RESEARCH ARTICLE

A Comparative Technique Using as Joint Studying to prove Structure and Determination the Quantitative Estimation of Organic Compound (Irbesartan) as a Drug in Multicomponent Tablet Form

Imad Tarek Hanoon[1], Abed Mohammed Daheir AL-Joubory[2], Marwa Mohamed Saied[3]

[1,3]University of Samarra, College of Applied Science, Samarra, Iraq; [2]University of Tikrit, College of Pharmacy, Tikrit, Iraq

Received: 08th July, 19; Revised: 13th August, 19, Accepted: 07th September, 19; Available Online: 12th September, 2019

ABSTRACT

A simple, specific, accurate, and precise RP-HPLC method was developed for the determination of Irbesartan (IRB) in pharmaceutical dosage forms in tablets products and sachet using symmetry (L1) column at 30° C. The signal was detected at 225 nm. A mobile phase dissolves 0.5 g of buffer potassium phosphate in 100 ml distilled water and adjusts pH 2.7, methanol and acetonitrile at ratio (40: 30: 30). And the flow rate of 1.2 ml/min-1 at pH=7.2 a mobile phase. The percent recovery was detected by 101 %, and the linearity of concentration was 10-50 µg.mL-1 and supported this method by using (FT.I.R.) spectrum method for an organic spectrophotometer to prove the chemical structure of this drug and some physical properties. We obtained; the result is identical to other literature. The proposed method was applied successfully for the determination of the IRB in tablets products.

Keywords: Irbesartan, Linearity, HPLC, Tablet form

International Journal of Drug Delivery Technology (2019); DOI: 10.25258/ijddt.v9i3.6

How to cite this article: Hanoon, I.T., Daheir AL-Joubory, A.M. and Saied M.M. (2019). A Comparative Technique Using as Joint Studying to prove Structure and Determination the Quantitative Estimation of Organic Compound (Irbesartan) as a Drug in Multicomponent Tablet Form. International Journal of Drug Delivery Technology, 39(3): 360-366.

Source of support: Nil

Conflict of interest: None

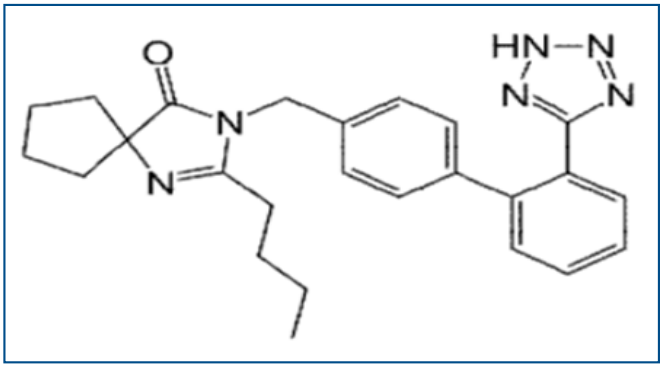
INTRODUCTION

Irbesartan is used mainly for the treatment of hypertension.[1-7] Irbesartan (INN) pronounced is an angiotensin II receptor antagonist. Irbesartan IAPUC name is 2-butyl-3-({4-[2-(2H-1,2,3,4-tetrazole-5-yl)phenyl]phenyl}methyl)-1,3-diazas-piro [4.4]non-1-en-4-one and molecular formula C25H28N6O (Figure 1).

2-butyl-3-({4-[2-(2H-1,2,3,4-tetrazole-5-yl)phenyl]phenyl} methyl)-1,3-diazas-piro[4.4]non-1-en-4-one

A literature survey revealed that numerous methods had been reported for the estimation of Irbesartan in pharmaceutical formulations has been reported. The present study involves the development of High-performance liquid chromatography (HPLC) method[8-12] using simple mobile phase which is sensitive and rapid for quantification of Irbesartan in tablet dosage forms as well as subsequent validation of developed method according to ICH guidelines.

