ISSN : 2320 4850

BI MONTHLY

Asian Journal of Pharmaceutical Research And Development

(An International Peer Reviewed Journal of Pharmaceutical Research and Development)

AJPRD

Volume - 01 Issue - 03 MAY-JUN 2013

website: www.ajprd.com
editor@ajprd.com

Asian Journal of Pharmaceutical Research and Development
(An International Peer-Reviewed Journal of Pharmaceutical Research and Development)
www.ajprd.com
ISSN 2320-4850

Research Article

DEVELOPMENT AND VALIDATION OF A UV SPECTROPHOTOMETRIC METHOD FOR ESTIMATION OF VINPOCETINE IN BULK AND TABLET DOSAGE FORM

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Received: 09 May 2013, ***Revised and Accepted: 18 May 2013***

ABSTRACT

Vinpocetine is a neuroprotective drug used in the treatment of various neurological disorders such as dementia, Parkinson's disease, Alzheimer's disease and other mental illnesses. The present work describes an accurate and precise UV spectrophotometric method for quantitation of Vinpocetine in bulk and tablet dosage forms. Methanol was used as an economical solvent and all spectrophotometric parameters were optimized. The wavelength of maximum absorption for Vinpocetine was found to be 274 nm. The analytical method was validated as per ICH (International Conference on Harmonization) guidelines. It obeyed Beer-Lambert's law indicated by the calibration curve in the range 5-30 µg/ml. The regression equation was y= 0.030x + 0.004. The Correlation Coefficient (R^2) was found to be 0.999. Limit of Detection and Limit of Quantitation were calculated as 0.38 µg/ml and 1.16 µg/ml respectively. The proposed method can be applied for the routine quality control studies for assay of Vinpocetine in bulk and tablet dosage forms.

KEYWORDS: *Vinpocetine, Neuroprotective, UV spectrophotometric, Validation.*

INTRODUCTION

Cognition is the mental action or process of acquiring knowledge and understanding through thought, experience, and the senses [1]. Cognition function loss is one of the major health concerns associated with various neurological disorders like dementia, memory loss, Parkinson's disease and other mental illnesses. It is usually considered as a part of the natural process of ageing. Various botanical as well as nutritional supplements have been considered for treating neurological illnesses by restoring cognitive dysfunction. Vinpocetine is one such drug, which has been recognized as a neuroprotective which increases cerebral blood flow, activates cerebral metabolism and enhances cognition [2]. Vinpocetine is derived from vincamine, an alkaloid which is procured from the leaves and seeds of the Vinca minor plant (lesser periwinkle) or *Voacanga africana* [2, 3]. *Voacanga Africana* is a small tropical plant native to western Africa whose barks and seeds have been used as a poison, stimulant, aphrodisiac and psychedelic in African folklore [2]. It has also been exploited as a brain's metabolism support for treating cerebrovascular diseases and associated dementia in countries like Germany, Poland, Hungary and Japan since decades [4, 5].

Vinpocetine is official in British Pharmacopoeia. Chemically, Vinpocetine is Ethyl (13a*S*,13b*S*)-13a-ethyl-2,3,5,6,13a,13b-hexahydro-1*H*-indolo[3,2,1-*de*]pyrido[3,2,1-*ij*][1,5]naphthyridine-12-carboxylate (Figure 1). It is practically insoluble in water, soluble in methylene chloride and slightly soluble in anhydrous ethanol [6]. After oral administration, Vinpocetine is readily

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absorbed from the small intestine. It undergoes metabolism to give its main metabolite, apovincaminic acid which is absorbed from the stomach. Due to extensive metabolism, Vinpocetine has a low bioavaibility, about 6.7 % under fasting conditions. [7, 8].The neuroprotective action of Vinpocetine is due to the inhibition of voltage dependent neuronal Na (+)-channels and increase in intracellular Ca (2+)-levels causing inhibition of some molecular cascades. It is a selective inhibitor of Ca (2+)-calmodulin dependent cGMP-PDE thus enhancing intracellular a GMP levels leading to an increase of cerebral flow [9].

Literature survey reveals that High Performance Liquid Chromatography (HPLC) has been used to determine Vinpocetine in pharmaceutical dosage forms [10]. However, there is no UV spectrophotometric method reported for the analysis of Vinpocetine in pharmaceuticals. Hence, the aim of the present work is to develop a simple, rapid and precise UV spectrophotometric method for the estimation of Vinpocetine in tablet dosage form.

MATERIALS AND METHODS

Instrumentation and Apparatus

All spectral measurements were taken with a UV visible double beam spectrophotometer purchased from Shimadzu Corporation (UV-1800, Japan) using two identical 1 cm quartz cells. It had a wavelength range from 190 to 1100nm with wavelength accuracy of ±0.3nm. All weights were taken using an Electronic Balance belonging to Shimadzu Corporation (Type: AX 200, Japan). It had a working range of 0.1 milligrams to 200 grams of substance. An Ultrasonic Cleaning Bath procured from Spectra lab (Model UCB 40, India) was used for sonication of standard and sample solutions. All the glass wares (Borosil®) were calibrated before use.

