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SERTRALINE HYDROCHLORIDE IN MARKETED FORMULA ESTIMATION USING HIGH-PERFORMANCE LIQUID CHROMATOGRAPHIC METHOD

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ABSTRACT: A study was performed to develop a simple HPLC method for estimating sertraline Hydrochloride in unit dose. The method was created by evaluating the drug sertraline hydrochloride's solubility in phosphate buffer, pH 4.0, at 254 nm. The chromatographic separation was accomplished on Prominence I LC 2030 C (Shimadzu Corporation, Japan). A 10 µl sample volume and a C18 column (250 x 4.6 mm (5 µm) were employed. The created and improved procedure produced the desired results. A 0.9998 linearity value was discovered. Buffer (Monobasic Potassium Phosphate of Buffer pH 4.0): Acetonitrile: and Methanol (50:25:25) were combined in a mobile phase designed for the technique at a 2.0 ml/min flow rate. Sertraline Hydrochloride was simultaneously identified at 254 nm with a retention time of 10.4±0.2 min. The percentage of the medicine was calculated using the specification limits after a quantitative assay of the commercial formulation. According to ICH guideline Q2R1, validation was completed successfully. The suggested approach can be used for a BE study to assess its applicability further and estimate sertraline Hydrochloride in pharmaceutical formulations.

INTRODUCTION: Sertraline is mostly a serotonin reuptake inhibitor [1]. Sertraline is primarily used in treating clinical depression in adult outpatients and obsessive-compulsive, panic, and social anxiety disorders in adults and children [2]. Sertraline hydrochloride in the oral dosage form of a tablet is usually taken once daily either in the morning or evening. Sertraline does not result in weight gain, although it does share the same adverse effects and contraindications as other SSRIs [3]. The hydrochloride salt of sertraline is called sertraline hydrochloride. Sertraline is a synthetic naphthalenamine derivative having anti-serotoninergic and anti-depressant effects.

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The CNS's serotonin levels are increased by sertraline, which seems to limit serotonin's uptake by neurons selectively. Sertraline is white to an off-white color, a crystalline powder having no odor. Chemically of Sertraline Hydrochlorideis (1*S*, 4*S*)-4-(3, 4-dichlorophenyl) - *N* - methyl-1, 2, 3, 4-tetrahydronaphthalen – 1 - amine; hydrochloride having molecular formula $C_{17}H_{18}Cl_3N$ [4].

A thorough literature review revealed that sertraline hydrochloride can be measured simultaneously in drug estimates and biological fluids using UV spectroscopy, HPLC, and LC-MS (i.e., human and rat plasma) [5-8].

This work describes a brand-new chromatographic approach for determining sertraline hydrochloride in pharmaceutical formulations that is very sensitive, quick, easy, exact, repeatable, affordable, and stable. **Fig. 1** represents the structural formula of Sertraline Hydrochloride.

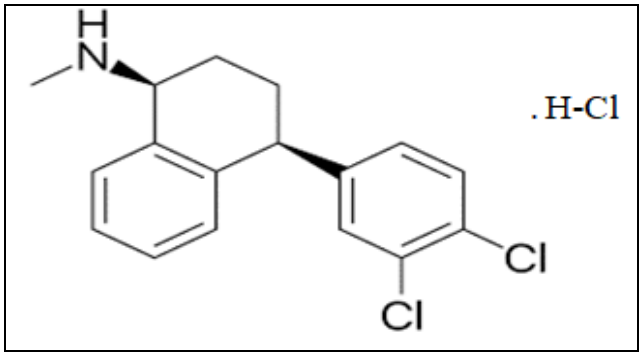

FIG. 1: SERTRALINE HYDROCHLORIDE

MATERIALS AND METHODS:

Reagents and Chemicals: Methanol and acetonitrile of HPLC quality were purchased from Merck Industries (Mumbai, India). A Milli Q water system was used to produce HPLC-quality water (Bangalore, India). Wanbury, Ltd. in India provided the reference standard for sertraline hydrochloride as a gift sample. The marketed medication was obtained from a local drugstore in Gujarat.