Hypertension is a common health problem in developed countries and developing countries. The cause of hypertension is diverse due to genetic factors, lifestyle, and stress. Uncontrolled hypertension can lead to various diseases such as stroke, heart failure, diabetic nephropathy, myocardial infarction, kidney failure, and even death. Various drugs used for the treatment of Hypertension are Hydrochlorothiazide, Amlodipine Besylate, Chlorthalidone, Losartan, Telmisartan, Irbesartan, Atorvastatin Calcium, etc.[9-11]



Schema 1: Molecular structure of Irbesartan

Experimental Work

Table 1: Some physical properties of Irbesartan preparation solutions

S. No	Name	M.Formula	Color	m. point C°	Solvent
1	Irbesartan	$C_25H_28N_6O$	White	180-181	Methanol

*Author for Correspondence: dr.imadtarek@gmail.com

Preparation of Stock Solution 1000 µg/mL (IRB)

It is prepared by dissolve (the equivalent of about 0.1g of irbesartan to a 100 mL volumetric flask and dilute with methanol up to the mark.

Preparation of 100 µg/mL (IRB)

From the stock solution has taken 10ml in 100 mL volumetric flask and complete the volume with the mobile phase.

Preparation of 20 µg/mL (IRB)

From 100 µg /mL (IRB) taken 20 mL in 100 mL volumetric flask and complete the volume with the mobile phase.

Mobile phase

Dissolve 0.5 g of buffer potassium phosphate in 100 mL distilled water and adjust pH 2.7, methanol, and acetonitrile at ratio (40:30:30).

Stationary Phase

Column C_{18}- (L_{-1}) (150mm × 4.6 mm × 5 µm)

RESULTS AND DISCUSSION

20 µL of (IRB) were injected in HPLC using a UV detector to get the best separation of drug using were ideal analytical parameters.

Which are shown in Tables 1 and 2. Determination of drug by high-performance liquid chromatography (HPLC) technique

Selection of Column

The best separation column is selected for the IRB drug of type C_{18}-(L_{-1}) (150mm × 4.6mm × 5µm) due to its high separation efficiency.

Effect of a column on separating of drug

20 µL of IRB solution of 20 ppm concentration is injected separately in three columns C18 (L1), C- silica (L3), (L7) in the high-performance liquid chromatography apparatus and the response (peak area) is recorded for each column. The results are shown in Table 3 and Figure 1. The obtained results have affirmed the correctness of choosing the column L1 because the retention time is little (2.931), and the peak is sharp. The measurements are responses of peak areas compared with the responses of peak areas of the CRS (Chemical reference standard).

Selection of mobile phase

The effect of mobile phase ratio on the chromatogram and the retention time is studied by taking a various ratios of the mobile phases of dissolve 0.5 g of buffer potassium phosphate in 100 ml distilled water and adjust pH 2.7, methanol and acetonitrile at ratio (40 : 30 : 30). and the results are shown in Table 4 and Figures 2. Because of the appearance of a strong and obvious peak, small retention time.

The effect of wavelength (λ max)

20 µL of standard IRB solution is injected, and the response (peak area) is recorded at (200, 225, 240, 260) nm. It is found that the best peak is at 225nm, where a sharp peak and small retention time are obtained. This wavelength is therefore adopted in the next experiments and the results are shown in Figure 3.

Selection of Flow rate For mobile phase

20 µL aliquot of 20 ppm solution from the standard IRB is injected, and the mobile phase with a flow rate between

Mobile phase	*Dissolve 0.5 g of buffer potassium phosphate in 100 mL distilled water and adjust pH 2.7, methanol, and acetonitrile at ratio (40:30:30).*
Stationary phase =	C18- (L1)
Linear range µg /mL	10 - 50
Recovery	101
Correlation coffient	0.9999
ʎmax nm	225
Detection limit µg /mL	1.8×10^{-5}
Standar deviation	0.042
Flow rate ml / min	1.2
pH	7.2
Pharmaceutical formulation	Tablet, Syrup, Injection
Type of HPLC	RP - HPLC
Cegression line	Y = 3424 X + 4432.3
Retention time (min)	2.944

