A REVIEW ON ANALYTICAL METHODS FOR ESTIMATION OF OLANZAPINE AND SERTRALINE HYDROCHLORIDE

Nidhi S. Ghetiya¹ and Dr. Dilip G. Maheshwari²*

¹Department of Quality Assurance and Pharm Regulatory Affairs, L.J Institute of Pharmacy, Ahmedabad.
²Head of Department, Department of Quality Assurance and Pharm Regulatory Affairs, L.J Institute of Pharmacy, Ahmedabad.

ABSTRACT

Olanzapine and Sertraline are effective in ameliorating symptoms of depression, anxiety and aggression, reducing sensitivity in interpersonal relationships and alleviating obsessive symptoms, pessimistic behaviors and somatization disorders in patients with personality disorders on methadone maintenance therapy. They are generally administered as tablet. This review entails different methods developed for determination of the combination of Olanzapine and Sertraline Hydrochloride like UV-spectroscopy and HPLC method.

KEYWORDS: Olanzapine, Sertraline Hydrochloride, UV-Spectroscopy, High Performance Liquid Chromatography (HPLC).

INTRODUCTION

Olanzapine has a higher affinity for 5-HT₂A serotonin receptors than D₂ Dopamine receptor and is chemically designated 2- Methyl – 4 - (4- methyl- 1- piperazinyl) -10H- thieno [2, 3-b] [1, 5] benzodiazepine. which is a common property of all atypical antipsychotics, aside from the Benzamide antipsychotics such as Amisulpride. Olanzapine also had the highest affinity of any second-generation antipsychotic towards the P-glycoprotein in one in vitro study. P-glycoprotein transports a number of drugs across a number of different biological membranes including the blood-brain barrier, which could mean that less brain exposure to Olanzapine results from this interaction with the P-glycoprotein.
Sertraline hydrochloride belongs to a class of antidepressant agents known as selective serotonin-reuptake inhibitors (SSRIs) is chemically designated (1S, 4S)-4-(3, 4-dichlorophenyl)-N-methyl-1, 2, 3, 4-tetrahydronaphthalen-1-amine hydrochloride. As with other antidepressant agents, several weeks of therapy may be required before a clinical effect is seen. SSRIs are potent inhibitors of neuronal serotonin reuptake. They have little to no effect on norepinephrine or Dopamine reuptake and do not antagonize α- or β-adrenergic, Dopamine D2 or histamine H1 receptors. During acute use, SSRIs block serotonin reuptake and increase serotonin stimulation of somatodendritic 5-HT1A and terminal auto receptors. Chronic use leads to desensitization of somatodendritic 5-HT1A and terminal auto receptors. The overall clinical effect of increased mood and decreased anxiety is thought to be due to adaptive changes in neuronal function that leads to enhanced serotonergic neurotransmission. Sertraline may be used to treat major depressive disorder, obsessive-compulsive disorder (OCD), panic disorder, post-traumatic stress disorder (PTSD), premenstrual dysphonic disorder (PMDD) and social anxiety disorder (social phobia).

Combination of Olanzapine and Sertraline hydrochloride are effective in ameliorating symptoms of depression, anxiety and aggression, reducing sensitivity in interpersonal relationships and alleviating obsessive symptoms, pessimistic behaviors and somatization disorders in patients with personality disorders on methadone maintenance therapy.

Different methods have been developed for determination of like UV-spectroscopy, High Performance Liquid Chromatography.

**Reported methods are categorized depending on the following considerations.**
1. Single component analyzed by UV-spectroscopy methods and chromatographic method.
2. Analysis of Olanzapine and Sertraline Hydrochloride combination with other drug by UV-spectroscopy methods and chromatographic method.

