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Original Article

Simple UV spectrophotometric assay of Furosemide

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Abstract

Furosemide is the most commonly used high potency loop diuretics use in clinical practices. A least time consuming efficient and simple UV spectrophotometric method for the assay of furosemide has been developed. Comparison of assay of four different brands of furosemide (Furosemide, Lasix, Diuza, Diride) has also been made available in medical store of Karachi, Pakistan. The assay is based on the ultraviolet UV absorbance maxima at about 243nm wavelength of furosemide using water as solvent. A sample of drug was dissolved in water to produce a solution containing furosemide. Similarly, a sample of ground tablets of different brands were dissolved in water and various dilutions were made. The absorbance of sample preparation was measured at 276 nm against the solvent blank and the assay was determined by comparing with the absorbance of available brand. Our results reveal that among all the four brands of furosemide (Furosemide, Lasix, Diuza, Diride) Lasix and Duride shows highest percentage assay of 103.45%. Furosemide shows percent assay of 101.72% while Diuza shows lowest value for percentage assay 94.82%.

Key words : Furosemide assay, UV spectrophotometry, Furosemide, Lasix, Diuza, Diride

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1. Introduction

Furosemide is the most commonly used high potency loop diuretics use in clinical practice. It's an organic acid and highly bound to protein, which reaches the proximal tubular epithelial cells and it is secreted by the anion transporter into the tubular lumen in active free form. Furosemide site of action of is the thick ascending limb of loop of Henle. The mechanism of action is by inhibiting active chloride transport at the Na-K-2Cl channel which leads to impaired chloride and sodium reabsorption resulting in free water clearance and natriuresis [1]. Furosemide increases delivery of solutes out of loop of Henle. It is is a sulphonamide derivative and is the most common diuretic used in the newborn period. If given in excessive amounts, can lead to electrolytic depletion and dehydration. Furosemide blocks the Na^+-K^+-$2Cl^-$ cotransport system in ascending limb

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and inhibit Na^+, Cl^- and K^+ which are entering in the tubular cell. Loop diuretics are highly efficacious so for this reason, they are called "high-ceiling-diuretics". The flux of Na^+, K^+ and Cl^- into the epithelial cells in the thick ascending limb from the lumen is mediated by a Na^+-K^+-$2Cl^-$ symporter. This symporter use to capture free energy in the Na^+ electrochemical gradient which is established by basolateral Na^+ pump and also provides for "uphill" transport of Cl^- and K^+ into the cell. Furosemide has also weak carbonic anhydrase-inhibiting activity and binds extensively to plasma proteins and bilirubin displacement is negligible while using normal doses of furosemide. Delivery of this drug by filtration to the tubules is limited; it enters the tubules by the tubular secretion [2]. Furosemide is a rapidly acting loop diuretic which is used in edematous states which is associated with hepatic, renal and particularly cardiac failure So far, the routes of administration are oral and intravenous. If intravenously, furosemide is used that is in decompensate heart failure, when we require rapid diuretic action and intestinal absorption may be delayed because of gastrointestinal oedema Thus, time to peak, lag time and peak of serum concentration may differ in compensated when compared with decompensate patients after the oral furosemide is intake, whereas elimination half-life and area under the serum concentration curve are similar, bioavailability of furosemide exhibits large interindividual variability, primarily because of limited absorption[3]. Our research group did this types of assay for different generic for quality analysis and this study very useful for pharmacy, medicine and health professionals[4-9] because by this they can choose best drug with minimum price or compare local brands with multinational brands.

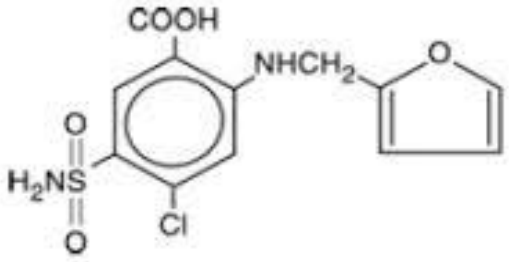

Figure1 : Structure of furosemide

2. Experimental Design

UV visible 1601 Shimadzu double beam spectrophotometer was used to measure spectra. The solvent which are used for the assay was water.

Wavelength Selection

About 100 ppm of furosemide solution was accurately prepared in water. These solutions were scanned in the 200-400 nm UV regions. The wavelength maxima (λmax) were observed at 276 nm and this wavelength was adopted for absorbance measurement.

Standard Stock solution

Accurately weighed 10 mg of furosemide standard was transferred to a volumetric flask and added sufficient water to produce 100 ml.

