British Journal of Pharmaceutical Research
4(4): 418-428, 2014

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UV Spectrophotometric Method for the Simultaneous Determination of Desloratidine and Pseudoephedrine HCl in Combined Dosage Form

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Authors' contributions

Author KHR managed literature survey, analysis of the study and wrote the first draft of manuscript. Author MN designed the study plan and Analysis of study. Authors VVLNP and PVD approved the work.

Original Research Article

Received 28th June 2013
Accepted 4th October 2013
Published 21st December 2013

ABSTRACT

Aims: UV Spectrophotometric Method for the Simultaneous Determination of Desloratidine and Pseudoephedrine HCl in combined Dosage form.
Study Design: A simple, rapid and specific UV spectroscopic method with good sensitivity was developed and validated for the simultaneous determination of Desloratidine and Pseudoephedrine HCl in bulk and pharmaceutical dosage form.
Place and Duration of Study: Department of pharmaceutical Analysis & Quality Assurance, School of Pharmacy, Anurag Group of Institutions, Venkatapur, R.R Dist, Andhra Pradesh, India during February 2013 and April 2013.
Methodology: Vierodt's (Simultaneous equation) method was performed for Estimation of Desloratidine and Pseudoephedrine HCl in Pharmaceutical dosage form.
Results: In Ethanol the λ_{max} of Desloratidine and Pseudoephedrine HCl was fixed as 240 and 258 nm respectively using a Shimadzu UV-Visible spectrophotometer. In this proposed method both drugs obeyed linearity within the concentration range of 5-30 μg/ml

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and 80-800 μg/ml for Desloratidine and Pseudoephedrine HCl respectively. The low RSD values indicate good precision and high recovery values indicate accuracy of the proposed method. The proposed method has been applied to the determination of drugs in commercial formulations. Assay results were in good agreement with label claim. The method was validated as per ICH guidliness.

Conclusion: The developed method was simple, accurate, precise, specific, sensitive and reproducible which can be efficiently and easily applied to pharmaceutical dosage forms**.**

Keywords: Desloratidine (DES); Pseudoephedrine HCl (PSE); UV-visible spectrophotometer; simultaneous determination.

1. INTRODUCTION

Desloratidine (DES) is chemically 8-chloro-6, 11-dihydro-11-(4-piperdinylidene)-5H benzo (5,6) cyclohepta [1,2-b] pyridine (Fig. 1). Its molecular formula is $C_{19}H_{19}ClN_2$ having molecular weight of 310.82 g/mole. Desloratidine is a tricyclic antihistamine, which has a selective and peripheral H1-antagonist action. It is an antagonist at histamine H1 receptors, and an antagonist at all subtypes of the muscarinic acetylcholine receptor. It has a long-lasting effect and in moderate and low doses, does not cause drowsiness because it does not readily enter the central nervous system [1]. Unlike other antihistamines, desloratadine is also effective in relieving nasal congestion, particularly in patients with allergic rhinitis.[2] Pseudoephedrine HCl is chemically (1S,2S)-2-methylamino-1-phenylpropan-1-ol hydrochloride (Fig. 2). Its molecular formula is $C_{10}H_{15}NO$,HCl having molecular weight of 201.7 g/mole. Pseudoephedrine is a diastereomer of ephedrine and is readily reduced into methamphetamine or oxidized into methcathinone. Pseudoephedrine is a sympathomimetic amine. The vasoconstriction that pseudoephedrine produces is believed to be principally a α-adrenergic receptor response [3]. It may be used as a nasal/sinus decongestant, as a stimulant [4], or as an antitussive drug [5] found in many over-the counter preparations, either as a single ingredient or (more commonly) in combination with antihistamines, guaifenesin, dextromethorphan, and/or paracetamol (acetaminophen) or another NSAID (such as aspirin or ibuprofen).

