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Comparative UV-Visible Spectrophotometric Analysis of Different Paracetamol Brands

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Abstract: Paracetamol is a well-known analgesic and antipyretic drug available in different marketed brands in India. This study embraces a comparative assay of paracetamol (PCM) using UV-Visible Spectrophotometry, a widely used analytical technique for the analysis of pharmaceutical products. The assay focused on the quantification of PCM in various tablet formulations by measuring the absorbance of individual tablet solution at its characteristic wavelength (257nm). The percentage purity of the particular brand was determined by comparing the absorbance of the individual brand with the absorbance of the standard paracetamol. According to IP (Indian Pharmacopoeia) specifications, the percent purity of paracetamol should fall within the range of 95% to 105%.

The spectrophotometric assay revealed that samples A,B,C and D complied with the IP-specifiedpurity limit, while sample E was found to be outside the acceptable range.

Keywords: Paracetamol, Acetaminophen, Quantitative Assay

INTRODUCTION

Paracetamol, generically also known as acetaminophen is a widely used non-opioid over the counter drug which is sold without any written prescription by a medical practitioner.It is used to treat a wide range of pain ranging from headache to menstrual pain and is used to decrease elevated temperature.

Chemically, Paracetamol is the de ethylated active metabolite of phenacetin. It has the appearance of a white

crystalline powder and a molar mass of 151.163g/mol, making it ideal for specific industrial processes. Its IUPAC name is: N-(4-hydroxyphenyl) acetamide, N-(4-hydroxyphenyl) ethanamide.

Due to the high prevalence off ever and pain in individual's,the high acceptability of paracetamol, and its negligible side effects, it is available in various marketed brands.

The safety and purity of all marketed brands matters a lot, which can be compared and accessed by evaluatingthepercentagepurity.Onewaytoevaluatethepercentageisbyrecordingtheabsorbanceofdrug compound by UV visible spectrophotometer.

Mechanism of action

Paracetamol exerts its pharmacological action by inhibiting the synthesis of Prostaglandin. Prostaglandinis believed to be responsible for eliciting pain sensation. Arachidonic acid is converted toPGH2 by the action of COX enzyme, which is further converted to prostaglandin. Paracetamol acts by indirectly inhibiting the action of the COX enzyme. Thus, the conversion of arachidonic acid to PGH2 and the synthesis of prostaglandin is blocked.

Arachidonic Acid

-PCM

COXEnzyme PGH2

Prostaglandin

The term **spectrophotometer** is a combination of two terms namely: a **spectrometer** for a part of instrument responsible for producing light at a selected wavelength and a **photometer** for a part of instrument responsible for measuring the intensity of light. If we talk specifically about UV Spectrophotometer, it deals with the analysis of compounds which shows the absorbance of light in the range of 200-800nm.Range of 200-400 nm is for colourless compound where as range of 400-800 nm is for coloured compound.

UV-Visible Spectrophotometer is a highly sophisticated and advanced instrument widely used in the pharma and food industries for analysis of different products and compounds. It is based on the principle of absorbtion of UV-Visible electromagnetic radiation.

Components of UV-Visible spectro photometer includes-

- Radiation Source
- A Collimating system
- A Monochromator System
- Sample holder/Cuvette
- Detector
- Amplifier

UV-Visible Spectrophotometer is mainly based on the principle of **Beer-Lamberts law** which states that– Amount of light transmitted by sample solution to the detector which is being incident by light source depends on concentration and path length of sample solution.

MATERIALSANDMETHOD

Material:

Sample collection–5 Different Brands of Paracetamol tablets Containing 650mg paracetamol along with excipients were purchased from medical store of Mandsaur city.