Instrumentation: The Prominence I LC 2030 C system was used to conduct HPLC research (Shimadzu Corporation, Japan). The chromatographic analysis equipment included a 250 x 4.6 mm (5 µm) C18 column, a binary low-pressure and UV detector, and a 2 mL sample container. For data collection and processing, Lab Solutions data station software was used.

Wavelength Selection: Sertraline hydrochloride, 50 µg/mL, was added to a buffer solution made up of 50:25:25 acetonitrile, methanol, and monobasic potassium phosphate (buffer pH 4.0). At wavelengths between 200 and 400nm, the typical solution was scanned [9].

Preparations for a Reference Solution and a Sample Solution: For the preparation of the standard solution, 50 mg of sertraline hydrochloride API were dissolved in a mixture of 50 mg each of acetonitrile, methanol, and buffer (monobasic potassium phosphate of buffer pH 4.0). This standard solution made A series of dilutions in the mobile phase.

Method Development: The proposed method was created by adjusting the mobile phase composition, mobile phase ratio, pH, column type, and dimensions during a number of trials runs in order to achieve a symmetrical analyte peak at a brief enough run time. In the mobile phase, an organic modifier consisting of acetonitrile and methanol was employed. At first, different acetonitrile to water ratios used as the mobile phase for separations showed peak asymmetries [10].

Finally, using Buffer (monobasic potassium phosphate of buffer pH 4.0), a symmetric analyte peak with a tolerable short run time was obtained: A C18 (250 x 4.6mm, 5 µm) was used as the stationary phase, and the eluents were seen at a wavelength of 254 nm. The mixture of acetonitrile, methanol, and the flow rate was 50:25:25 at a rate of 2 mL/min. At 10.4 +/- 0.2 minutes, sertraline hydrochloride was eluted. Before adding the mobile phase to the HPLC system, it was prepared by passing through a 0.45 µ PTFE membrane filter.

System Suitability: The creation and validation of an analytical method, which ensures the system's optimal performance, heavily relies on system suitability criteria. After administering six replicates of the industry-standard sertraline hydrochloride at a concentration of 50 µg/ml, chromatographic parameters including the number of theoretical plates, retention duration, resolution, and asymmetric factor were scanned.

Method Validation: The devised RP-HPLC technique was tested in accordance with the ICH requirements for the parameters linearity, precision, specificity, accuracy, robustness, detection limit, and quantitative limit. The method was intended to calculate sertraline hydrochloride [11, 12].

Accuracy and Precision Studies: Studies conducted during the day and in between the days gauge the method's accuracy. The proposed approach was studied using six separate injections at three different doses. The samples were analyzed on the same day to investigate intraday precision and repeatability, and the samples were analyzed on different days to examine interday precision. Using intraday and interday research results, mean and % RSD calculations were made [13]. Recovery studies demonstrate the method's accuracy. The standard addition technique, which involves analyzing a sample that has been spiked with a standard at a given concentration while being subjected to ideal chromatographic conditions, was

used to evaluate the method's accuracy. The recovery results from the three different concentration levels were used to calculate the standard deviation, percentage relative standard deviation, and average recovery [14].

Specificity/ Selectivity: By administering the diluents, the standard sertraline hydrochloride solution, and the sample solution obtained from solid dosage form for any co-eluting peaks within the drug's retention time, the method's specificity was demonstrated [15].

Linearity and Range: The linearity of the aforementioned analytical procedure is defined by the acquired response's linear proportionality to the analyte concentration. Under optimum chromatographic conditions, a chosen series of quantities [25 ppm to 75 ppm] was injected in, and the corresponding chromatograms were recorded. The basis for calculating the linearity was the co-relation coefficient obtained by graphing a concentration graph [14].

Limit of Detection and Limit of Quantification: The response of a method describes its ability to identify analytes at their lowest feasible concentrations in the absence of noise. This is evaluated using the LOD and LOQ parameters.