Literature survey revealed that there are several methods reported on the determination of DES. Both in formulation and biological fluids *viz:* Spectrophotometry [6-7], Spectroflourimetry [8], Densitometry [9], Electrophoresis [10], UPLC [11], HPLC with detectors like UV [12-14], fluorescence [15], MS [16-21], ESI-MS/MS [22], and GC with nitrogen phosphorus detector [23]. It has been estimated simultaneously in combination with other drugs using RP-UPLC [24], LC-MS [25], and LC-MS/MS [26-27].

Literature survey revealed that PSE has been estimated individually or in combination with other drugs using UV [28-29], Capillary Electrophoresis [30-31], HPLC [32-37] and HPTLC [38].

Since, No spectrophotometric method has been reported yet for simultaneous estimation of DES and PSE. The present work describes the development of a simple, precise, accurate and reproducible spectrophotometric method for the simultaneous estimation of DES and PSE in Pharmaceutical dosage form. The developed method was validated in accordance with ICH Guideline [39].

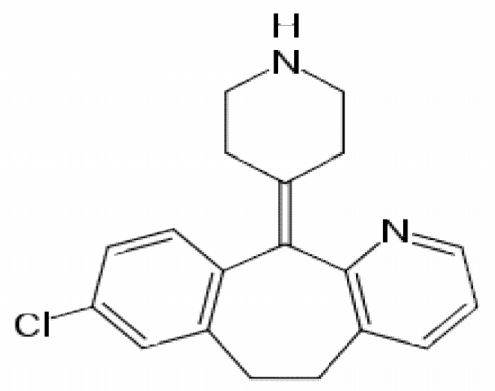

Fig. 1. Chemical Structure of Desloratidine

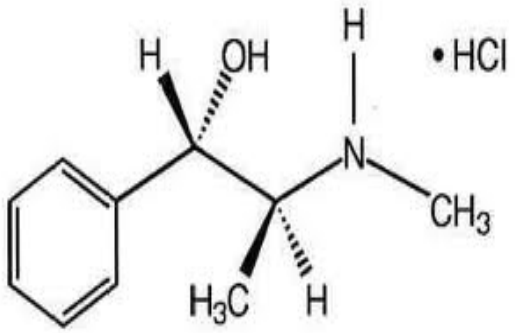

Fig. 2. Chemical Structure of Pseudoephedrine HCl

2. MATERIALS AND METHODS

2.1 Materials

2.1.1 Instruments

Shimadzu UV-Visible Spectrophotometer (Model UV-1800), Shimadzu digital electronic balance (BL 220H), fast clean ultra sonic cleaning system (Life care equipments Pvt Ltd).

2.1.2 Chemicals

Analytical pure samples of DES and PSE were provided by Savan Pharmaceuticals and Granules India Pvt Ltd as gift samples respectively. Formulation, Clarinex-D12 (DES-2.5mg + PSE-120mg) manufactured by Shering Corporation was procured from a local pharmacy in Hyderabad. Ethanol is used as solvent.

2.2 Methods

2.2.1 Selection of Solvent and λ_{max}

The absorbance of both drugs was found to be maximum in ethanol.so, Ethanol is used as solvent and λ_{max} of DES and PSE was fixed as 240 (Fig. 3) and 258 (Fig. 4) respectively.

2.2.2 Preparation of DES standard stock solution

Standard stock solution of DES was prepared by dissolving 10mg of drug in 10ml of ethanol to get a concentration of 1000 μg/ml.

2.2.3 Preparation of PSE standard stock solution

Standard stock solution of PSE was prepared by dissolving 100mg of drug in 100ml of ethanol to get a concentration of 1000 μg/ml.

