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COMPARATIVE UV-VISIBLE SPECTROPHOTOMETRIC ANALYSIS OF DIFFERENT PARACETAMOL BRANDS

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Comparative UV-Visible Spectrophotometric Analysis of Different Paracetamol Brands

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-specified purity limit, while sample E was found to be outside the acceptable range.

KEYWORDS

Paracetamol, UV/Vis Spectroscopy, Acetaminophen, 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.

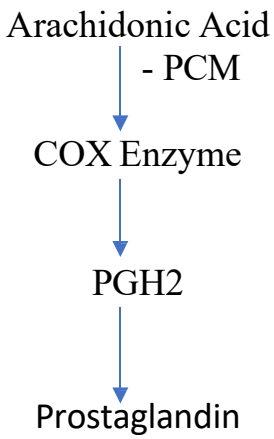
Chemically, Paracetamol is the deethylated active metabolite of phenacetin. It has the appearance of a white crystalline powder and a molar mass of 151.163g/mol, making it ideal for specific industrial processes. Its IUPAC name is: N-(4-hydroxyphenyl) acetamide, N-(4-hydroxyphenyl) ethanamide.

Due to the high prevalence of fever 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 evaluating the percentage purity. One way to evaluate the percentage is by recording the absorbance of drug compound by UV visible spectrophotometer.

Mechanism of action

Paracetamol exerts its pharmacological action by inhibiting the synthesis of Prostaglandin. Prostaglandin is believed to be responsible for eliciting pain sensation. Arachidonic acid is converted to PGH2 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.



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 200-800 nm. Range of 200-400 nm is for colourless compound whereas 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 spectrophotometer 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 pathlength of sample solution.

MATERIALS AND METHOD

Material:

Sample collection – Five Different Brands of Paracetamol tablets Containing 650 mg 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 Wavelength Range: 190 to 1,100 nm
- Spectral bandwidth: 1 nm (190 to 1,100 nm)
- Wavelength Repeatability: ± 0.1 nm
- Wavelength Accuracy: ± 0.1 nm at D2 peak 656.1 nm, ± 0.3 nm for entire range.
- Scanning Speed: 3000 to 2 nm/min, 29000 nm/min when survey scanning.
- Photometric Range: Absorbance -4 to 4 Abs Transmittance – 0% to 400%
- Photometric Accuracy: + 0.002 Abs at 0.5 Abs + 0.004 Abs at 1 Abs + 0.006 Abs at 2 Abs

- Source: Halogen (WI) and Deuterium Lamp.
- Detector: Silicon Photodiode Supplied with below accessories:
- Shimadzu Lab Solutions UV-Vis Software
- Power cable for 240 V 2.4m.
- 10mm Rectangular Quartz Cell - 1 Pair.

Diluent Preparation (0.1M NaOH)-

4 gram of sodium hydroxide was dissolved in a small quantity of water in 1000 mL 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 amount of 0.1M NaOH for 10 min. After sonication, 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 resultant mixture 4ml of solution is withdrawn and added to 50ml 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 weight of 20 tablets from each brand was taken and tablet was crushed in clean mortar and pestle. Weigh accurately quantity of powder equivalent to 100mg 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 pipetted out in 100ml of volumetric flask and the volume was made up by adding 0.1M NaOH.

Finally, from the resultant mixture 4ml of solution is withdrawn and added to 50ml volumetric flask and volume is adjusted by adding 0.1M NaOH. These results in the formation of 8 µg/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).

RESULT AND CONCLUSION

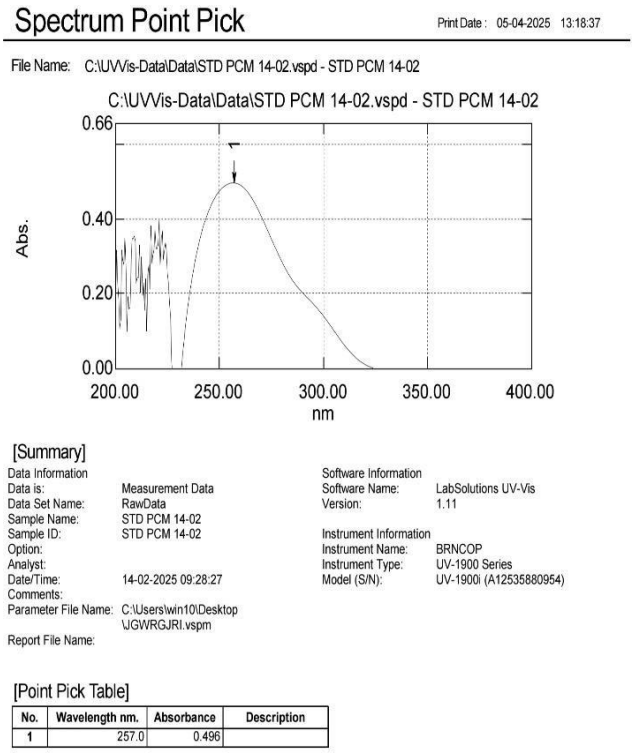
The absorbance and the percentage purity of paracetamol tablets of different brands was determined by uv-visible spectroscope and is summarized in the table-