The Limit of Quantification (LOQ) is the lowest concentration of the analyte that produces a response that can be pretty much exactly quantified, as opposed to the Limit of Detection (LOD), which is the lowest concentration of the substance that can be spotted by the developed method and elicits a quantifiable response (signal to noise ratio 3). (Signal-to-noise ratio 10) [16, 17, 18]. The formula can be used to determine LOD and LOQ:

$$LOD = 3.3 * \sigma / S, LOQ = 10 * \sigma / S$$

Where, σ = SD; S = Slope

Robustness: By making minor adjustments to the specified experimental conditions, such as small variations in analyte concentrations, the source of the reagent, different brands of columns, and minor fluctuation in the proportion of the mobile phase, pH of the aqueous buffer, flow of eluents, *etc*., the criterion of ruggedness and robustness of the proposed methodology was scaled [19].

Assay of the Marketed Formulation: 10 Sertraline Hydrochloride (100 mg) tablets were weighed, finely ground in a mortar and pestle, and transferred to 100 mL volumetric flasks in an amount equal to the average weight of the formulation.

The formulation was then solubilized in about 50 mL of mobile phase and sonicated for about 10 minutes. Then, 0.45-micron nylon paper was used to filter these solutions. The solution was subjected to two thorough chromatographic analyses. After recording the chromatograms and assessing the amount of drug present, SD and %RSD were calculated and reported.

RESULTS AND DISCUSSION: A worthwhile effort was made to estimate sertraline hydrochloride using the RP-HPLC method. Following the completion of preliminary work, advancement was made.

Tables 1 and **2** represent the Validation Parameters and Accuracy Study of Sertraline HCL. Additionally, **Table 3** shows the data related to the assay of the marketed formulation.

TABLE 1: VALIDATION PARAMETERS OF SERTRALINE HYDROCHLORIDE

Sr. no.	Parameters	Sertraline hydrochloride
1	Linearity range	25 ppm to 75 ppm
2	Slope	458.91
3	Intercept	838.8571429
4	Correlation coefficient (r^2)	0.9998
5	SE of intercept	321.0584544
6	SD of line	131.0715652
7	Accuracy	100.2%
8	Precision after 48 hr	1.17%
9	Interference	0.0089%
10	LOD	0.452529396(µg/mL)
11	LOQ	1.856149684(µg/mL)

TABLE 2: ACCURACY STUDY OF SERTRALINE HYDROCHLORIDE

Sr. no.	Actual concentration(ppm)	% Recovered*, %RSD
1	25	99.1;0.54
2	50	99.3;0.27
3	75	100.2;0.07

*****Mean of three determinations.

TABLE 3: ASSAY OF MARKETED FORMULATION

Sr. no.	Sample[#]	Assay* ± SD
1	Zoloft (sertraline hydrochloride) tablets100 mg	99.4 ± 0.070

*: mean of 3 determinations. [#]:20 numbers of the tablet dosage form. SD: standard deviation.

Chromatograph Representation: Chromatograms of the blank, sample, and marketed formulation are shown in **Fig. 2**, **Fig. 3**, and **Fig. 4,** respectively.

Blank:

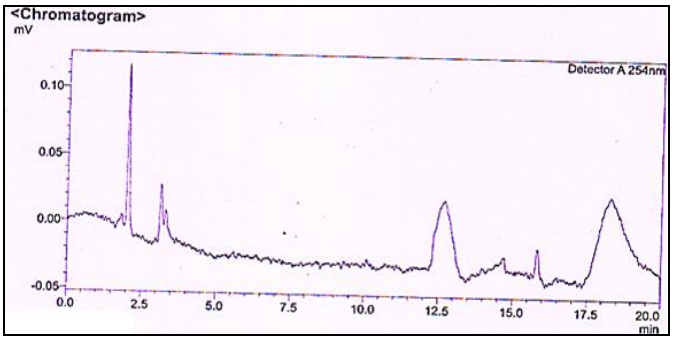

FIG. 2: CHROMATOGRAPH OF BLANK SOLUTION

Sample:

