis of raw material and the intermediate during manufacturing process of drugs. Analytical chemistry is the science that seek ever improved means of measuring the chemical composition of natural and artificial.

Role of analytical chemistry:

1. Accurately developing drug for consumption in correct amount.
2. Analytical chemistry provides the mean of testing of raw material and for assuring the quality of finished product.

TYPE OF THE ANALYTICAL CHEMISTRY : QUALITATIVE ANALYSIS:

Qualitative evaluation generally is dedication of the very chemical composition of the sample, which sort of is significant. It encompasses the set of analytical chemistry method that seeks mounted the presence of given functional group or natural compound or inorganic compound in the sample, or so they thought.

METHODS FOR DETECTING ANALYTE:

There are three method used in the detection of the analyst is mainly:

1. Physical
2. Using electric charge
3. Using spectroscopy.

ULTRAVIOLET ABSORBTION OF SPECTROPHOTOMETERY:

It is primarily based on the lambert -beer's law, which state that the absorbance of the solution is at once proportional to attention of absorbing species in the answer and fixed route length. The absorbance of sample is unexpectedly modifications with the concentration of the pattern. The UV -visible place of strength for the electromagnetic spectrum covers 1.5 – 6.2 eV which relate to wavelength ranges of 200 – 800 nm.

The necessary precept of the beer's lambert law State that the absorbance of the solution is directly proportional to concentration of the absorbing specie in the solution and the path length of the sample holder.

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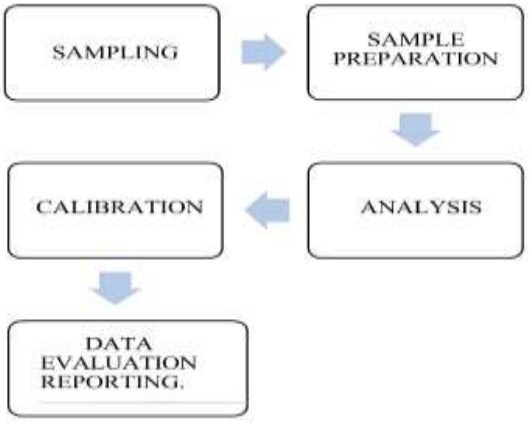
STEPS IN ANALYTICAL CYCLE:



CALIBRATION AND REFERENCE:

A Blank reference will basically be needed at the very commencing of the analysis of the in reality solvent to be used and if awareness analysis normally wishes to in reality be performed, calibration answer need to actually be made accurately in a basically fundamental way.

For the blank reference water and hexane for all intents and purposes solvent virtually are used to literally function the calibration of baseline correction, which is significant.

CRITERIA FOR SOLVENT:

1. A good solvent should not be absorbed UV radiation in the same region as the substance whose spectrum is being determined.
2. The solvent most commonly used are water, 95% ethanol, and n- hexane.
3. The solvent must be transparent.
4. The ability of solvent to influence the wavelength of the ultra violet light which will be absorbed.
5. Solvent have the shortest wavelength at which they remain transparent to ultraviolet wavelength.

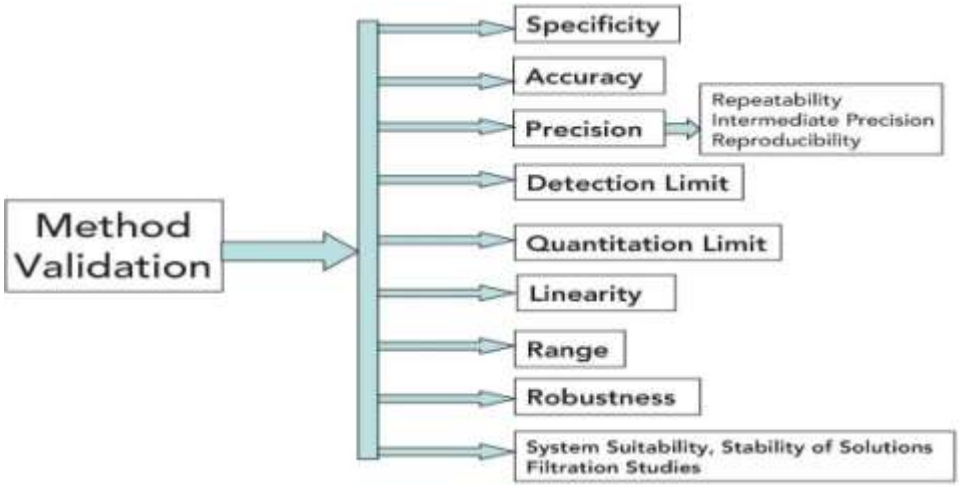
CHOICE OF CONTAINER:

