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Research Article

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Determination of Atenolol in Pharmaceutical Preparations and Environmental Wastewater Samples: Application to Content Uniformity Testing

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ABSTRACT

A simple, accurate, precise, rapid, economical and sensitive Uv spectrophotometric method has been developed for the determination of Atenolol in pharmaceutical preparations and environmental wastewater samples, which shows maximum absorbance at 225 nm in methanol. Beer's law was obeyed in the range of 2.5 -30 µg/ ml, with molar absorptivity of 9.9877×103 $L.mol^{-1}.cm^{-1}$, relative standard deviation of the method was less than 1.6%, and accuracy (average recovery %) was 100 ± 1.2. No interference was observed from common excipients and additives often accompany with Atenolol in pharmaceutical preparations. The method was successfully applied to the determination of Atenolol in some pharmaceutical formulations (tablets) and industrial wastewater samples. The proposed method was validated by sensitivity and precision which proves suitability for the routine analysis of Atenolol in true samples.

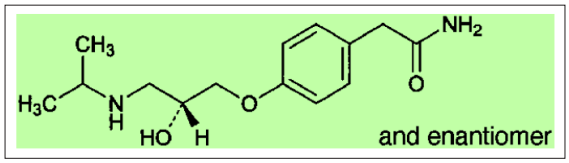
Keywords: Atenolol, Spectrophotometry, Pharmaceutical Preparations

Environmental Samples

Introduction

Atenolol (ATNL), chemically identified as 2-[4-[(2RS)-2-hydroxy-3-[(1-methylethyl) amino] propoxy] phenyl] acetamide (Figur1). It is a white powder; it is soluble in ethanol but water is sparingly soluble [1-3].

Atenolol (ATEN), a beta-blocker is used to treat angina and high blood pressure. Hydrochlorothiazide (HCTZ) is a thiazide diuretic that increases the urine flow and prevents the retention of fluid in the body. It is used to treathigh blood pressure [4].



$C_{14}H_{22}N_2O_3$: 266.34
2-(4-{(2RS)-2-Hydroxy-3-[(1-methylethyl) amino] propyloxy} phenyl) acetamide

Figure 1: Atenolol Chemical structure

The literature survey reveals that various methods has been reported for estimation of Atenolol by Titrimetric method [3]. Spectrofluorometric methods Spectrophotometric methods, RP-HPLC methods, Flow-injection chemiluminescence analysis method continuous flow injection analysis via turbid metric method [5-17].

Second derivative spectroscopy method, and oxidative derivatization method in the view of the need in the industry for routine analysis of Atenolol, attempts are being made to develop simple and accurate instrumental methods for quantitative estimation of Atenolol [18,19]. Thus, there is need for the development of new, simple, sensitive and accurate analytical method for the quantitative estimation of Atenolol as an active pharmaceutical ingredient. The present work describes simple and accurate Spectrophotometric methods for the estimation of Atenolol hydrochloride in bulk and dosage form

Experimental

Apparatus

Shimadzu UV- 1700 pharmaspec (double beam) spectrophotometer with 1.0 cm quartz cells was used for absorption measurement.

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Reagents

All chemical used were of analytical or pharmaceutical grade and Atenolol standard material was provided from the state company of drug industries and medical appliance (NDI) Nineveh-Iraq.

Atenolol Stock Solution (1000 ppm) was prepared by dissolving 0.1g of Atenolol in 100 ml methanol in a volumetric flask.

Atenolol Standard Solution (100 ppm) was prepared by diluting10 ml of stock solution to 100 ml by methanol in a volumetric flask.

Determination of Absorption Maxima

The standard solution of Atenolol (20µg/ml) was scanned in the range of 220-300 nm which shows maxima located at 225 nm Figure 2. Therefore, 225 nm wavelength was selected for the construction of calibration curve.

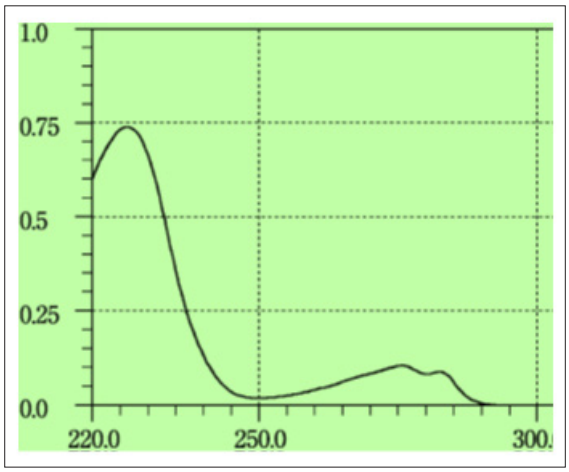

Figure 2: Absorption Spectra of 20 (µg/ml) Atenolol Against Methanol.

Recommended Procedure

From the absorption maxima, calibration curve was prepared in the concentration range of 2.5-30 µg/ml. The absorbance was measured at 225 nm against methanol as a blank. The concentration of the sample solution can be determined by using the calibration curve.

