International Journal of Homoeopathic Sciences

E-ISSN: 2616-4493
P-ISSN: 2616-4485
www.homoeopathicjournal.com
IJHS 2025; 9(3): 406-409
Received: 22-04-2025
Accepted: 24-05-2025

Shivaa Harini Shri K
UG Scholar, Sarada Krishna Homoeopathic Medical College, Kulasekharam, Kanyakumari, India

Sherin Sindhiya Mary
UG Scholar, Sarada Krishna Homoeopathic Medical College, Kulasekharam, Kanyakumari, Inia

Sindhumathi P
UG Scholar, Sarada Krishna Homoeopathic Medical College, Kulasekharam, Kanyakumari, India

Dr. Sibin
RAMD (HOM)
Assistant Professor, Department of Organon of Medicine, Sarada Krishna Homoeopathic Medical College, Kulasekharam, Kanyakumari, India

Corresponding Author:
Shivaa Harini Shri K
UG Scholar, Sarada Krishna Homoeopathic Medical College, Kulasekharam, Kanyakumari, India

An UV visible spectrophotometric analysis of *Thuja occidentalis* of various homoeopathic pharmaceutical companies

Shivaa Harini Shri K, Sherin Sindhiya Mary, Sindhumathi P and Sibin

DOI: https://www.doi.org/10.33545/26164485.2025.v9.i3.F.1684

Abstract
UV-visible spectrophotometry is a fundamental analytical technique widely used for the qualitative and quantitative analysis of chemical substances. This study explores the application of UV-vis spectrophotometry in determining the concentration of an analyte by measuring its absorbance at a specific wavelength. Based on the Beer-Lambert Law, the method establishes a direct relationship between absorbance and concentration. A calibration curve was constructed using standard solutions, and the concentration of unknown samples was successfully determined. The simplicity, rapidity, and cost-effectiveness of the technique make it highly suitable for routine analysis in pharmaceutical, environmental, and biochemical laboratories. The results demonstrated high accuracy and reproducibility, confirming the reliability of UV-vis spectrophotometry as a tool for spectroscopic analysis.

Keywords: UV-vis spectrophotometry, Beer-Lambert law, *Thuja occidentalis*

Introduction
UV-visible spectrophotometry is a widely used analytical technique in chemistry and biology that measures the absorbance of Ultraviolet (UV) and visible light by a substance in solution. The technique is based on the interaction of light with matter, where molecules absorb light of specific wavelengths leading to electronic excitation. The amount of light absorbed at a particular wavelength is related to the concentration of the absorbing species in the sample, following the Beer-Lambert law.

This technique typically covers the wavelength range from 200 nm (in the UV region) to 800 nm (in the visible region). When a beam of UV or visible light passes through a solution, some of the light is absorbed by the molecules present, and the spectrophotometer records this as a decrease in intensity. The resulting absorbance spectrum can provide qualitative information (e.g., identifying functional groups or molecular structure) and quantitative data (e.g., concentration of analytes).

UV-vis spectrophotometry is especially valuable in pharmaceutical analysis for the assay of Active Pharmaceutical Ingredients (APIs), purity testing, and dissolution studies. It is also widely applied in environmental monitoring, food and beverage analysis, forensic investigations, and biochemical assays such as DNA and protein quantification.

The method is favored due to its simplicity, speed, non-destructive nature, and relatively low cost. It requires minimal sample preparation and can analyze small quantities of substances with high sensitivity. Moreover, modern UV-vis spectrophotometers offer features like wavelength scanning, dual-beam detection, and computer interfacing for advanced data handling.

In summary, UV-Visible spectrophotometry plays a crucial role in modern analytical laboratories, offering a reliable and efficient means to assess the chemical composition and concentration of various substances across a broad range of applications.

Aim and Objectives
Aim
To analyze the absorbance characteristics of a given sample using UV-visible spectrophotometry and determine its concentration using Beer-Lambert's Law.

Objectives

1. To understand the working principle of a UV-Vis spectrophotometer.
2. To identify the wavelength of maximum absorbance (λmax) of the analyte.
3. To construct a calibration curve using standard solutions.

Review of Literature

1. Skoog, West, Holler, and Crouch (2014) highlighted the role of UV-vis spectroscopy in the quantitative analysis of drugs and biological samples, emphasizing the sensitivity and specificity of the technique.
2. Beer's Law (1852) and Lambert's Law (1760) are foundational to this method. Combined, they state that absorbance is directly proportional to concentration and path length.
3. Rosenberg *et al*., (2001) demonstrated the use of UV-Vis spectroscopy in environmental monitoring, especially in detecting pollutants like nitrates and phosphates.
4. British Pharmacopoeia (BP 2023) and United States Pharmacopeia (USP 2023) both outline protocols for UV-Vis methods in drug assay and purity testing.
5. Patel *et al*., (2019) validated UV-Visible spectrophotometric methods for simultaneous estimation of multi-drug formulations, proving it to be cost-effective and efficient for routine quality control.

