SPECTROPHOTOMETRIC DETERMINATION OF SERTRALINE IN PURE AND BLOOD SAMPLE

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ABSTRACT

A simple and sensitive spectrophotometric method has been developed for the determination of Sertraline in pharmaceutical and blood sample. The current method is depend upon the reaction between the sertraline and chloranilic acid in slightly alkaline medium, giving a purple colour complex having maximum absorbance at 527.5 nm. The reaction is selective for sertraline with 0.01mg/mL. The colour reaction obeys Beer's law from 0.1mg to 5mg/mL of sertraline and relative standard deviation is 0.19%. The quantitative estimation of sertraline in blood sample is also studied.

Key Words: Spectrophotometric, Sertraline, chloranilic acid, Beer's law, quantitative estimation.

INTRODUCTION

Sertraline Hydrochloride is a Selective Serotonin Reuptake Inhibitor (SSRI) and is a tricyclic compound with antidepressant activity¹. The antidepressant effect of sertraline is presumed to be linked to its ability to inhibit the neuronal reuptake of serotonin². It has only very weak effects on norepinephrine and dopamine neuronal reuptake. At clinical doses, sertraline blocks the uptake of serotonin into human platelets³. Like most clinically effective antidepressants, sertraline down regulates brain norepinephrine and serotonin receptors in animals⁴. In receptor binding studies, sertraline has not a significant affinity for adrenergic (alpha(1),alpha(2) and beta), cholinergic, GABA, dopaminergic, histaminergic, serotonergic(5-HT1A,5-HT1B,5-HT2) or benzodiazepine binding sites⁵. In placebo- controlled studies in normal volunteers, sertraline did not cause sedation and did not interfere with psychomotor performance⁶.

Various analytical techniques have been developed for the determination of Sertraline HCl. In the UV-VIS spectrophotometric determinations, colour was obtained by the reaction of sertraline HCl with either p acceptors chloranil and 2,3-dichloro-5,6-dicyanoquinone (DDQ) or s acceptor iodine⁷. In the qualitative analysis of some antidepressants by first derivative spectrophotometry and HPLC, antidepressant (sertraline HCl) is determined (analysed). In the first derivative spectrophotometry, sertraline hydrochloride by measurement of its first derivative signals at 271.6-275.5nm (peak-to-peak amplitude) and in the HPLC method, the UV detection were carried out at 270.0nm⁸.

Structure of Sertraline and Chloranilic acid

Apparatus

A UV-VIS spectrophotometer (Techcomp-UV2300) was used to measure the absorbance. A pH meter (Cyber Scan) and graduated pipettes were employed.

Reagent:

All reagents were of analytical grade and doubly distilled water was used. Sertraline standard solution (w/v) 0.5mg/mL was prepared by dissolving 50mg sertraline HCl in 10.0 mL distilled water. The solution was made alkaline (pH ~ 11) by slowly adding 10% NaOH solution (checked with pH paper). Transferred it to a separating funnel and added 20.0 mL of chloroform. Shaked well and allowed to stand and separated lower portion of chloroform (leaving a very small portion behind). Repeated this step thrice and passed the extract through a funnel embedded with anhydrous Na₂SO₄. The solution was made up to 100 mL with chloroform⁹.

0.005% (w/v) chloranilic acid was prepared by dissolving 0.05g of it in 25mL methanol and the volume was made up to 100 mL with methanol.

1M (w/v) sodium hydroxide (E. Merck) was prepared in distilled water.

General Procedure

To an aliquot of sertraline, added 0.2 mL of chloranilic acid and measured the absorbance of the resulting purple color at 527.5 nm. After this, performed different effects including concentration of reagents, pH, time, temperature, complex stability and finally a calibration curve was drawn (Fig-I).

Fig-I Calibration Curve of Sertraline (0.1 – 5 mg/10mL)

Conditions: 0.005 % chloranilic acid, Temperature 32°C, pH = 11.15, $\lambda_{\max} = 527.5\text{nm}$

RESULTS AND DISCUSSION

Absorption Spectrum of Colored Complex

Sertraline reacts with chloranilic acid without any heating give purple color complex, the absorption maxima of which under optimum condition, is at 527.5nm (Fig-II).

Fig-II Absorption spectra of Sertraline-Chloranilic acid complex

Conditions: Sertraline 0.5 mg / mL, Room Temperature, $\lambda_{\max}$ found = 527.5 nm

Effect of Color Producing Reagent

Chloranilic acid was used as a color producing reagent. It was found that the complex was stable and with the increase the concentration of chloranilic acid (mL), increase in the absorbance observed, thus a linear relationship observed as in Fig-III.