Chemicals and Reagents

The pure drug, Vinpocetine was received as a gift sample from Linnea, Switzerland. The solvent used, methanol was of analytical grade. It was purchased from Merck India Ltd.

Preparation of Standard Solution

A stock standard solution of pure Vinpocetine was prepared by dissolving 10 mg accurately weighed drug in 10 ml of methanol to obtain drug concentration of 1 mg/ ml (1000 µg/ml). From this solution, 0.2 ml was further diluted with methanol to obtain solution of 20 µg/ml concentration as a working standard solution. This solution was scanned between 400 to 200 nm in UV spectrophotometer against methanol as blank. The drug was found to show a maximum absorbance at a wavelength corresponding to 274 nm. To prepare standard solutions, the Stock Standard Solution (1000 µg/ml) was further diluted to give aliquots of concentrations 5, 10, 15, 20, 25 and 30 µg /ml using the same solvent. These solutions were scanned from 400 to 200 nm and their absorbances were noted at 274 nm.

Assay of Tablet Dosage Form

Neurovin tablet (Sun Pharmaceuticals Limited, India, Label Claim: 10 mg of Vinpocetine per tablet) was selected for assay. Twenty tablets were accurately weighed and crushed into a fine powder. Powder equivalent to 10 mg of Vinpocetine was weighed accurately and transferred into a 100 ml volumetric flask. It was dissolved with about 40 ml methanol. The contents were sonicated for about 30 minutes and diluted up to mark with methanol. The solution was filtered using Whatmann filter paper (No.41). The first 5 ml of filtrate was discarded and suitable aliquot was diluted to obtain solution of 20 µg/ml concentration. The absorbance of this solution was measured at 274 nm (Table 1).

Method Validation

Validation of an analytical procedure is the process by which it is established by laboratory studies that the performance characteristics of the procedure meet the requirements for the intended analytical application. The objective of validation of an analytical procedure is to demonstrate that it is suitable for its intended purpose. The proposed method was validated for various parameters such as linearity, precision, accuracy, Limit of detection (LOD), Limit of Quantitation (LOQ) according to ICH Q2 (R1) guidelines [11].

Linearity and Range

The standard solutions were prepared by diluting stock standard solution with methanol to give a concentration range of 5 to 30 µg/ml. The spectrums of these solutions were measured at 274 nm and overlain spectra was recorded (Figure 2).Calibration curve was plotted using Absorbances verses Concentrations and regression line equation and correlation coefficient were determined (Figure 3).

Precision

of scatter) between a series of measurements obtained from multiple sampling of the same homogeneous sample under the prescribed conditions [11]. Intraday precision was studied by measuring the absorbance of a standard solution of 20 µg/ml concentration at six independent series in the same day. Inter day precision studies were performed by measuring the absorbance of standard solution of 20 µg/ml concentration on three subsequent days. The percentage relative standard deviation (%RSD) was calculated (Table 2).

Accuracy

The accuracy of an analytical procedure expresses the closeness of agreement between the value which is accepted either as a conventional true value or an accepted reference value and the value found. This is sometimes termed trueness [11]. The method

RESULTS AND DISCUSSION

The standard solution of Vinpocetine showed the λmax at 274 nm when scanned in UV range. The relationships between the absorbances against the drug concentrations were found to be linear in the range 5 to 30 µg/ml. Assay of Vinpocetine tablet dosage form was performed successfully and the

The precision of an analytical procedure expresses the closeness of agreement (degree

was applied to drug sample and recovery studies were performed where Vinpocetine corresponding to 80, 100, and 120% of label claim was present (Table 3)

Limit of Detection (LOD) and Limit of Quantitation (LOQ)

The detection limit of an individual analytical procedure is the lowest amount of analyte in a sample which can be detected but not necessarily quantitated as an exact value. The quantitation limit of an individual analytical procedure is the lowest amount of analyte in a sample which can be quantitatively determined with suitable precision and accuracy [11]. LOD and LOQ were determined by using the formulae as LOD = 3.3 (SD)/S and LOQ = 10 (SD)/S, where S is average value of slopes of calibration plots and SD is calculated using values of y intercepts of regression equations.

percentage purity of the tablet was found to be 100.43 %. The intra-day and inter-day precision results in terms of percent relative standard deviation values were found to be satisfactory. The accuracy study results indicated good recovery of the drug. The limit of detection and limit of quantitation values were found to be 0.38 µg/ml and 1.16 µg/ml respectively. The validation parameters are summarised in Table 4.