Procedure for Real Water Samples

To demonstrate the practical applicability of the proposed method, real water samples were analyzed by this method. Industrial waste water from the state company of drug industries and medical appliance (NDI) Nineveh-Iraq, were fortified with the concentrations in the range of 10,20,30 µg/ml of Atenolol. The fortified water samples were analyzed as described above for recommended procedure and the concentration was calculated by using the calibration curve of this method.

Procedure for Pharmaceutical Preparations (Tablets)

Weight and powder 10 tablets [Tenornin Tablets 25,50 mg]. Dissolve a quantity of the powdered tablets containing 0.01 gm of Atenolol in about 100 ml methanol and mixed for 20 mint and then filtered. The filtrate was mad up to 100 ml with methanol and aliquot of this solution was treated as described above for recommended procedure and the concentration was calculated by using the calibration curve of this method.

Result and Discussion

UV visible spectrophotometry is still considered to be a convenient and low-cost method for the determination of pharmaceuticals [20-25]. The method used for the determination of Atenolol in pharmaceutical preparations and environmental wastewater samples was found to be sensitive, simple, accurate, and reproducible. Beer s law was obeyed in the concentration range of 2.5-30 µg/ml. Figure 3 with correlation coefficient of 0.999, intercept of 0.001 and slope of 0.0375. The conditional molar absorptivity was found to be 9.9877 x10_3 l/mol.cm.

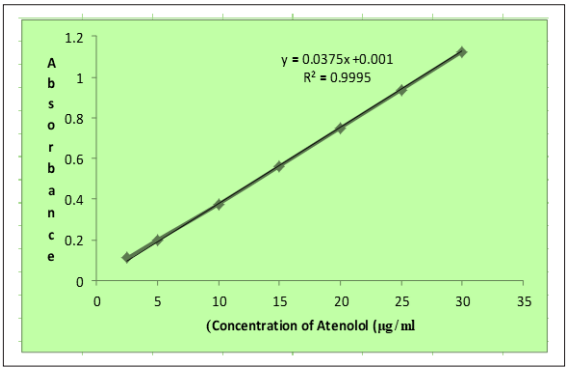

Figure 3: Calibration Curve for Atenolol.

The accuracy and precision of the method, a pure drug solution was analyzed at three different concentrations, each determination being repeated ten times. The relative error (%) and relative standard deviation values are summarized in table 1. From table 1 the values of standard deviation were satisfactory and the recovery studies were close to 100%, The RSD% value is less than1.6 indicative of accuracy of the method.

Table 1: Accuracy and Precision of the Proposed Method

Atenolol taken(µg/ml)	Er (%)[a]	RSD (%)
5	1.1	1.4
15	1.1	1.5
30	1.2	1.5

* Average of Ten Replicate Determinations

Analytical Application

The proposed method was satisfactorily applied to the determination of Atenolol in its pharmaceutical preparations tablets and wastewater samples, the results of the assay of the pharmaceutical preparations revels that there is close agreement between the results obtained by the proposed method and the label claim Table 2, and the results of water samples Table 3 show that the recovery values obtained were closed to 100%.

Table 2: Assay of Atenolol in Pharmaceutical Formulations.

Pharmaceutical formulation supplied by NDI	Amount of Atenolol* Proposed method	Label claim	%Recovery
Tablet 25mg	25.08mg	25 mg	100.32
Tablet 50 mg	50.1mg	50mg	100.2

*Mean of Ten Determinations

Table 3: Determination of Atenolol in Spiked Industrial Wastewater Sample

Water samples	Atenolol (µg/ml) *		Recovery%
	Taken	Found	
Industrial wastewater	10	10.01	100.1
	20	20.04	100.2
	30	29.92	99.73

*Mean of ten determinations.

Application of the Method to Content Uniformity [26-30]

The proposed method proved to be suitable for the content uniformity test, where a great number of assays on individual tablets are required. Data presented in Table [4] indicate that the proposed method can accurately and precisely quantitate Atenolol in its commercially available tablets. The mean percentage (with RSD) of the labeled claim found in ten tablets was (0.518%) which fall within the content uniformity limits specified by the USP 30 [28].

Table 4: Content uniformity testing of Atenolol Tablets Using the Proposed Method

Parameter	% of the label claim
Tablet NO. 1	100. 28
Tablet NO. 2	100. 11
Tablet NO. 3	99. 56
Tablet NO. 4	100.71
Tablet NO. 5	99.38
Tablet NO. 6	99. 35
Tablet NO. 7	99.72
Tablet NO. 8	100. 55
Tablet NO. 9	100.66
Tablet NO. 10	99.76
Mean (x)	100.008
% RSD	0.518
Max. allowed unit [28]	±15%

Conclusion

In this work, a simple, rapid, precise and accurate spectrophotometric method was developed and validated for the determination of Atenolol in pharmaceutical preparations and industrial waste water samples. The method free from such experimental variables as heating or solvent extraction step. The method relies on the use of simple and cheap chemicals and techniques and can be used for rapid routine determination and quality control of Atenolol in pure form, bulk sample, pharmaceutical preparations and real industrial waste water sample.

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