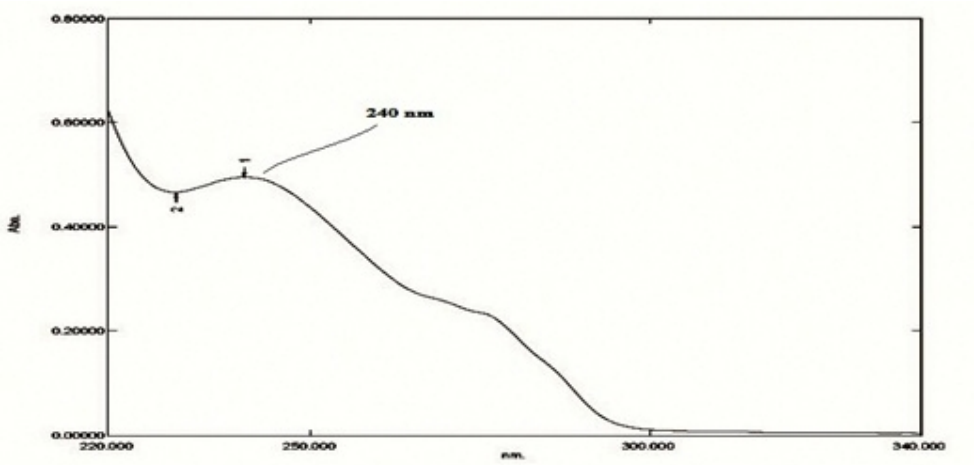

Fig. 3. Spectrum of the solution of DES in ethanol

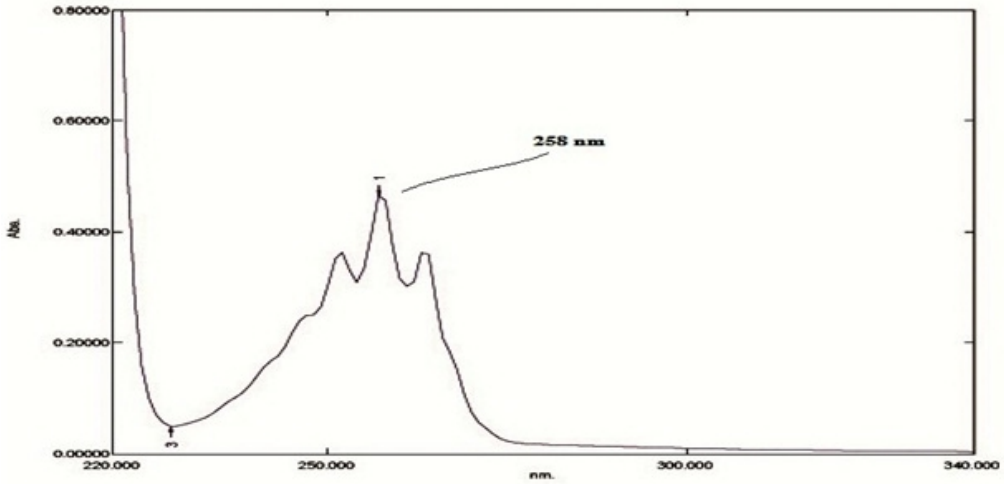

Fig. 4. Spectrum of the solution PSE in ethanol

2.2.4 Vierodt's (simultaneous equation) method

In quantitative estimation of two components by Vierodt's (Simultaneous equation) method two wavelengths i.e, 240nm of DES and 258nm of PSE were selected as their respective λ_{max} from the overlain spectrum, (Fig. 5) at which both drugs have maximum absorbance. A set of two simultaneous equations were formed using absorptivity coefficients at selected wavelengths. The concentrations of two drugs in the mixture were calculated using the following two simultaneous equations.

$$C_x = A_2\, ay_1 - A_1\, ay_2 \,/\, ax_2\, ay_1 - ax_1\, ay_2 \text{ --- (1)}$$
$$C_y = A_1\, ax_2 - A_2\, ax_1 \,/\, ax_2\, ay_1 - ax_1\, ay_2 \text{ --- (2)}$$

Where, C_x and C_y are the concentrations of x and y A_1 is the absorbance of mixture at λ_1, A_2 is the absorbance of mixture at λ_2, ax_1 is the absorptive value of x at λ_1, ax_2 is the absorptive value of x at λ_2, ay_1 is the absorptive value of y at λ_1, ay_2 is the absorptive value of y at λ_2.