Table 2: Best analytical Parameters for determination drug

Drug	*SP*	*PE (mv)*	*PH (mv)*	*RT (min)*	*N*	*HETP*
DIH	L1	1346827	138211	2.944	554.69	0.27

SP = Stationary phase , PE = Peak area , PH = Peak height, mv = millivolt , RT = retention time , N = Number of theoretical plates, HETP = High Equivalent theoretical plates

Table 3: Choosing of the best column

Type of column	*Peak height (mv)*	*Peak area (mv)*	*Mobile phase*	*Retention time(min)*	*N.*	*HETP*	Comments
L1	138730	1386819	Buffer:Acetonitrile: methanol (40:30:30)	2.931	366.53	0.40	Sharp band , low HETP and good N
L3	184129	8828848	Buffer:Acetonitrile: methanol (40:30:30)	3.906	198.43	0.71	Deformed band , high HETP and low N
L7	87886	1373024	Buffer:Acetonitrile: methanol (40:30:30)	2.940	276.59	0.54	Sharp band , low HETP and low N

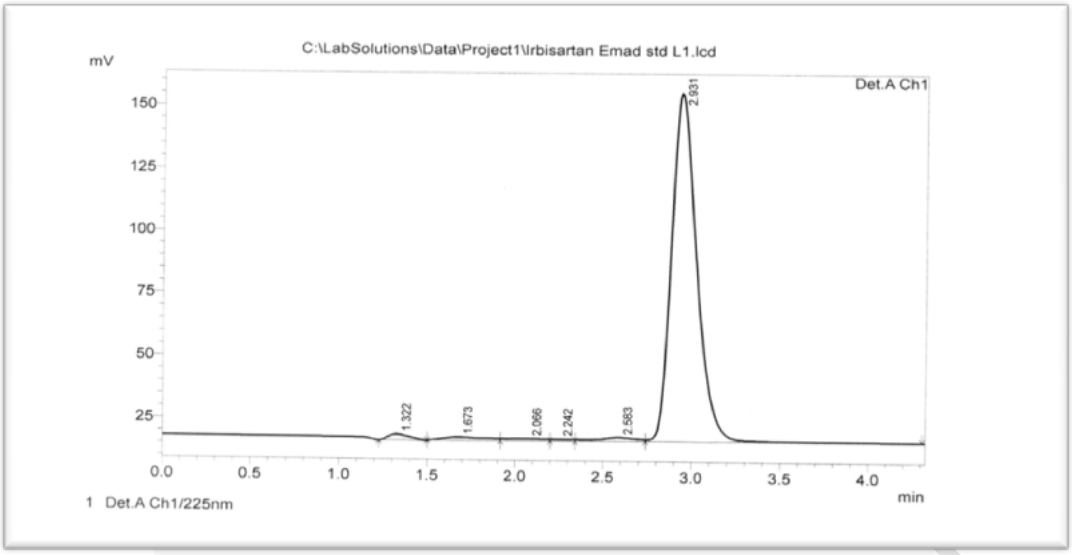


Figure 1: Chromatogram of 20 µL of 20 ppm IRB at wavelength 225 nm

Table 4: Selection of mobile phase

Mobile phase	*Peak height(mv)*	*Peak area(mv)*	*Retention time (min)*	*N.*	*H.E.T.P*	*Comment*
Buffer: methanol: ACN	159568	1411532	2.260	1307.54	0.115	Wideband, high HETP, and low N
Buffer: methanol: ACN	64315	1365262	6.245	9984.0	0.01	Wide band, R.T is large
Buffer: methanol: ACN	184801	1634624	2.728	1904.4	0.078	Telling band, R.T is large
Dissolve 0.5 g of buffer potassium phosphate in 100 ml distilled water and adjust pH 2.7, methanol and acetonitrile at ratio (40:30:30)	138420	1374334	2.910	2167.83	0.069	Sharp band, low HETP and good N.R.T is low

(0.7–1.7) mL. minute^{-1} at 220 nm is used. At the flow rate of indicating to good separation efficiency (1.2) ml. minute^{-1} at appearing the sharp peak, a small retention time. The flow rate of 1.2 ml.min^{-1} is chosen because of the small HETP and a high number of plates.