Sample Preparation

The four different brands (Furosemide, Lasix, Diuza, Diride) were purchased from different medical store in Karachi, Pakistan. The all tablets of each brand had same batch number and were labeled to conatin furosemide 10mg per tablet. All the four brands had 5 year shelf life.

20 tablets of four different brands of furosemide (Furosemide, Lasix, Diuza, Diride) from the marketed sample were weighed and crushed uniformly with the help of a mortar and pestle. By calculating

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the average weighed sample powder equivalent to 10 mg of furosemide was transferred into a volumetric flask containing 10mL water. The solutions were sonicated for about 5 min and then make up volume upto 100 ml with water.

Procedure

After preparation of standard and tablet solutions, strength of solution 100 ppm in 100 ml absorbance of the sample preparation and standard preparation in 1cm cell at the wavelength of maximum absorbance at about 276nm, using a spectrophotometer, using the blank solution was measured. Calculate the quantity in mg, of furosemide per tablet.

3. Result and discussion

Method validation and development

The aim of the present study was to develop a simple, economical, accurate and sensitive UV method for the determination of furosemide available dosage form for separation at ambient temperature.

The absorbance of sample preparation was measured at 276nm against the solvent blank and the assay was determined by comparing with the absorbance of available brand. Our results reveals that among all the four brands of furosemide (Furosemide, Lasix, Diuza, Diride) Lasix and Duride shows highest percentage assay of 103.44%. Furosemide shows percent assay of 101.724% while Diuza shows lowest value for percentage assay 94.82 %.This method is applicable for daily routine quantification of furosemide.

The method showed good linearity in the range of 6.25-100 µgmL-1 for all brands of furosemide with a correlation coefficient of 0.9999. The recovery of all brands of furosemide (Furosemide, Lasix, Diuza, Diride) was > 90 % . Table 1 shows the percent assay of drugs and Table 2 shows regression equation with R value which is >0.93. Table 3 shows the absorbance of all brands and the Table 4 shows correlation between absorbance and concentration. The results are highly significant t value 0.00 shows linear relation of absorbance and concentrations. Figure 2 shows % assay of different brands and Figure 3 to 6 shows linearity of all brands.

Brand Name	Average wt of tablet mg	Absorbance at 276 nm	% assay
Furosemide	163	0.059	101.72
Lasix	156	0.06	103.44
DIUZA	143	0.055	94.82
Duride	206	0.06	103.44

Table 1: % assay of different brands of Furosemide

Brand Name	Regression equations	R^2
Furosemide	y = 0.0006x + 0.001	0.9786
Lasix	y = 0.0006x - 0.0045	0.9471
DIUZA	y = 0.0006x - 0.0004	0.9997
Duride	y = 0.0006x - 0.0046	0.9489

Table 2: Regression equations and R^2 of different brands of Furosemide

Conc ppm	Furosemide Abs	Lasix Abs	DIUZA Abs	Duride Abs
100	0.059	0.059	0.059	0.059
50	0.03	0.03	0.03	0.03
25	0.02	0.02	0.02	0.02
12.5	0.01	0.01	0.01	0.01
6.25	0.005	0.005	0.0047	0.0049

Table 3: Absorbance of different brands

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		conc	abs
conc	Pearson Correlation	1	1.000**
	Sig. (2-tailed)		.000
	N	6	6
abs	Pearson Correlation	1.000**	1
	Sig. (2-tailed)	.000	
	N	6	6
**. Correlation is significant at the 0.01 level (2-tailed).			

Table 4: Correlations

Selectivity and Specificity

The selectivity and specificity of the method was established through the study of resolution factor of the peak of each brand from that of excepients. The method demonstrated good resolutions and was found to be free of interference from the excipients used in formulation products and thus, the method is specific for individual as well as combine drugs. Figure 2.

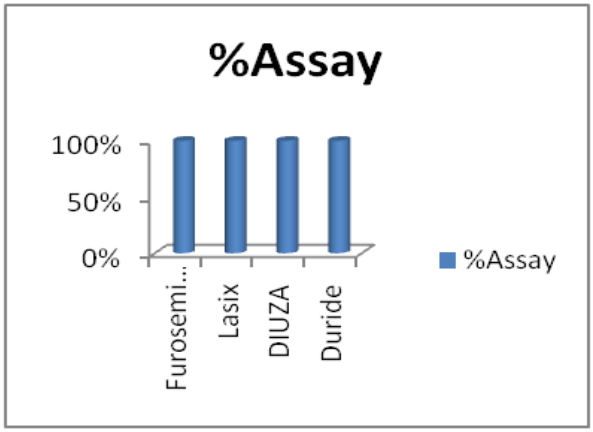

Figure 2 : percent assay of different brands of furosemide

Accuracy and recovery

Data corresponding to these assays for the assay of different brands are presented in table 1. The data given in table 1 shows that there is no significant difference between the amount of drug recovered. Thus, excepient did not interfere with the estimation.