Paracetamol Standard–Standard of Paracetamol was obtained from Suvidhinath Laboratories Vadodara Gujarat. (Product Code- 5715)

Instrumentation-

Model

Shimadzu Japan and UV-1900i

Specifications

- Optical System: Double Beam Optics Wave length Range: 190to1,100 nm
- Spectral b and width:1nm (190to1,100 nm)
- Wavelength Repeatability: ±0.1nm
- Wavelength Accuracy: ±0.1nmat D2peak 656.1nm,± 0.3nm forentirerange.
- Scanning Speed:3000 to 2nm/min,29000nm/min when survey scanning.
- Photometric Range: Absorbance-4to4Abs Transmittance–0%to 400%
- Photometric Accuracy:+ 0.002Absat0.5Abs+0.004Absat1Abs+0.006Absat2 Abs
- Source: Halogen (WI) and Deuterium Lamp.
- Detector: Silicon Photodiode Supplied with below accessories:
- Shimadzu Lab Solutions UV is Software
- Powercablefor240V2.4m.
- 10mm Rectangular Quartz Cell -1 Pair.

Diluent Preparation (0.1MNaOH)-

4gram of sodium hydroxide was dissolved in a small quantity of water in1000mL Volumetric flask and the resultant solution is sonicated for 10 min. After sonication, a sufficient amount of distilled water is added to produce a final 1000 mL volume of 0.1%NaOH.

Quantitative Assay

Preparation of standard solution of Paracetamol

100mg of std paracetamol powder was taken in 100 ml volumetric flask and sonicated by adding a small amountof0.1MNaOHfor10min.Aftersonication,the volume is adjusted by adding the required amount of 0.1M NaOH to form 1000 µg/mL stock solution.

The mixture in flask is mixed well and filtered through a nylon filter paper. From the filtrate 10ml of the solution was pipetted out in 100 mL of volumetric flask and the volume was made up by adding 0.1M NaOH.Finally,from the result an t mixture 4ml of solution is with drawn and added to 50 ml volumetric flask and the volume is adjusted by adding 0.1M NaOH. These results in formation of 8 µg/ml of standard paracetamol solution.

Preparation of test solution of Paracetamol

Avg weigh to f 20 tablets from each brand was taken and tablet was crushed in clean mortar and pestle.Weigh accurately quantity of powder equivalent to100 mg of std. paracetamol and dissolved in a small quantity of 0.1M NaOH. Sonicate for 10 min and make final volume of 100mL by 0.1M NaOH after successful sonication.

The mixture in flask was mixed well and filtered through a nylon filter paper. From the filtrate 10ml of the solution was pipette out in100 ml of volumetric flask and the volume was made up by adding 0.1MNaOH.

Finally,from the result an mixture 4ml of solution is withdrawn and added to50ml volumetric flask and volumeisadjustedbyadding0.1MNaOH.These results in the formation of 8µg/ml of test paracetamol solution.

Instrument operation

Load the [Spectrum] module and connect the instrument by clicking [Connect]. Check all setup parameters for safety purpose.

The absorbance of 0.1M NaOH was marked as zero by running blank run.

Record the absorbance of all test sample and standard paracetamol at characteristic wavelength (257nm).

RESULTAND CONCLUSION

The absorbance and the percentage purity of paracetamol tablet so f different brands was determined by uv-visible spectroscope and is summarized in the table-

Sr NO.	BrandName	Labelweight(mg)	AvgWeight (mg)	%Purity (%)
1	TYNOL	650	729	100
2	DOLOWHEFF	650	815	104.2
3	DOLO 650	650	821	102
4	CALPOL	650	865	104.4
5	ADMOL	650	789	93

Tablet

According to IP specification percentage purity of paracetamol tablet should fall in therangeof95-105%. When the specified data is applied to the obtained result,it was found that four out of five drug falls in the specified range, whereas one tablet shows slight variation.