Sr NO.	Brand Name	Label weight (mg)	Avg Weight (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

Table I

According to IP specification percentage purity of paracetamol tablet should fall in the range of 95-105%. 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-



Spectrum Point Pick

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C:\UVVis-Data\Data\STD PCM 14-02.vspd - STD PCM 14-02

Abs.

nm

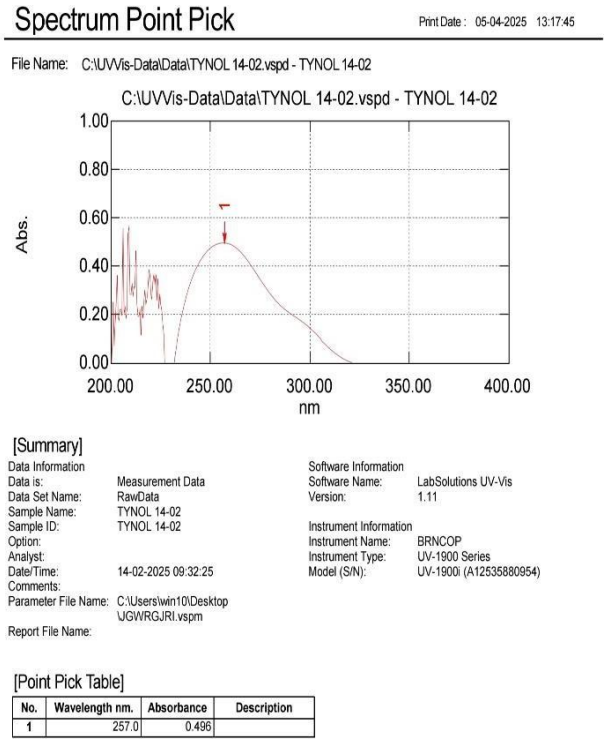
[Summary]

Data Information		Software Information	
Data is:	Measurement Data	Software Name:	LabSolutions UV-Vis
Data Set Name:	RawData	Version:	1.11
Sample Name:	STD PCM 14-02		
Sample ID:	STD PCM 14-02	Instrument Information	
Option:		Instrument Name:	BRNCOP
Analyst:		Instrument Type:	UV-1900 Series
Date/Time:	14-02-2025 09:28:27	Model (S/N):	UV-1900i (A12535880954)
Comments:			
Parameter File Name:	C:\Users\win10\Desktop \JGWRGJRI.vspm		
Report File Name:			

[Point Pick Table]

No.	Wavelength nm.	Absorbance	Description
1	257.0	0.496	

Fig. 1 Standard Paracetamol



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

Abs.

nm

[Summary]