A cuvette or container is small essentially straight tube and for all intents and purposes round particularly move section, type of opposite to famous belief

Example:

1. Glass
2. Quartz
3. Plastic

Method Validation Parameter:



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SPECIFICITY:

The ability to measure the analyte of interest precisely and specifically in the presence of exceptional components that are typically expected to be present in the sample matrix in a significant manner is known as specificity.

Additionally, ICH uses the time period specificity and separates it into two distinct categories: impurity test and identification test.

ACCURACY :

Accuracy is a measure of how exact an analytical procedure is, or how closely the cost found settles with the price that is typical as a conventional, authentic value or a generic reference price.

The percentage of analyte recovered by assay is used to measure it. The following formula can be used to calculate the recovery.

Recovery = Analytical Result / True Value x 100%.

PRECISION:

The USP states that an analytical technique's precision is essentially the level of agreement between character analysis results when the method is applied consistently to numerous samplings of homogeneous samples in a significant manner.

In essence, precision is typically examined at three degrees, which is rather important.

Replicability Intermediate accuracy reproducibility.

LIMIT OF DETECTION:

The lowest concentration of an analyte in a sample that can be identified but not always quantified is known as the Limit of Detection (LOD) of an analytical system. This limit indicates whether an analyte is above or below a positive value.

LOD = 3.3x σ/S.

where
σ =the response's standard deviation.
S = the calibration curve's slope.

QUANTITATION LIMIT:

The lowest analyte concentration in a sample that can be identified with suitable accuracy and precision under the method's specified operating conditions is known as the limit of quantitation.

LOQ = 10 x σ / s.

Where
σ = the response's standard deviation.
S =the calibration curve's slope.

Linearity:

The ability of an analytical method to produce test findings that are exactly proportionate to the analyte concentration in samples within a specified range is known as linearity.

The variation around the slope of the regression line, which is determined using a mathematical connection formed from test results derived from the analysis of samples with different analyte concentrations, is typically used to express linearity.

ROBUSTNESS:

The ability of a method to withstand minor, intentional changes in its parameters is known as robustness. A method's robustness is assessed by adjusting its parameters, such as temperature, ionic strength, pH, and organic matter percentage, and assessing any impact on the method's output.

Robustness should be taken into account at an early stage of a method's development, as stated in the ICH standards.

Range:

The interval between the upper and lower levels of analyte (including these levels) that have been shown to be determined with an appropriate degree of precision, accuracy, and linearity using the process as specified is known as the range of analytical procedures.

SYSTEM SUITABILITY:

A lot of analytical processes include system suitability assessment. The tests are predicated on the idea that the apparatus, electronics, analytical processes, and samples that need to be examined form a cohesive system that can be assessed as such.

II. CONCLUSION:

An essential analytical tool for ensuring the precision, accuracy, and specificity of the analytical processes is method validation.

The detection and quantitation limits for the estimation of drug components are established using this procedure. The system appropriateness and validation processes are carried out simultaneously.

The analytical outcomes of the validation features are also interpreted using a few statistical

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methods.

Both the statistical processing of the analytical data and the performance of the characteristics parameter are necessary for the validation of analytical procedures.

These treatments affect whether the variation of the analytical data is accept.