Following analytical data of individual tablet is obtained from the spectrophotometer-

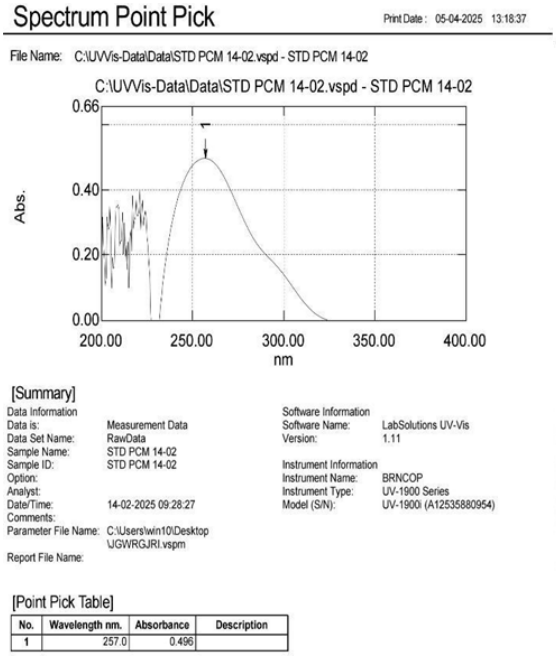


Fig.1StandardParacetamol

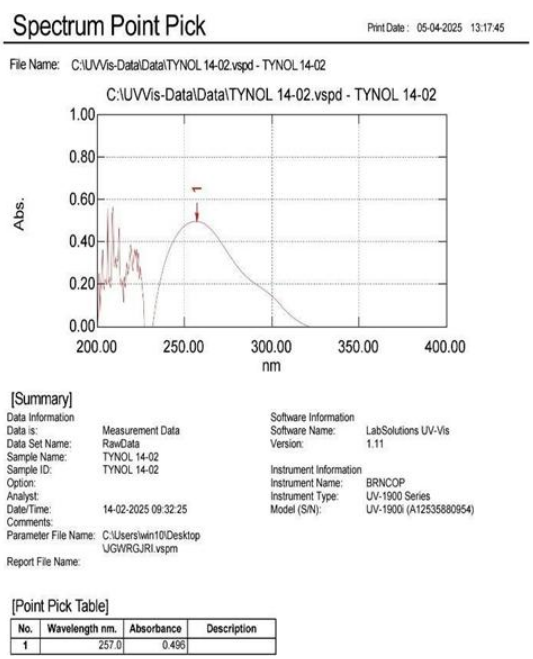


Fig.2TYNOL

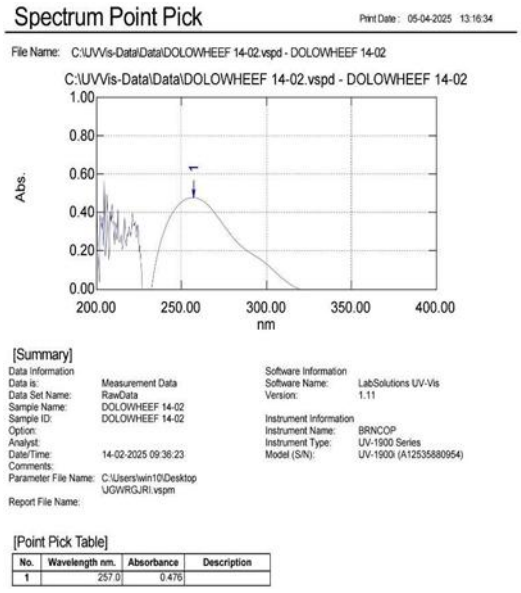


Fig.\3DOLOWHEFF

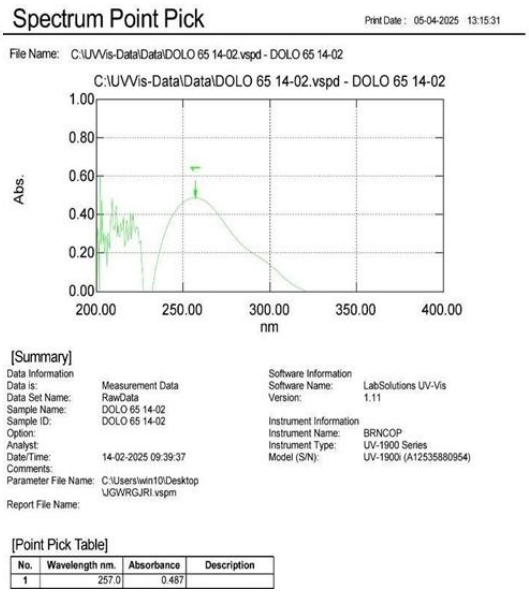
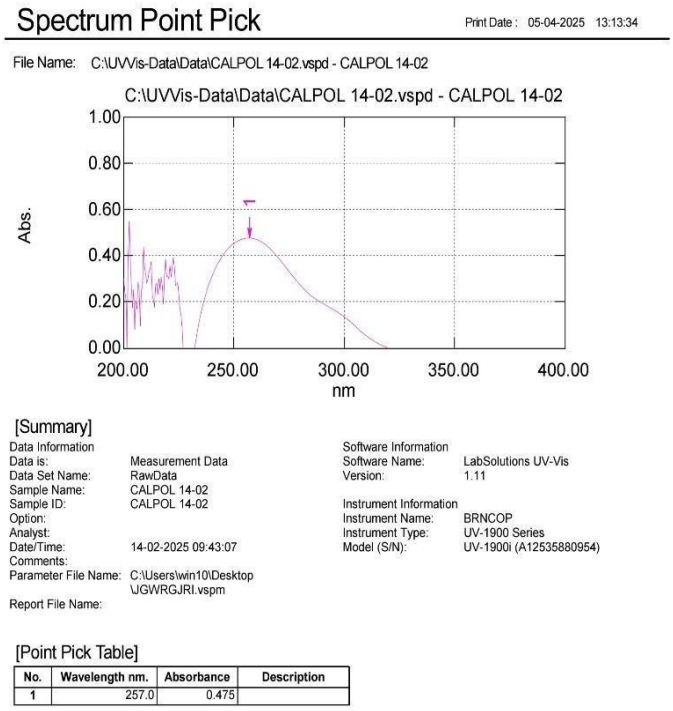


Fig.4DOLO-650



Spectrum Point Pick

Print Date : 05-04-2025 13:13:34

File Name: C:\UVVis-Data\Data\CALPOL 14-02.vspd - CALPOL 14-02