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Data Set Name:	RawData	Version:	1.11
Sample Name:	TYNOL 14-02		
Sample ID:	TYNOL 14-02	Instrument Information	
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Analyst:		Instrument Type:	UV-1900 Series
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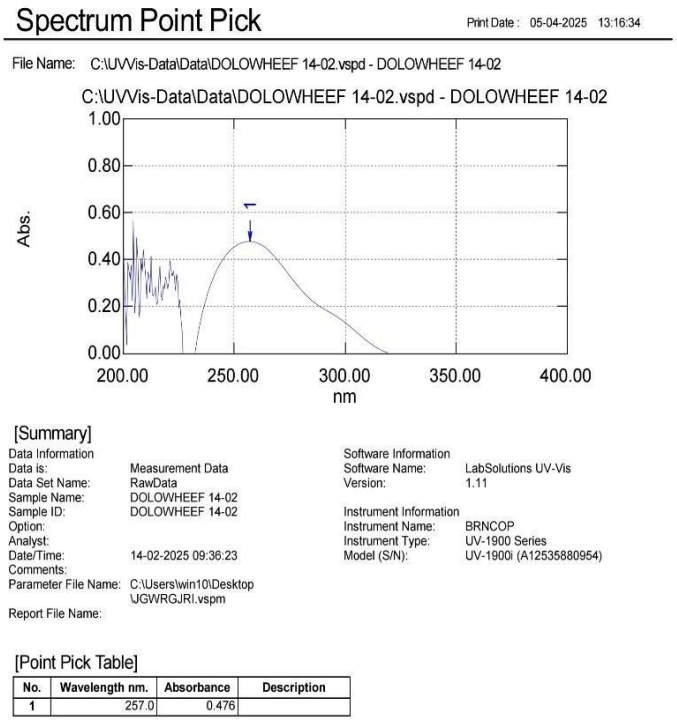
Report File Name:			

[Point Pick Table]

No.	Wavelength nm.	Absorbance	Description
1	257.0	0.496	

Fig.2 TYNOL



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

Abs.

nm

[Summary]

Data Information		Software Information	
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Data Set Name:	RawData	Version:	1.11
Sample Name:	DOLOWHEEF 14-02		
Sample ID:	DOLOWHEEF 14-02	Instrument Information	
Option:		Instrument Name:	BRNCOP
Analyst:		Instrument Type:	UV-1900 Series
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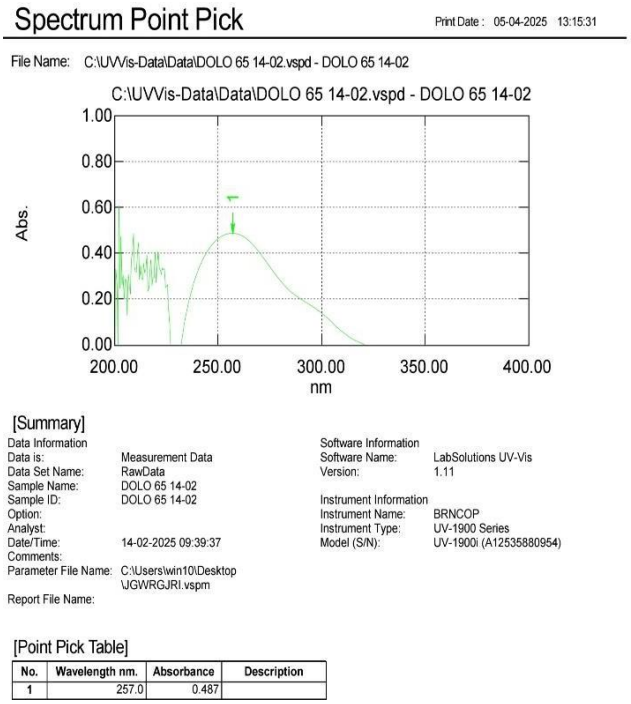
Report File Name:			

[Point Pick Table]

No.	Wavelength nm.	Absorbance	Description
1	257.0	0.476	

Fig. 3 DOLOWHEFF



Spectrum Point Pick

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C:\UVVis-Data\Data\DOLO 65 14-02.vspd - DOLO 65 14-02

Abs.

nm

[Summary]

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Data Set Name:	RawData	Version:	1.11
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Sample ID:	DOLO 65 14-02	Instrument Information	
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Analyst:		Instrument Type:	UV-1900 Series
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Comments:			
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Report File Name:			

[Point Pick Table]