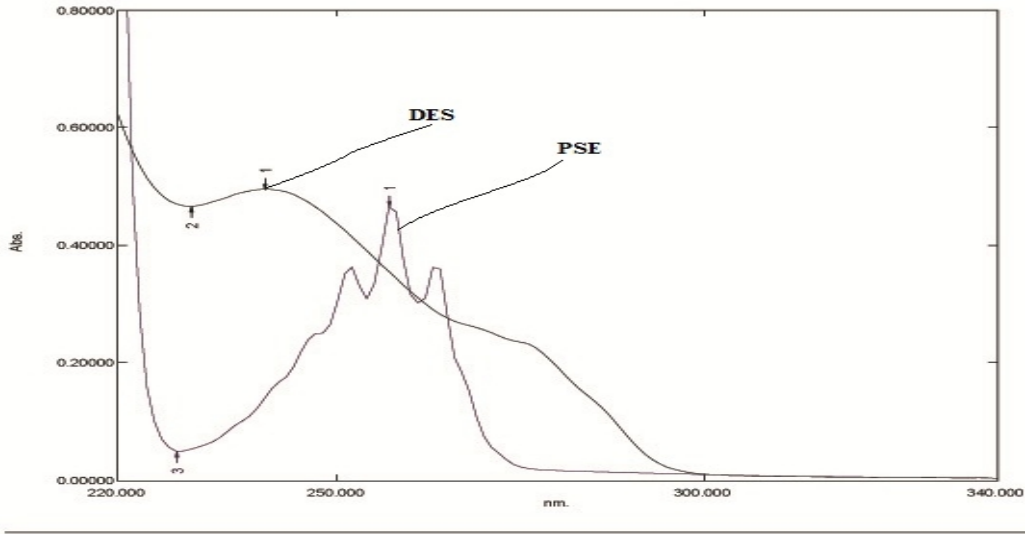

Fig. 5. Over lay spectra of DES and PSE

2.3 Validation Parameters

2.3.1 Linearity

To construct Beer's law plot for DES and PSE different aliquots of DES (0.5-3ml) with different concentrations (5, 10, 15, 20, 25, and 30μg/ml) (Fig. 6) and PSE (0.8-8.0ml) with different concentrations (80, 160, 240, 320, 400, 480, 560, 640, 720, and 800 μg/ml) (Fig. 7) were prepared by serial dilutions with ethanol form individual standard stock solutions. Then Absorbances of these solutions were measured at 240 and 258nm for DES and PSE respectively. Linearity values are shown in Table 1.