**Official Method**

**Table:** 1. Olanzapine and Sertraline Hydrochloride Single Component Chromatography

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Drug</th>
<th>Method</th>
<th>Description</th>
<th>Ref. No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Olanzapine Tablet dosage form in (IP2014)</td>
<td>HPLC</td>
<td>Detection wavelength : 260nm Mobile phase: 3g ammonium dihydrogen orthophosphate in 900ml water, add 2ml of triethylamine and dilute 1000ml with water.</td>
<td>[2]</td>
</tr>
</tbody>
</table>
| 2 | Olanzapine in API | HPLC | Adjust the pH to 2.5 with orthophosphoric acid and 30 volumes of methanol, 
**Stationary phase**: Stainless steel column 25cm×4.6mm packed with octadecysilane bonded to porous silica (5µm) 
**Flow rate**: 1ml/min 
**Injected volume**: 10µl |
|---|---|---|---|
| 3 | Sertraline in tablet dosage form (IP2014) | HPLC | **Detection wavelength**: 230nm 
**Mobile phase**: 1) Buffer sol.of pH 6.8 and acetonitrile (80:20) Acetonitrile 
**Stationary phase**: Stainless steel column 25cm×4.6mm packed with octadecysilane bonded to porous silica (5µm) 
**Flow rate**: 1.2ml/min 
**Injection volume**: 10ml. |
| 4 | Sertraline Chloride API (IP2014) | HPLC | **Detection wavelength**: 1) 265nm 
2) 210nm 
**Mobile phase**: 1) Methanol and 0.286%v/v glacial acetic acid & 0.348 %v/v triethylamine and acetonitrile (15:40:45) 
2) 0.272%w/v solution of Potassium dihydrogen orthophosphate, adjust to PH= 3.0 with orthophosphoric acid & Acetonitrile 
3) Propan-2-ol and 0.23%w/v solution of ammonium dihydrogen orthophosphate (10:90) 
**Stationary phase**: Stainless steel column 25cm×4.6mm, packed with octadecysilane bonded to porous silica (5µm) 
**Flow rate**: 1) 1.8ml/min. 
2) 1ml/min. 
3) 0.7ml/min. 
**Injected volume**: 1) 20µl 
2) 40µl |
Reported method

Table: 2. Olanzapine and Sertraline Hydrochloride Single component UV-spectroscopy methods

<table>
<thead>
<tr>
<th>Sr. no</th>
<th>Drug</th>
<th>Methods</th>
<th>Description</th>
<th>Ref. No</th>
</tr>
</thead>
</table>
| 5      | Olanzapine in bulk & p’ceutical dosage form | UV Spectrophotometric method                 | Detection Wave length: 258nm  
Solvent: water - HCL (9:1)  
Linearity range: 5-40µg/ml  
Regression coefficient(R²): 0.998 | [6]     |
| 6      | Olanzapine in bulk & p’ceutical formulation & preformulation | UV spectrophotometric method                 | Detection Wave length: 258nm  
Solvent: (100mm HCL with PH 1.2 & phosphate buffer saline with PH 7.4)  
Linearity range: 2-10 µg/ml.  
Regression coefficient (R²): 0.9998 | [7]     |
| 7      | Olanzapine in bulk and pharmaceutical dosage form | UV spectrophotometric method                 | Detection wave length : 257nm  
Solvent: water-HCl(9:1)  
Linearity range: 5-40µg/ml  
Regression coefficient(r²): 0.998 | [8]     |
| 8      | Assay of Olanzapine                        | UV spectrophotometric method                 | Detection wave length: 258 – 259nm  
Solvent: Methanol  
Linearity range: 2-12µg/ml  
Regression coefficient(r²):0.986 | [9]     |
| 9      | Olanzapine in bulk pharmaceutical dosage form | UV spectrophotometric method                 | Detection wave length: 258nm  
Solvent: Water-HCl  
Linearity range: 5-40µg/ml  
Regression coefficient: 0.998 | [10]    |
| 10     | Olanzapine in pharmaceutical formulation   | 1st&2nd dvt spectrophotometric method       | Detection Wave length:  
1st dvt. -222nm, 2nd dvt. -230nm  
Solvent: methanol  
Linearity range: 1st dvt. 2-10µg/ml, 2nd dvt. 2-12µg/ml  
Regression co-efficient: 1st dvt.-0.9989, 2nd dvt.-0.9994 | [11]    |
| 11     | Sertraline HCL In bulk drug and tablets    | UV Spectrophotometric Method                 | Detection Wave length: 228  
Solvent: Methanol  
Linearity range: 5-30µg/ml  
Correlation Co-efficient: 0.999 | [12]    |
| 12     | Sertraline in tablets dosage forms         | UV spectrophotometric Method                 | Detection Wave length: 425nm  
Linearity range: 20-90µg/ml  
Coloring agents:  
Coloring agent drug with alizarin red (0.11w/v)  
Coloring agent drug with | [13]    |
<table>
<thead>
<tr>
<th>Sr No.</th>
<th>Drug Description</th>
<th>Methods</th>
<th>Detection wave length</th>
<th>Mobile phase</th>
<th>Stationary phase</th>
<th>Flow rate</th>
<th>Linearity range</th>
<th>Regression coefficient</th>
<th>Retention time</th>
<th>% Recovery</th>
<th>Ref. No</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>Sertraline from In-vitro</td>
<td>UV Spectrophotometric Method</td>
<td>274nm</td>
<td>0.05M acetate buffer PH4.5</td>
<td>20-120µg/ml</td>
<td>0.9998</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Sertraline in Human Plasma</td>
<td>UV Spectrophotometric Method</td>
<td>315nm</td>
<td>Borate buffer of PH 8.0</td>
<td>0.05-1.0µg/ml</td>
<td>0.998</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Sertraline in-vitro Capsule dosage</td>
<td>UV Spectrophotometric Method</td>
<td>270nm</td>
<td>Methanol</td>
<td>5-25µg/ml</td>
<td>0.9997</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table: 3. Olanzapine and Sertraline Hydrochloride Single component HPLC methods