No.	Wavelength nm.	Absorbance	Description
1	257.0	0.487	

Fig.4 DOLO-650

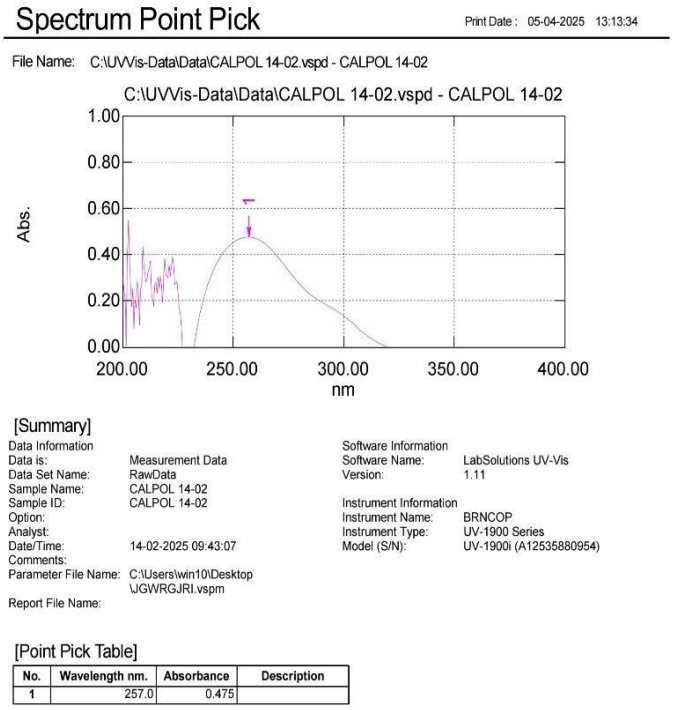

Fig. 5 CALPOL

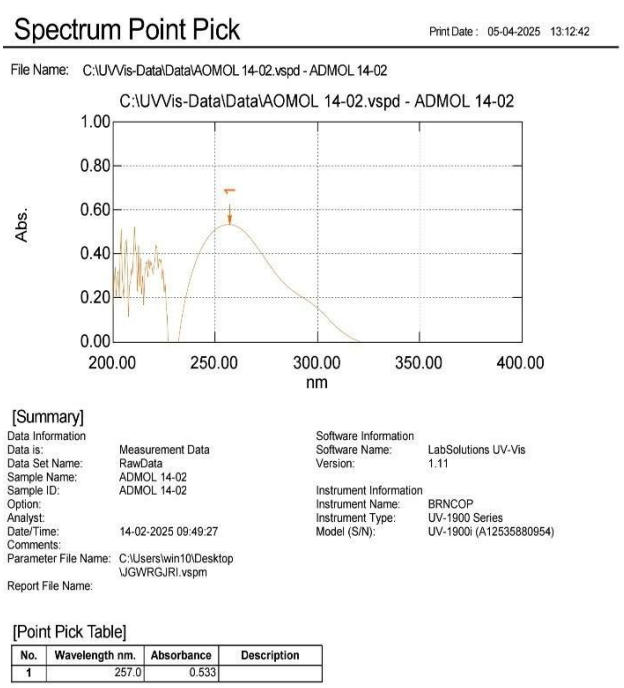

Fig.6 ADMOL

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 within the IP specification range and meets the therapeutic requirement as per the specification.

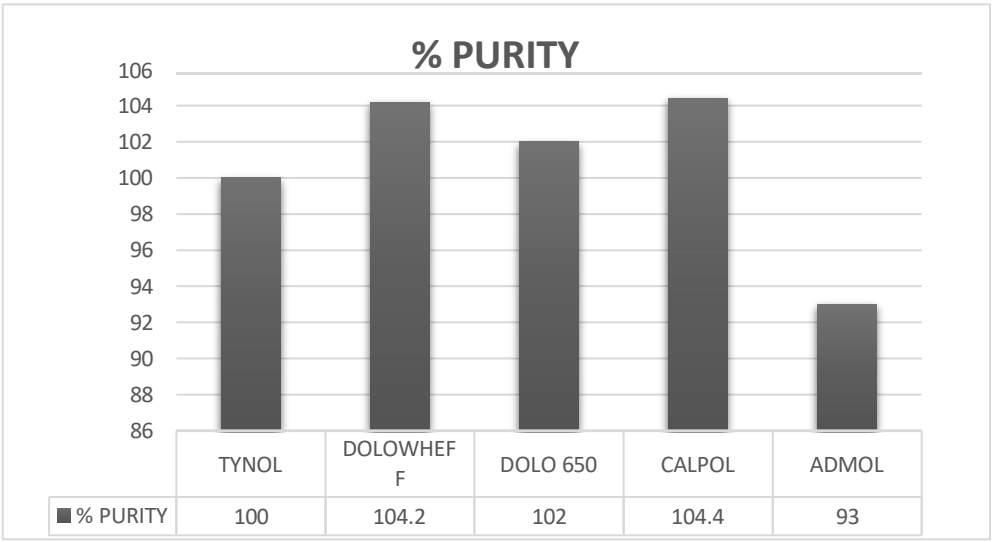

Fig. 7

ACKNOWLEDGEMENT

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