4. Methodology

4.1 Sample collection

Tinctures of Thuja occidentalis will be obtained from a variety of pharmaceutical businesses [SBL, Schwabe, Bakson] which will ensure that a wide range of brands and batches are represented. There will be labels placed on each sample, and it will be kept in the suitable conditions until it is analysed.[11]

4.2 Preparation of samples

In order to remove any particles that may be present, the tinctures will be filtered.

4.3 UV-visible spectrophotometry

A UV-visible spectrophotometer will be utilized in order to determine the absorbance of every sample over a wavelength range that extends from 200 to 800 nanometres. A blank solution will be utilized in the process of calibrating the instrument. The absorbance spectra are going to be recorded, and the major absorbance peaks are going to be recognized and checked out thoroughly [12].

4.4 Data analysis

The next step will be a comparison made between the absorbance values and spectra that were obtained from various brands and batches. Analysis will be performed on a number of parameters, including peak wavelength, peak absorbance, and spectral profile. A number of statistical techniques, including Analysis of Variance (ANOVA), will be utilized in order to ascertain whether or not there are discernible variations in absorbance values among the samples. For the purpose of providing a clear visualization, the data will be provided in tables and graphs.

4.5 Evaluation of quality

The next step will be an evaluation of the quality of the tinctures based on the consistency of their absorbance profiles and a comparison. It is possible that differences in the concentration or composition of the active substances are contributing to the spectrum patterns that have been observed

5. Observations

Table 1: Comparison of values

Wave length	Control	Sample 1	Sample 2	Sample 3
300	0.179	0.43	0.49	30.47
325	0.227	0.55	0.67	0.55
350	0.26	0.48	1.1	0.57
375	0.971	0.03	0.12	0.03
400	0.093	0.04	0.13	0.03
425	0.128	0.21	0.29	0.43
450	0.026	1.6	9.91	0.96
475	0.064	0.56	0.5	6.85
500	0.069	0.8	2.27	8.95
525	0.066	2.46	6.43	20.8
550	0.063	17.3	10.6	22.4
575	0.072	12.7	16.2	17.4
600	0.056	10.6	100	13.2
625	0.036	1.16	1.59	1.07
650	0.015	45.6	34.4	50.9
675	0.019	82.4	58.6	85.2
700	0.003	80.4	75.2	78.7
725	0.057	83.8	75.9	81.6
750	0.003	85.3	90.9	82.8
775	0.051	85.9	80.7	83.3
800	0.058	86.1	81.3	83.1

Graphical representation

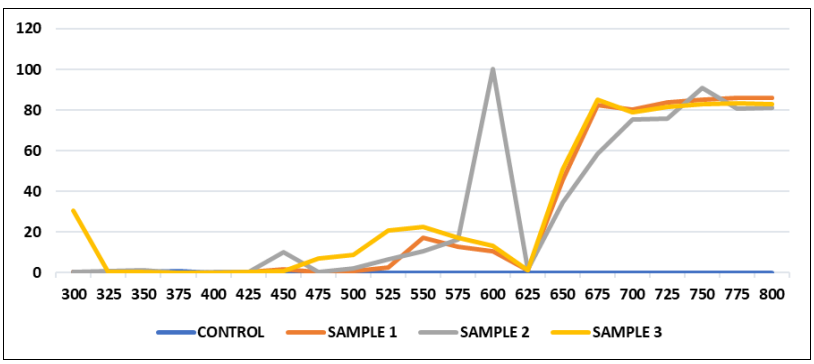

Fig 1: Graphical representation of values

6. Inference and Results

Absorbance of *Thuja tinctures*

- **Sample 1:** The absorbance values of the tincture remain low in the UV region, with minor peaks at 450 nm (1.6), 525 nm (2.46), and 550 nm (17.3). The highest absorbance occurs at 675 nm (82.4) and 700 nm (80.4), suggesting higher chromophore presence in the red-visible spectrum.
- **Sample 2:** The tincture shows similar trends, with higher absorbance values at 600 nm (100), 650 nm (34.4), and 675 nm (58.6). Schwabe's tincture exhibits overall higher absorption in the visible spectrum compared to SBL.
- **Sample 3:** Tincture displays significant variations, with a peak at 650 nm (50.9) and consistently higher values at 675 nm (85.2), 700 nm (78.7), and 725 nm (81.6). The high absorbance at these wavelengths suggests a more substantial presence of active constituents or variations in the tincture composition.