<table>
<thead>
<tr>
<th>Sr No.</th>
<th>Drug Description</th>
<th>Methods</th>
<th>Detection wave length</th>
<th>Mobile phase</th>
<th>Stationary phase</th>
<th>Flow rate</th>
<th>Linearity range</th>
<th>Regression coefficient</th>
<th>Retention time</th>
<th>% Recovery</th>
<th>Ref. No</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>Assay of olanzapine</td>
<td>HPLC Method</td>
<td>254nm</td>
<td>10mM disodium hydrogen phosphate buffer (PH 7.4), Acetonitrile (35 : 65v/v)</td>
<td>Intersil ODS 3v column</td>
<td>1.0 ml/min</td>
<td>2.5-20.0µg/ml</td>
<td>0.9999</td>
<td>10min</td>
<td>99-104.7%</td>
<td>17</td>
</tr>
<tr>
<td>17</td>
<td>Olanzapine tablet dosage forms</td>
<td>RP-HPLC Method</td>
<td>270nm</td>
<td>Acetonitrile , water, triethylamine (60:40:0.1v/v/v)</td>
<td>Cap cell pake C18 (250×4.6mm)5µm column</td>
<td>1.0ml/min</td>
<td>2 to 12µg/ml</td>
<td>0.9999</td>
<td>6.53min</td>
<td>97 -103%</td>
<td>18</td>
</tr>
<tr>
<td>18</td>
<td>Quantitative determination of Olanzapine</td>
<td>HPLC Method</td>
<td>271nm</td>
<td>Acetonitrile, water, triethylamine (60:40:0.1v/v/v)</td>
<td>Intersil ODS column (150mm×4.6mm) 5µm column</td>
<td>1.0ml/min</td>
<td>10 -200µg/ml</td>
<td>0.9999</td>
<td>97.7 – 102.3%</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Olanzapine in bulk dosage form</td>
<td>HPLC Method</td>
<td>220nm</td>
<td>Ammonium phosphate buffer-methanol (70:30v/v)</td>
<td>Intersil C18 column</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20</td>
<td></td>
</tr>
</tbody>
</table>
Dilip et al.  
World Journal of Pharmacy and Pharmaceutical Sciences

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Drug</th>
<th>Methods</th>
<th>Description</th>
<th>Ref. No.</th>
</tr>
</thead>
</table>
| 20     | Sertraline in tablet dosage form | RP-HPLC Method | Flow rate : 1.0ml/min  
Linearity range : 2-10µg/ml  
Retention time : 3.447min  
Regression co-efficient : 0.999  
% Recovery : 99.86% | [21] |
| 21     | Sertraline HCl in bulk & Pharmaceutical dosage form | RP – HPLC Method | Detection Wave length : 220nm  
Mobile phase: Methanol-50MM potassium dihydrogen ortho phosphate(80:20 v/v) PH:6.2  
Flow rate : 1.0 ml/min  
Linearity range : 0.5 – 2.5 µg/ml  
Retention time: Sertraline- 4.3min.,  
Tamsulosin: 2.8min.  
Regression co-efficient : 0.998  
% Recovery: 99.02 -101.68% | [22] |
| 22     | Sertraline and alprazolam in bulk and tablet | RP-HPLC Method | Detection wave length : 237nm  
Mobile phase: Acetonitrile(0.05M) and ammonium acetate buffer (PH-3)(70:30)  
Stationary Phase: Intersil ODS-3V(250×4.6mm)  
Flow rate : 1.0ml/min  
Retention time: Alprazolam-4.005  
Sertraline-2.658  
Linearity: Alprazolam-5 - 35µg/ml  
Sertraline – 0.2-1.8µg/ml  
% Recovery : 97-102%  
Correlation Coefficient (R²): 0.999 | [23] |