Preparation Calibration Curve for the drug

Different solutions (10–50) µg/mL were prepared from the stock solution 20 µL of the IRB was injected in HPLC using the ideal conditions the response was measured at 225 nm. The calibration Curve is showing in Figures 5 and 6.

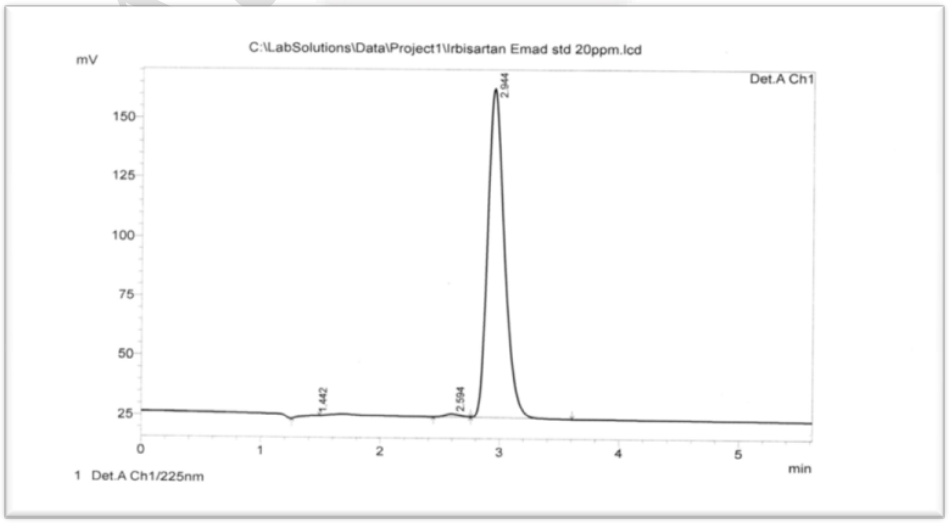


Figure 3: Chromatogram of 20 µL of 20 ppm IRB at wavelength 225 nm

The precision accuracy and the detection limit of each drug were measured and detected in Table 5.

Evaluation of the results

The FT.I.R. spectrum of the organic compound (Irbesartan) , The functional groups of it are :The band of(C=N-) stretching is observed at (735 cm^{-1}) . and the (-C=C-) of benzene aromatic rings is observed at (1625cm^{-1}), the carbonyl group of (lactam) tertiary amide (-C=O) is observed at (1750 cm^{-1}) as strong single band . The stretching of aliphatic (–C–H) is observed at (2825-2950 cm^{-1}) as double bands. The (-N-H) stretching observed at (3550cm^{-1}) as a weak band in Figure 7.[13] The results are evaluated by using test T. and F. Value for comparison between these methods for determination of drug and standard menthols used in British pharma Copeia B.P 2005. t-tests for these experiments is less than the tabular value at a reliable level of 95 %. F. Value for experiments is also less than turban value at a reliable level 95 %

Determination of drugs in its formulations.