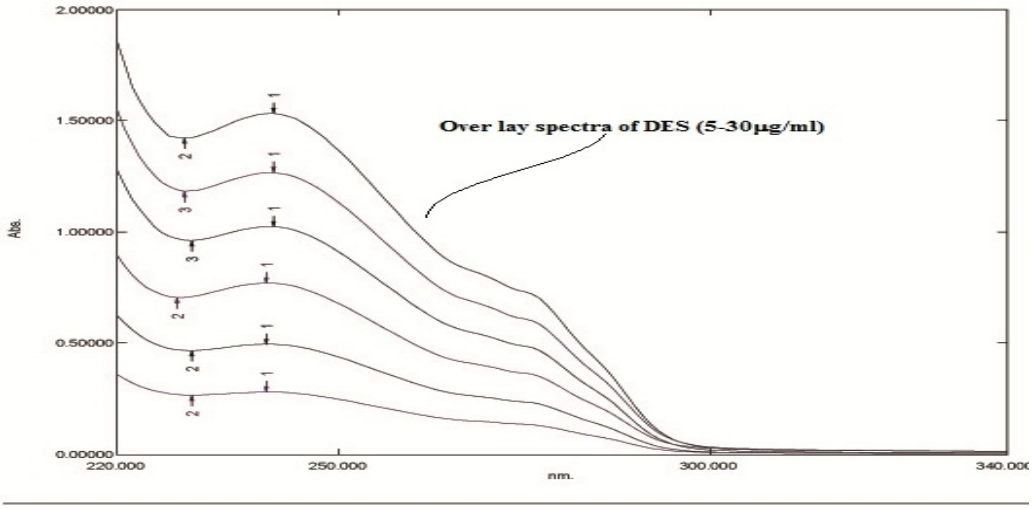

Fig. 6. Over lay spectras of DES (5-30 g/ml)

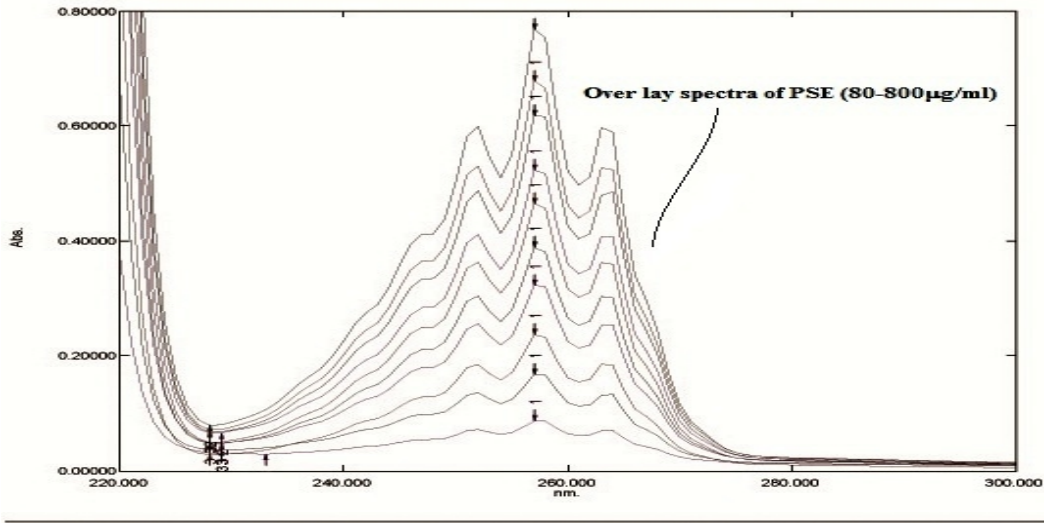

Fig. 7. Over lay spectras of PSE (80-800µg/ml)

Table 1. Linearity values of DES and PSE

Parameter	DES	PSE
Range	5-30µg/ml	80-800 µg/ml
Slope	0.0504	0.0009
Intercept	0.012	0.0173
R^2	0.9993	0.9986

2.3.2 Precision

The Precision of the method was established by carrying out the analysis of the analyte using the proposed developed method. The low value of standard deviation showed that the methods were precise. The precision values are shown in Table 2.

Table 2. Precision values of DES and PSE

Drug(µg/ml)	% RSD	
	Intra day	Inter day
DES (10µg/ml)	0.88	1.05
PSE (480µg/ml)	1.12	1.34

**Mean of % RSD of six readings*

2.3.3 LOD and LOQ

The limit of detection (LOD) and limit of quantification (LOQ) of the drugs were derived by calculating the signal-to-noise (i.e. 3.3 for LOD and 10 for LOQ) ratio using the following equations designated by International Conference on Harmonization (ICH) guideline.

LOD = 3.3 X σ/S
LOQ = 10 X σ/S

Where, σ = the standard deviation of the response S = slope of the calibration curve.

The LOD values of DES and PSE was found to be 0.32μg/ml and 18.33μg/ml respectively and the LOQ values were found to be 0.99μg/ml and 55.5μg/ml respectively.