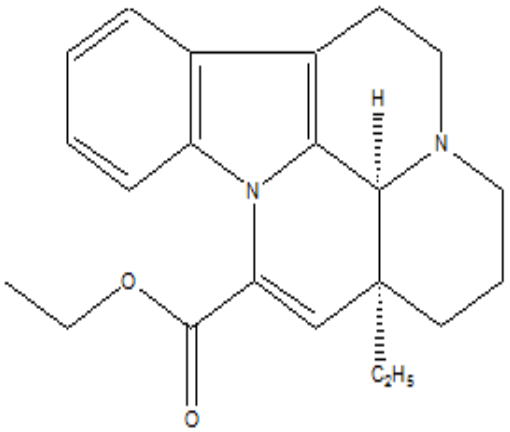

Figure 1: Structure of Vinpocetine

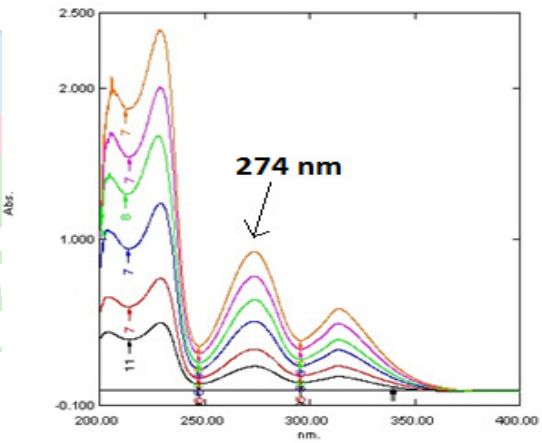

Figure 2: UV spectrum of Vinpocetine (5-30 µg/ml)

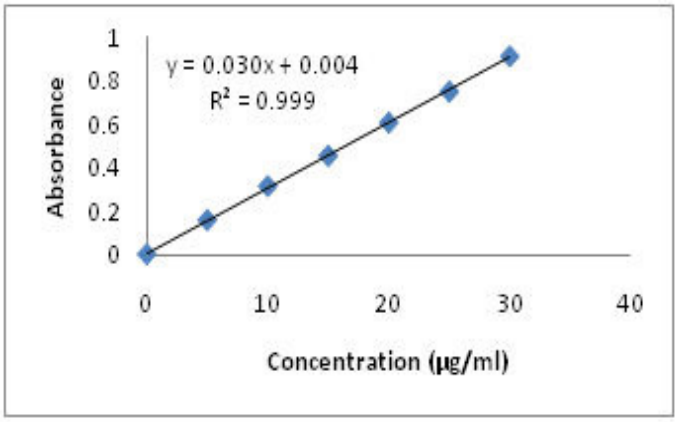

Figure 3: Calibration Curve of Vinpocetine (5-30 µg/ml)

Table I: Assay of Tablet dosage form

Tablet solution containing (µg/ml)	*% Found*	*Mean % Found**	*% RSD**
20	100.48	100.43	0.25
20	100.16		
20	100.64		

*n=3

Table II: Precision data of Vinpocetine

Parameters	*Intra-day precision*	*Inter-day precision*
Sample solution concentration (µg/ml)	20	20
Absorbance (Mean ± S.D)*	0.6232±0.0026	0.6235±0.0033
%RSD	0.42	0.52

*n=6

Table III: Accuracy data of Vinpocetine

Accuracy Level	*Amount added (µg/ml)*	*% Recovery**	*Mean % Recovery**	*% RSD**
I (80%)	16	100.58±0.5127	100.50%	0.15
II (100%)	20	100.59±0.4053		
III (120%)	24	100.33±0.4291		

*n=3

Table IV: Summary of Validation Parameters

Parameter	*Results*
λ max (nm)	274
Linearity Range (µg/ml)	5-30
Regression Equation (y=mx+c)	y= 0.0030x+0.004
Slope (m) ± SD*	0.0030 ± 0.0015
Intercept (c) ± SD*	0.004 ± 0.0036
Correlation Coefficient ($R^{2)}$	0.999
Precision (% R.S.D*)	
Intraday	0.42
Interday	0.52
Accuracy (Mean % Recovery)	100.50 %
LOD	0.38 µg/ml
LOQ	1.16 µg/ml

*n=6

CONCLUSION

A simple, rapid, precise and accurate UV Spectrophotometric method for the estimation of Vinpocetine has been developed. It can be used for routine quality control studies for assay of Vinpocetine in bulk and tablet dosage form.

ACKNOWLEDGEMENT

The authors would like to convey regards to Linnea, Switzerland for providing the gift sample of the pure drug and Dr. K. N. Gujar, Principal, Sinhgad college of Pharmacy, Vadgaon (Bk.), Pune for providing the necessary facilities for carrying out the research work.

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