Fig. III Effect of concentration of reagent (chloranilic acid)

Conditions: Sertraline = 0.5 mg / mL, Room Temperature, pH ~ 10, $\lambda_{\max} = 527.5\text{nm}$

Effect of pH

When Sertraline was mixed with chloranilic acid without the addition of NaOH, the pH was 5.5 and the color was purple. Though for the complete reaction pH should be greater than 7 and complex would be stable. However at pH = 11.15 give the maximum intensity as shown in the Fig-IV.

Fig. IV: Effect of pH on formation of Color complex

Conditions: Sertraline = 0.5 mg/ mL, 0.005 % chloranilic acid, ($\lambda_{\max} = 527.5\text{ nm}$)

Effect of Temperature

The effect of temperature is shown in Fig.V. The colour develops at room temperature. As the temperature increases the complex starts dissociating, due to which the colour intensity decreases. It was found that heating at 30°C gave maximum colour, however above and below this temperature the colour intensity decreased and the colour was unstable.

Fig. V Effect of Temperature on stability of color complex

Conditions: Sertraline = 0.5 mg/mL, 0.005 % chloranilic acid, $\lambda_{\max} = 527.5\text{nm}$

Effect of Heating Time

The color develops at room temperature, but as the time increases the color intensity decreases. It was found that heating for 20 min gave maximum color above and below which, color was unstable (Fig-VI).

Fig. VI: Effect of Heating Time on formation of color complex

Conditions: Sertraline = 0.5 mg / mL, 0.005 % chloranilic acid, Temp. = 32°C, $\lambda_{\max} = 527.5\text{nm}$

Effect of time on stability of colour

To study the stability of the color, 5.0 mL of Sertraline (0.5mg/mL) was mixed with 0.2mL of Chloranilic Acid (0.005%) and heated at 30°C. Absorbance was noted after every 5 minutes. A graph was plotted between the time and absorbance. These results are plotted in Fig. VII which shows that there is no effect of time on stability of color.

Fig. VII: Effect of time of stability of color

Conditions: Sertraline = 0.5 mg / mL, 0.005 % chloranilic acid, Room Temp., $\lambda_{\max}$ = 527.5 nm

Validity on Blood Sample:

Took blood sample in anticoagulant tube and centrifuge it at 4000 rpm for 5 minutes. Serum was separated from the blood and divided in to eight portions (vials). Then added different concentrations of drug (i.e. 0.5mL, 1.0mL, 1.5mL, 2.0mL, 2.5mL, 3.0mL, 3.5mL, 4.0mL) in the centrifuge tubes and 3 mL acetonitrile was also added in each of the tube. Again centrifuge them at 5000 rpm for the removal of proteins. After separation of serum, added 0.2mL of reagent (chloranilic acid) in each of the eight tubes (or vials) and measured the absorbance at 527.5 nm. The results showed that the method may be applicable on biological sample and an excellent method for determination of sertraline from 1.5 mg/mL to 2.5 mg/mL. Results expressed in Fig VIII and IX.

Fig. VIII: Concentration of Sertraline in blood samples

Fig. IX: Concentration of Sertraline in blood sample

Sensitivity

The recovery results for the determination of Sertraline in solutions are shown in Table I, which shows the sensitivity and reproducibility of the method. It is also reasonable precise and accurate, as the amount taken from identical samples is known and the amount found does not exceed a relative standard deviation of 0.19% for six values. The optimization has been done at lower analyte concentration.

Table 1: Determination of Sertraline from Pure So.

Sertraline HCl taken (mg/mL)	Sertraline HCl recovered (mg/mL)	RSD (%)
0.05	0.0502	0.18
0.1	0.0998	0.11
0.15	0.1493	0.26
0.2	0.2006	0.09
2	2.003	0.08
3	3.007	0.04
4	3.997	0.08
5	5.008	0.06

The overall findings are summarized in Table II

Table II : Determination of Sertraline from Pure Solution.

Parameter	Value
$\lambda_{\max}$ (nm)	527.5 nm
Beer's law limit (mg/ ml)	0.01-5.0
Limit of detection (mg/ml)	0.01
Optimum photometric range	0.01-5.0
Relative standard deviation (RSD) (%)	0.19

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