C:\UVVis-Data\Data\CALPOL 14-02.vspd - CALPOL 14-02

Abs.

1.00
0.80
0.60
0.40
0.20
0.00

200.00 250.00 300.00 350.00 400.00

nm

[Summary]

Data Information
Data is: Measurement Data
Data Set Name: RawData
Sample Name: CALPOL 14-02
Sample ID: CALPOL 14-02
Option:
Analyst:
Date/Time: 14-02-2025 09:43:07
Comments:
Parameter File Name: C:\Users\win10\Desktop\JGWRGJRI.vspm
Report File Name:

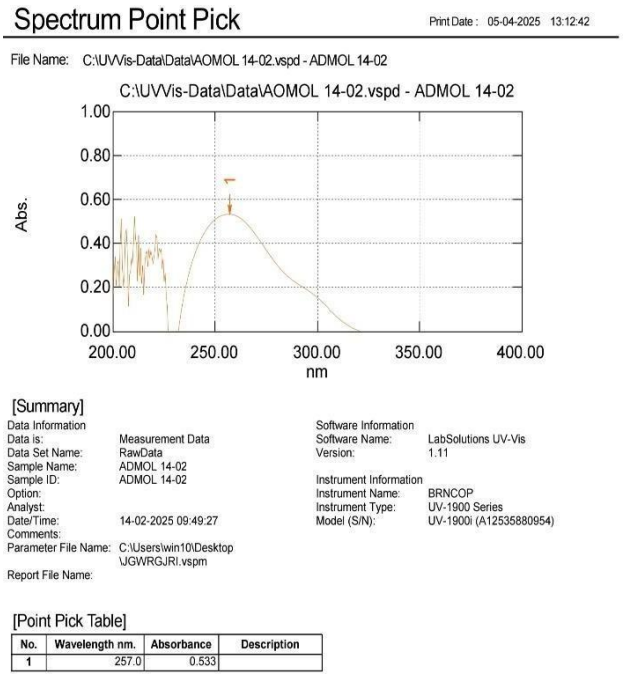
Software Information
Software Name: LabSolutions UV-Vis
Version: 1.11