2.3.4 Accuracy (recovery studies)

The recovery studies were carried out at two different levels i.e. 100% and 50% levels. To assure the reliability of the above method recovery studies were carried out by mixing a known quantity of the standard drug with the preanalysed sample formulation and the contents were reanalyzed by the proposed method. The % recovery values with % RSD are shown in Table 3.

Table 3. Recovery values of DES and PSE

Drug	Amount added (μg/ml) (%)	Amount recovered (μg/ml)	% Recovery	% RSD
DES	5 (100%)	4.92-4.98	98.4%-99.6%	0.857
	2.5 (50%)	2.54-2.56	101.6%-102.4%	0.555
PSE	240 (100%)	237.74-238.05	99.06%-99.19%	0.093
	120 (50%)	121.99-122.56	101.7%-102.1%	0.278

**Mean of %RSD of six readings*

2.3.5 Ruggedness

The ruggedness test of analytical assay method is defined as degree of reproducibility of assay results obtained by the successful applications of assay by multiple analysts. The % RSD values of assay performed in the same laboratory by two different analysts was found to be less than 2 indicating the ruggedness of the method. The values are shown in the Table 4.

Table 4. Ruggedness of Assay results and its % RSD values

Analyst	Drug	Label claim (mg)	Amount found (mg)	% Label claim	% RSD
Analyst I	DES	2.5	2.685	107.4	0.6614
Analyst II			2.660	106.4	0.6590
Analyst I	PSE	120	125.3	104.4	0.6741
Analyst II			126.5	105.4	0.6812

**Mean of %RSD of six readings*

2.3.6 Preparation of test solutions and estimation of DES and PSE in formulation

For analysis of commercial formulations 5 tablets (Clarinex D12 containing 2.5mg of DES and 120mg of PSE) were weighed, powered and weight equivalent to 5mg of DES and 240mg of PSE was taken and transferred into a volumetric flask and made upto 50ml with ethanol, sonicated for 10min, filtered and further diluted with ethanol to get the required concentration of respective drugs and measured the absorbance at 240 and 258nm for DES and PSE respectively. Then the amount of drugs present in the formulation was calculated

by using simultaneous equation and the results are shown in Table 5 along with % RSD values.

Table 5. Analysis of formulation and its % RSD values

Drug	Label claim (mg)	Amount found (mg)	% Label claim	% RSD
DES	2.5	2.685	107.4	0.6614
PSE	120	125.3	104.4	0.6741

**Mean of %RSD of six readings*

3. RESULTS AND DISCUSSION

From the optical characteristics obtained with the proposed method it was found that the drug obeys linearity with in concentration range of 5-30μg/ml for DES and 80-800μg/ml for PSE. From the precision studies it was found that the % RSD is less than 2% which indicates that the method has good reproducibility. From the results of recovery studies, it was found that the % recovery values of the pure drugs from the preanalysed solutions of formulations were in between 98.4-102.4%, which indicates that the method is accurate and reveals that commonly used excipients and additives present in the pharmaceutical formulations did not interfere in the proposed method. The proposed method was simple, sensitive, and reliable with good precision and accuracy. Hence this method can be used for the routine analysis of DES and PSE in bulk and pharmaceutical formulations.

4. CONCLUSION

A convenient and rapid UV method has been developed for simultaneous estimation of DES and PSE in available dosage form. The assay provides a linear response across a wide range of concentration. Low intra-day and inter-day %RSD coupled with excellent recoveries. Hence, this method can be easily and conveniently adopted for routine analysis of Desloratidine and pseudoephedrine in pure form and its dosage forms.

CONSENT

Not applicable.

ETHICAL APPROVAL

Not applicable.

ACKNOWLEDGEMENT

Authors are thankful to School of pharmacy, Anurag Group of Institutions, Hyderabad, for giving permission to carry out my research work.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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