Discussion

UV-visible spectrophotometry is a widely used analytical technique that helps in the detection and quantification of various compounds in plant extracts based on their light absorption in the ultraviolet (200-400 nm) and visible (400-700 nm) regions. In the case of Thuja (commonly Thuja occidentalis), this technique plays an important role in evaluating its phytochemical profile. Thuja is known for its diverse therapeutic properties, including antioxidant, anti-inflammatory, antimicrobial, and anticancer effects. These bioactivities are largely attributed to its rich phytochemical content, which includes flavonoids, polyphenols, tannins, and essential oils such as thujone.

Sample preparation

For UV-Visible analysis, plant material (leaves, usually dried and powdered) is extracted using solvents such as methanol, ethanol, or aqueous alcohol. The extract is filtered and appropriately diluted before analysis. The choice of solvent influences the type and yield of compounds extracted.

Spectral analysis

The extract is scanned in the UV-vis range using a spectrophotometer. A typical UV-visible scan of Thuja extract may show:

Absorption peaks around 270-280 nm: Indicating the presence of phenolic compounds. Peaks around 320-360 nm: Attributed to flavonoids, especially flavanols and flavones. Additional shoulders or minor peaks may suggest the presence of coumarins or terpenes, depending on the exact chemical profile of the extract. The spectral profile is a fingerprint that can be used to standardize Thuja extracts and compare different samples or batches.

Quantitative estimations

Using standard calibration curves of known phytochemicals like: Gallic acid for Total Phenolic Content (TPC), Quercetin for Total Flavonoid Content (TFC), The concentrations of these compounds can be estimated spectrophotometrically. These measurements help evaluate the potency and consistency of Thuja-based formulations.

Summary

The UV-Visible spectrophotometric analysis of Thuja offers a simple, rapid, and reproducible method for assessing its phytochemical composition. The method highlights the presence of flavonoids and phenolic compounds, which are key contributors to the plant's pharmacological activity. This analysis aids in:

Quality control and standardization of herbal products. Screening of bioactive compounds. Comparison of extraction methods and solvent efficiency. Supporting claims regarding the therapeutic value of Thuja preparations. The ability to quickly assess bioactive contents without complex procedures makes this technique highly suitable for routine herbal analysis.

Conclusion

UV-Visible spectrophotometric analysis is a vital tool in the phytochemical evaluation of Thuja. By revealing the absorption characteristics of phenolics and flavonoids, it provides insight into the plant's chemical makeup and therapeutic potential. This method not only helps in identifying key compounds but also supports the development of standardized, effective herbal remedies. Furthermore, it facilitates batch-to-batch consistency, an essential aspect of modern phytopharmaceutical production. Given its simplicity, affordability, and accuracy, UV-Vis spectroscopy remains an essential method in the analytical arsenal for Thuja and other medicinal plants.

References

1. Skoog DA, West DM, Holler FJ, Crouch SR. Fundamentals of Analytical Chemistry. 9th ed. Belmont: Brooks/Cole; 2014.
2. Rosenberg E, Legler TJ, Schlebusch H. UV-visible spectrophotometric analysis in environmental monitoring: Current trends and future perspectives. Anal Chim Acta. 2001;447(1):73-83.
3. Patel PM, Patel MM, Patel CN. UV-visible spectrophotometric method development and validation of combined dosage form of fluoxetine hydrochloride and olanzapine. Int J Pharm Sci Res. 2019;10(1):115-120.
4. British Pharmacopoeia Commission. British Pharmacopoeia 2023. London: The Stationery Office; 2023.
5. United States Pharmacopeial Convention. United States Pharmacopeia and National Formulary (USP 46-NF 41). Rockville, MD: USP; 2023.
6. De Smet PA. Herbal remedies. N Engl J Med. 2002;347(25):2046-2056.
7. Salehi B, Mishra AP, Shukla I, Sharifi-Rad M, Contreras M del M, Segura-Carretero A, *et al*. Thujone-containing essential oils: Evaluation of their biological effects and safety. Cell Mol Biol (Noisy-le-grand). 2018;64(8):27-34.
8. Kaur G, Alam MS, Athar M. Thuja occidentalis attenuates oxidative stress and inflammation in collagen-induced arthritis in rats. Biomed Pharmacother. 2013;57(3-4):157-169.
9. Kumar M, Prasad SK, Hemalatha S. A current update on the phytochemistry, pharmacology, and toxicology

of Thuja occidentalis L. Asian Pac J Trop Biomed. 2015;5(3):186-189.
10. Wagner H, Bladt S. Plant Drug Analysis: A Thin Layer Chromatography Atlas. 2nd ed. Berlin: Springer; 1996.

How to Cite This Article
K SHS, Mary SS, Sindhumathi P, Sibin. An UV visible spectrophotometric analysis of *Thuja occidentalis* of various homoeopathic pharmaceutical companies. International Journal of Homoeopathic Sciences. 2025;9(3):406-409.