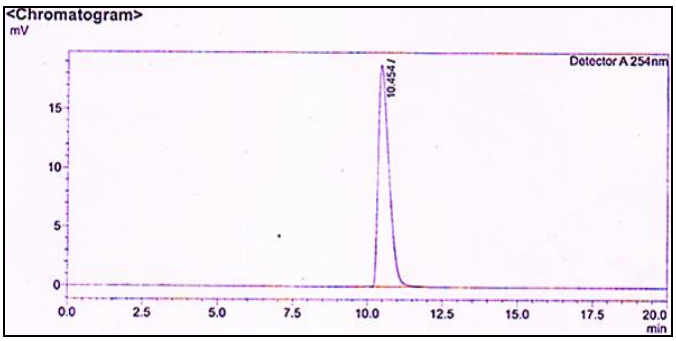

FIG. 3: CHROMATOGRAPH OF SAMPLE SOLUTION

Marketed Formulation:

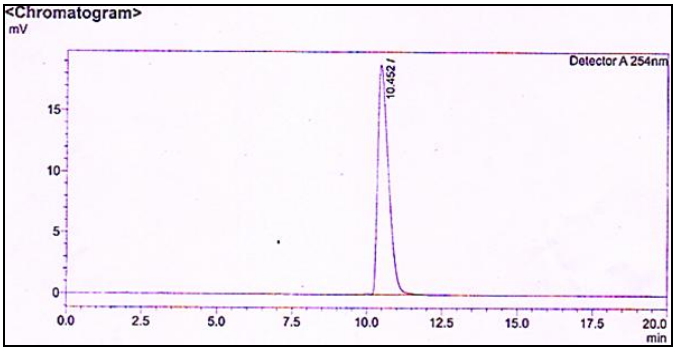

FIG. 4: CHROMATOGRAPH OF MARKETED FORMULATION

An inhibitor of selective serotonin reuptake is sertraline hydrochloride. The U.S. Food and Drug Administration (USFDA) approved this medication in 1999 under the brand name Zoloft from Pfizer.

Using the Prominence I LC 2030 C, HPLC system, the HPLC approach was selected to develop and validate the medication sertraline hydrochloride (Shimadzu Corporation, Japan). The chromatographic apparatus included a C18 column 250 x 4.6 mm (5 µm), a Shimadzu SPD-20A UV detector, a binary low-pressure mixing pump (LC-20AT), and a 2 mL sample container. Analysis and data collection were done using Lab Solutions' software. The technique underwent validation using each of the parameters listed in ICH guideline Q2R1.

Results that were in agreement were obtained using the designed and optimized approach. After a few tests, the mobile phase's composition of monobasic potassium phosphate of buffer pH 4.0, acetonitrile, and methanol in the ratio of 50:25:25 at a flow rate of 2.0 ml/min was found to be the most effective. Sertraline Hydrochloride was simultaneously identified at 254 nm with a retention time of 10.4±0.2 min. A specificity check revealed that neither the mobile phase nor the diluent used in the procedure interfered with the drug's retention period. In the overall procedure, the mobile phase was utilized as a diluent to eliminate interference from the produced chromatogram. The technique was discovered to be linear over the range of 25 to 75 ppm with an r2 value of 0.9998. The proportion of medication was determined to be 99.7 0.07 in a quantitative assay of the commercial formulation, which was within specification limits **Table 1**. Studies on accuracy and precision had metrics within the parameters set (RSD 2%), and the recovery percentage was between 99.1 and 100.2%.

CONCLUSION: The proposed Reverse Phase HPLC method for the estimation of Sertraline Hydrochloride may be used for the drug/formulation sample analysis in the pharmaceutical sector businesses and/or may be employed for bioanalytical sample analysis where the optimal retention time of 10.4±0.2 min is outside the plasma inference area concerned to chromatographic circumstances. For the estimation of the medication sertraline Hydrochloride, a simple, accurate, precise, and sensitive approach was established.

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CONFLICTS OF INTERESTS: Nil.