Table: 4 Olanzapine and Sertraline Hydrochloride double UV-spectroscopy

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Drug</th>
<th>Methods</th>
<th>Description</th>
<th>Ref. No.</th>
</tr>
</thead>
</table>
| 23     | Fluoxetine HCl & Olanzapine in bulk drug and pharmaceutical formulation | UV- Visible spectro-photometric method | Detection wave length :  
Flu:226nm, Olp:256nm  
Solvent : Methanol-HCl  
Linearity range: 10-50µg/ml  
Regression coefficient :  
Flu:0.993, Olp:0.995 | [24] |
| 24     | Sertraline and Alprazolam In bulk and pharmaceutical dosage form | UV Spectrophotometric Method | Detection Wave length : 239nm  
Solvent: Methanol  
Linearity range : 10-60µg/ml  
Correlation co-efficient : 0.997 | [25] |
| 25     | Sertraline and Alprazolam in | UV Spectrophotometric | Detection Wave length : 254nm  
Solvent: Methanol | [26] |
Table: 5. Olanzapine and Sertraline Hydrochloride HPLC Method Combined with other Drug

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Drug Description</th>
<th>Methods</th>
<th>Detection Wave length</th>
<th>Mobile phase</th>
<th>Stationary phase</th>
<th>Flow rate</th>
<th>Linearity Range</th>
<th>Regression coefficient</th>
<th>% Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>Olanzapine and Fluoxetine Combined dosage form</td>
<td>HPLC Method</td>
<td>227nm</td>
<td>Phosphate buffer, acetonitrile, methanol (55:40:5 v/v/v)</td>
<td>C18 column 75 mm</td>
<td>0.8 ml/min</td>
<td>10-32.5 µg/ml</td>
<td>0.9942</td>
<td>97.5 - 102%</td>
</tr>
<tr>
<td>27</td>
<td>Olanzapine and Fluoxetine HCl in capsule</td>
<td>HPLC Method</td>
<td>235nm</td>
<td>Phosphate buffer 4.0, acetonitrile, triethylamine (53:47:0.03 v/v/v)</td>
<td>C18 column with iso critic illations</td>
<td>1.0 ml/min</td>
<td>2-12 µg/ml</td>
<td>0.9998</td>
<td>99.86%</td>
</tr>
<tr>
<td>28</td>
<td>Olanzapine and fluoxetine</td>
<td>HPLC Method</td>
<td>225nm</td>
<td>9.5 sodium dihydrogen phosphate, acetonitrile, methanol (40:30:30)</td>
<td>Inertsil C18 reversed phase column (150mm×4.6mm, 5µm)</td>
<td>1.0 ml/min</td>
<td>25-75 µg/ml</td>
<td>Olp-0.995, Flu-0.995</td>
<td>98-100%</td>
</tr>
<tr>
<td>29</td>
<td>Fluoxetine HCl and Olanzapine in Pharmaceutical dosage form</td>
<td>RP-HPLC</td>
<td>233nm</td>
<td>Acetonitrile: Pot. Dihydrogen phosphate buffer : Triethylamine (0.2)(40:60:0.2 v/v/v)</td>
<td>Retention time: Flu -1.96 min, Olp – 5.59 min</td>
<td>1.0 ml/min</td>
<td>10-60 µg/ml, Olp-20-120 µg/ml</td>
<td>0.998</td>
<td>99.95-100.01%</td>
</tr>
<tr>
<td>30</td>
<td>Sertraline and alprazolam in bulk and tablet</td>
<td>RP-HPLC Method</td>
<td>237nm</td>
<td>Acetonitrile (0.05M) and ammonium acetate buffer (PH-3)(70:30)</td>
<td>Intersil ODS-3V(250×4.6mm)</td>
<td>1.0 ml/min</td>
<td>Retention time: Alprazolam-4.005</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Method</td>
<td>Detection Wave Length</td>
<td>Mobile Phase</td>
<td>Stationary Phase</td>
<td>Flow Rate</td>
<td>Linearity Range</td>
<td>Recovery</td>
<td>Correlation Coefficient ($R^2$)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------------------</td>
<td>---------------------------------------</td>
<td>-------------------</td>
<td>-----------</td>
<td>----------------</td>
<td>-----------</td>
<td>-------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>31 Sertraline HCL &amp; Alprazolam in tablet dosage form</td>
<td>222nm</td>
<td>Phosphate buffer and acetonitrile (40:60 v/v)</td>
<td>C$_{18}$ = 4.6mm×250mm</td>
<td>1.0ml/min</td>
<td>5-25µg/ml</td>
<td>99-102%</td>
<td>0.999</td>
<td></td>
<td></td>
</tr>
<tr>
<td>32 Sertraline HCL Alprazolam bulk &amp; p'ceutical dosage form</td>
<td>225nm</td>
<td>Methanol: Phosphate buffer PH 2.8 (55:45 v/v).</td>
<td>(18 column (150 mmx4.6 mm)5µg</td>
<td>1ml/min</td>
<td>0.5-2.5µg/ml</td>
<td>98%</td>
<td>0.999</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33 Alprazolam &amp; sertraline HCl</td>
<td>226 nm</td>
<td>ACN:0.05m phosphate Buffer (55:45)</td>
<td>(18 JN Analytical(4.6<em>25</em>5 µ)</td>
<td>1.0ml/min</td>
<td>10-50µg/ml</td>
<td>Sertraline:99.999</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CONCLUSION**