Range and linearity

Table 2 shows the regression statistics of concentration analytical response, the standard deviation of the regression line and the optimum linear range (6.25-100 μgmL^{-1}) for each compound. Calibration curves were constructed in the range of expected concentrations (6.25-100 μgmL-1) and were found to be linear within the quantification ranges for all the assayed drugs using a linear regression excellent linearity was obtained in all cases with correlation coefficients > 0.90.

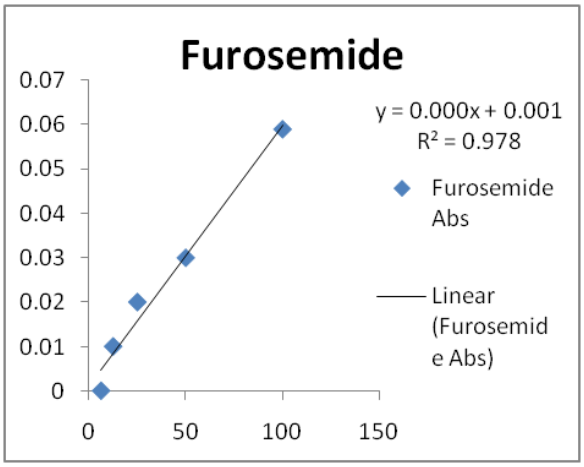

Figure 3 : Linearity of Furosemide

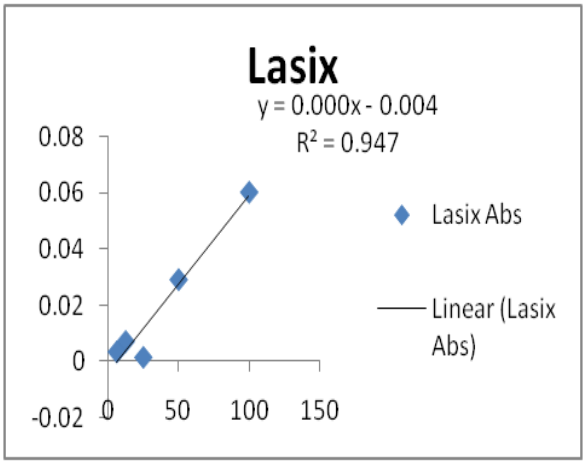

Figure 4: Linearity of Lasix

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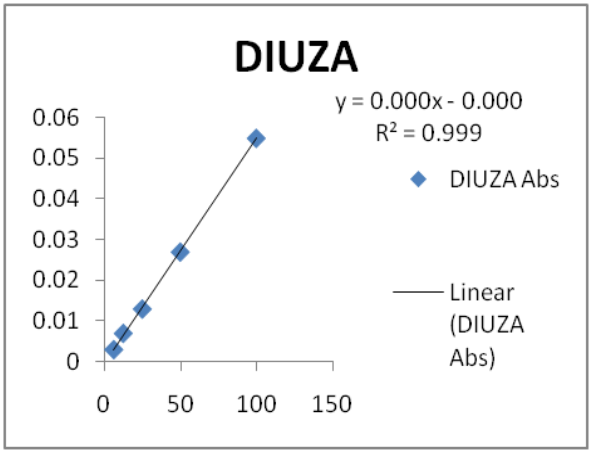

Figure 5 : Linearity of Diuza

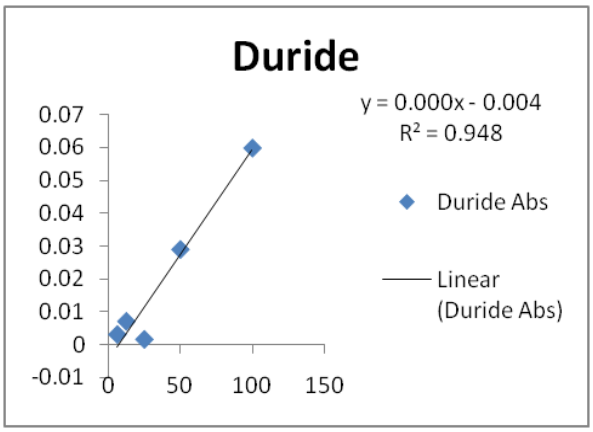

Figure 6 : Linerity of duride

4. Conclusion

It is concluded from above results and discussion that all the available brands of furosemide in Karachi Pakistan are having results of assay and linerity within the specified quality control range.

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