REFERENCES:

1. Masarwa R, Bar-Oz B, Gorelik E, Reif S, Perlman A and Matok IJAJoO: Prenatal exposure to selective serotonin reuptake inhibitors and serotonin-norepinephrine reuptake inhibitors and risk for persistent pulmonary hypertension of the newborn: a systematic review, meta-analysis, and network meta-analysis 2019; 220(1): 57-13.
2. MacQueen G, Born L and Steiner MJCDR: The selective serotonin reuptake inhibitor sertraline. Its profile and use in psychiatric disorders 2001; 7(1): 1-24.
3. Wagner KD, Ambrosini P, Rynn M, Wohlberg C, Yang R and Greenbaum MS: Efficacy of sertraline in the treatment of children and adolescents with major depressive disorder. Two Randomized Controlled Trials 2003; 290(8): 1033-41.
4. Johnson BM and Chang P-TL: Sertraline hydrochloride. Analytical Profiles of Drug Substances and Excipients. 24: Elsevier 1996; 443-86.
5. Atty SA, Ibrahim AH, Ibrahim H, Abdelzaher AM, Abdel-Raoof AM and Fouad FAJMJ: Simultaneous voltammetric detection of anti-depressant drug, sertraline HCl and paracetamol in biological fluid at CNT-cesium modified electrode in micellar media 2020; 159: 105524.
6. Rosetti A, Ferretti R, Zanitti L, Casulli A, Villani C and Cirilli RJJoPA: Single-run reversed-phase HPLC method for determining sertraline content, enantiomeric purity, and related substances in drug substance and finished product 2020; 10(6): 610-6.
7. Sharma A, Gaurav K and Srivastava RJACL: A Comparative Estimation of Alprazolam in Pharmaceutical Formulations by Validated HPLC and HPTLC Techniques 2021; 11(2): 187-97.
8. Jeremić A, Milosavljević F, Vladimirov S, Batinić B, Marković B and Jukić MJAoP: Validation of a quick and simple chromatographic method for simultaneous quantification of sertraline, escitalopram, risperidone and paliperidone levels in the human plasma 2021; 71(5): 365-77.
9. GV C: RP-HPLC method development and validation for simultaneous estimation of sertraline HCL and alprazolam in tablet dosage form 2015.
10. Bais S, Bhavsar M, Singhvi I and Chandewar AJPR: Analytical method de velopment and validation for the estimation of alprazolam and sertraline hydrochloride by HPLC 2014; 11(1).
11. Eswarudu M, Kumar YR and Eswaraiah MCJAJoRiC: Novel RP-HPLC method for simultaneous estimation of doxofylline and sertraline in bulk and tablet dosage form 2015; 8(8): 539-44.
12. Raza A, Murtaza SH, Hanif S, Iqbal J, Ali I and Aftab T: Validation of a rapid and economical RP-HPLC method for simultaneous determination of metformin hydrochloride and sitagliptin phosphate monohydrate: Greenness evaluation using AGREE score 2022; 35(1).
13. Dai G, Bi K, Liu R and Li Q: Determination and related substance test of sertraline hydrochloride by RP-HPLC with chiral mobile phase additive 2012.
14. Vahora S, Chhalotiya UK, Kachhiya H, Tandel J and Shah DJJJoPCMT: Simultaneous quantification of brexpiprazole and sertraline HCl in synthetic mixture by thin-layer chromatography method 2021; 34(6): 549-57.
15. Patil VK, Dhande ND, Petha NH and Narkhede HPJAM: A simple derivatization RP-HPLC method for the simultaneous determination of zineb and hexaconazole in pesticide formulation using a PDA detector 2021; 13(35): 3930-9.
16. Patel P, Panchal S, Mehta T, Solanki S and Patel C: Reversed-phase high performance liquid chromatographic (RP-HPLC) method for determination of tacrolimus in bulk and pharmaceutical formulation. Int J Pharm Pharm Sci 2011; 3(4): 220-2.
17. Kumar P, Mishra V, Verma S and Bhatia A: Development of RP-HPLC method for simultaneous estimation of mycophenolate mofetil and tacrolimus. J Mater Environ Sci 2018; 9: 1357.
18. Syed SM, Marathe R and Mahaparale PJJoCPR: Analytical method development and validation of RP-HPLC method for determination of eletriptan HBr 2019; 10(1): 3535-42.
19. Subramanian VB, Katari NK, Ponnam V, Konduru N, Dongala T and Marisetti VM: Stability-indicating reversed-phase-HPLC method development and validation for sacubitril/valsartan complex in the presence of impurities and degradation products: Robustness by quality-by-design approach 2022; 36(1): 5240.

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