This review represents the reported spectrophotometric and chromatographic methods developed and validated for determination of Olanzapine and Sertraline hydrochloride. According to the literature review it can be concluded that Olanzapine and Sertraline hydrochloride UV spectroscopy and HPLC method available in single as well as combined with other drug. All methods are found to be simple, accurate, economic, precise, and reproducible in nature. Comparing various validation parameters of already reported
methods, it can be concluded that different analytical methods like spectrophotometric and HPLC can be developed for Olanzapine and Sertraline hydrochloride showing its simplicity, sensitivity (low LOD and LOQ values) linearity and accuracy. As per review most of works have used the reversed-phase HPLC and UV absorbance detection because this provided with best available reliability, repeatability, analysis time and sensitivity.

ACKNOWLEDGEMENT
The authors are thankful to Dr. K. Pundarikakshudu, Director of L. J. Institute of Pharmacy, Ahmedabad, India for providing valuable guidance, all the facilities and encouragement to carry out the work.

REFERENCE
2. Indian Pharmacopeia; Government of India Ministry of Health and Family Welfare Published by Indian Pharmacopeia Commission, Ghaziabad, 2014; III: 2371-2372.
3. Indian Pharmacopeia; Government of India Ministry of Health and Family Welfare Published by Indian Pharmacopeia Commission, Ghaziabad, 2014; III: 2370-2371.
4. Indian Pharmacopeia; Government of India Ministry of Health and Family Welfare Published by Indian Pharmacopeia Commission, Ghaziabad, 2014; III: 2722-2724.
5. Indian Pharmacopeia; Government of India Ministry of Health and Family Welfare Published by Indian Pharmacopeia Commission, Ghaziabad, 2014; III: 2720-2722.
9. Chandrasekhar Ashok K., Gauri Santosh Kulkarni , Vithal V. Chopade, Somdatt Y. Chaudhry and P.D. Chaudhary “ Development and validation of stability indicating UV-
Vis.spectrophotometric Assay method of Olanzapine by using different stress degradation condition” WJPPS vol.3 Issue 8, 589-599, ISSN 2278-4357.


20. Kanakapura Basavaiah, Anil Kumar Urdigere Raingear, and alsang Tharp “Quantitative determination of olanzapine in pharmaceutical preparations by HPLC J Mex, chem, soc, 2008; 52(2); 120-124.


34. Sanjay Bais, Manank Bhavsar, Indrajeet Singhvi, Anil Chandewar, “Analytical method development and validation for the Estimation of Alprazolam and Sertraline HCl by HPLC.” Pharma. research, 2014; vol.11.