REFERENCE:

[1]. Gandhimathi R, Vijayaraj S, Jyothirmaie MP. Analytical process of drugs by ultraviolet (UV) spectroscopy–a review. International Journal of Pharmaceutical Research & Analysis. 2012; 2(2):72-8

[2]. Ahuja S, Scypinski S, editors. Handbook of modern pharmaceutical analysis. Academic press; 2001 Aug 9.

[3]. Verma G, Mishra M. Development and optimization of UV-Vis spectroscopy-a review. World Journal of Pharmaceutical Research. 2018 Apr 19;7(11):1170-80.

[4]. Grossiord N, Regev O, Loos J, Meuldijk J, Koning CE. Time-dependent study of the exfoliation process of carbon nanotubes in aqueous dispersions by using UV− Visible spectroscopy. Analytical chemistry. 2005 Aug 15;77(16):5135-9.

[5]. The United States Pharmacopoeia, Rockville, MD, Edition 3, 2003, 2320.

[6]. FDA, Guidance for Industry: Impurities in Drug Product, Draft Guidance, Center for Drug Evaluation and Research (CDER), 1998.

[7]. chemed.chem.purdue.edu. Retrieved 2016-03-17.

[8]. Abdelrahman MM. Simultaneous determination of Cinnarizine and Domperidone by area under curve and dual wavelength spectrophotometric methods. Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy. 2013 Sep 1;113:291-6.

[9]. Shabir GA. Validation of high-performance liquid chromatography methods for pharmaceutical analysis: Understanding the differences and similarities between validation requirements of the US Food and Drug Administration, the US Pharmacopeia and the International Conference on Harmonization. Journal of chromatography A. 2003 Feb 14; 1987(1-2):57-66.

[10]. Validation of Analytical Procedures: Text and Methodology Q2(R1), ICH Harmonised Tripartite guidelines, International Conference on Harmonisation of Technical Requirements for Registration of Pharmaceuticals for Human Use, 2005; 7.

[11]. Validation of Compendial Procedures <1225>, The United States Pharmacopeia, 32th Rev., and The National Formulary, 27th Rev., Rockville, MD: The United States Pharmacopeial Convention Inc., 2009; I: 735.

[12]. Validation of Analytical Procedures: Text and Methodology Q2(R1), ICH Harmonised Tripartite guidelines, International Conference on Harmonisation of Technical Requirements for Registration of Pharmaceuticals For Human Use, 2005; 10.

[13]. NK, Sahu M, Veerachamy A, Lalitha BV, Morgana AK, et al. (2015) Quantification and validation of simvastatin and ezetimibe in bulk drugs and combined dosage form by reverse phase liquid chromatographic method(RPLC). Pharmaceutical Methods 6: 115-119.

[14]. Sahoo NK, Sahu M, Praneeth P, Manjeera PSK, Lavanya K (2013) Degradation motitoring method development and validation of spectophotometric estimation of atrovastatin calcium in bulk and tablet formulation. J Pharm. Biomed Sci 33: 1551-1557.

[15]. Patel NK, Subhaiah G, Shah H, Kundlik M, Shrivastav SP (2008) Rapid LC-ESI-MS-MS method for the simultaneous determination of clopidogrel and its carboxylic acid metabolite in human plasma. J Chromatogr Sci 46: 867-875.

[16]. Sahoo NK, Sahu M, Alagarsamy V, Srividya B, Sahoo CK (2015) Current status of two-dimensional gel validation of assay indicating method development of imatinib in bulk and its capsule dosage form by liquid chromatography. Ann Chromatogr Sep Tech 1: 1010.

[17]. Validation of Compendial Procedures <1225>, The United States Pharmacopeia, 32th Rev., and The National Formulary, 27th Rev., Rockville, MD: The United States

[18]. Renger B, Jehle H, Fischer M, Funk W (1995) Validation of analytical procedures in pharmaceutical analytical chemistry: HPTLC assay of theophylline in an effervescent tablet. J Planar Chrom 8: 269-278.