Instrument Information
Instrument Name: BRNCOP
Instrument Type: UV-1900 Series
Model (S/N): UV-1900i (A12535880954)

[Point Pick Table]

No.	Wavelength nm.	Absorbance	Description
1	257.0	0.475	

Fig.5 CALPOL



Spectrum Point Pick

Print Date : 05-04-2025 13:12:42

File Name: C:\UVVis-Data\Data\AOMOL 14-02.vspd - ADMOL 14-02

C:\UVVis-Data\Data\AOMOL 14-02.vspd - ADMOL 14-02

Abs.

1.00
0.80
0.60
0.40
0.20
0.00

200.00 250.00 300.00 350.00 400.00

nm

[Summary]

Data Information
Data is: Measurement Data
Data Set Name: RawData
Sample Name: ADMOL 14-02
Sample ID: ADMOL 14-02
Option:
Analyst:
Date/Time: 14-02-2025 09:49:27
Comments:
Parameter File Name: C:\Users\win10\Desktop\JGWRGJRI.vspm
Report File Name:

Software Information
Software Name: LabSolutions UV-Vis
Version: 1.11

Instrument Information
Instrument Name: BRNCOP
Instrument Type: UV-1900 Series
Model (S/N): UV-1900i (A12535880954)

[Point Pick Table]

No.	Wavelength nm.	Absorbance	Description
1	257.0	0.533	

Fig.6ADMOL

CONCLUSION

Paracetamol, a well-known and widely used over the counter analgesic and antipyretic drug, is marketed by

different reputed pharmaceutical companies. The above study focused on the Quantitative estimation of five different marketed brands of paracetamol. When the absorbance of the drug is recorded at the characteristic wavelength of PCM and formulated.It was observed that four out of five tablets were within the range of IP specification and one tablet showed slight variation. It was concluded that tablets are

With in the IP specification range and meets the therapeutic requirement as per the specification.

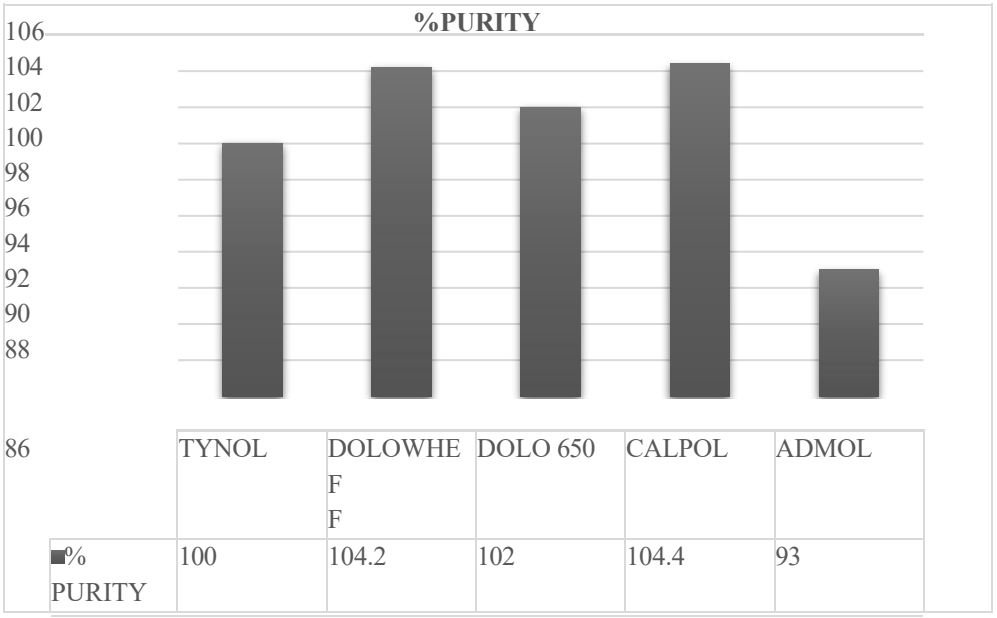


Fig. 7

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