Simultaneous high-performance liquid chromatography of Irbesartan in tablets 20 ppm[12]

Total 20 tablets are weighed, and then an accurately weighed equivalent 100 mg of each tablet of irbesartan add 80 mL of methanol alcohol, shake and sonicate for 15 minutes and complete the volume in the measuring flask to 100mL with methanol filter and by pipette 1 ml to 50 ml with methanol with the mobile phase. Using column type L_1 25 cm and a mobile phase consisting of buffer pH 3.2 (mix 5.5 mL of H_3PO_4 to 950 ml distilled water and adjust pH to 3.2 with Triethyleamine) and acetonitrile as the ratio (67:33) were used, and flow rate 1.5 $ml.min^{-1}$ and wavelength 220nm. The result (peak height) is compared with a standard curve with the same concentration. The recovery is calculated and found to be 101%. The chromatograms are shown in Figures 8 and 9.

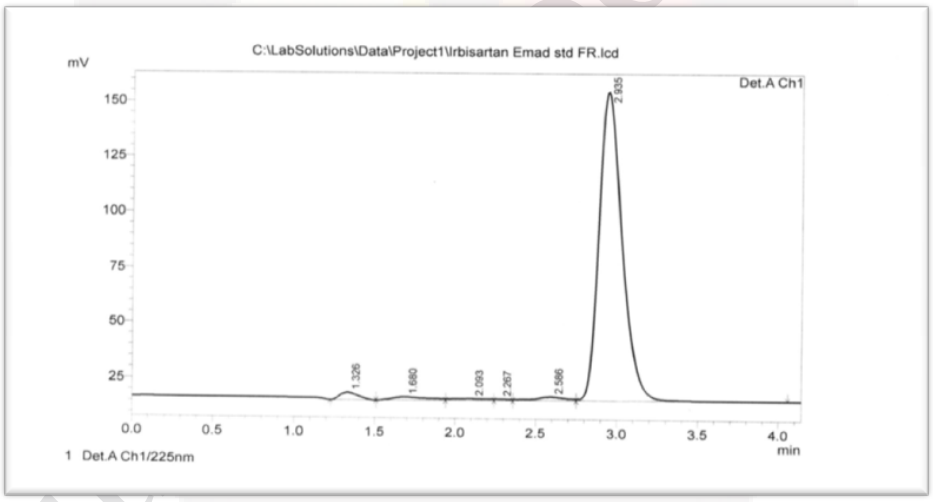


Figure 4: Chromatogram of 20 µL of 20 ppm IRB at wavelength 225 nm

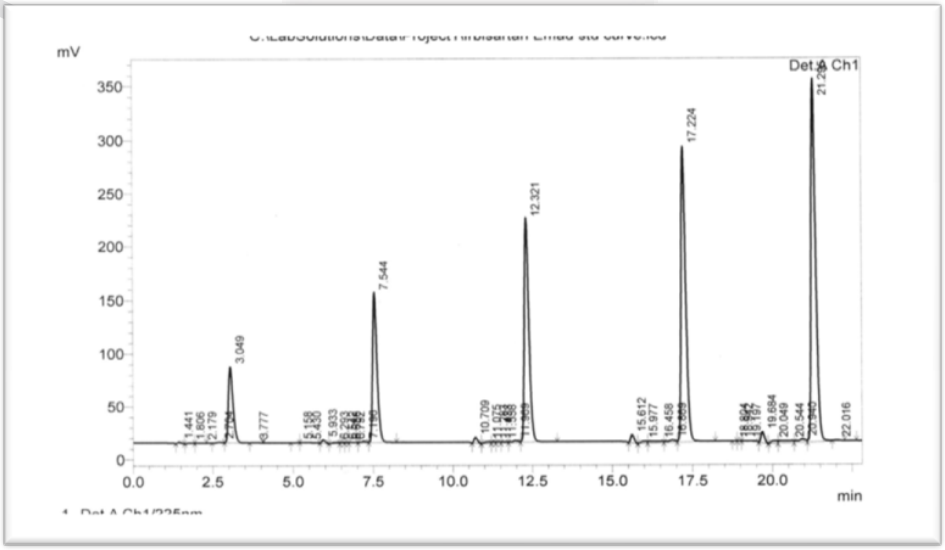


Figure 5: Chromatogram of 20 µL of IRB at wavelength 225 nm

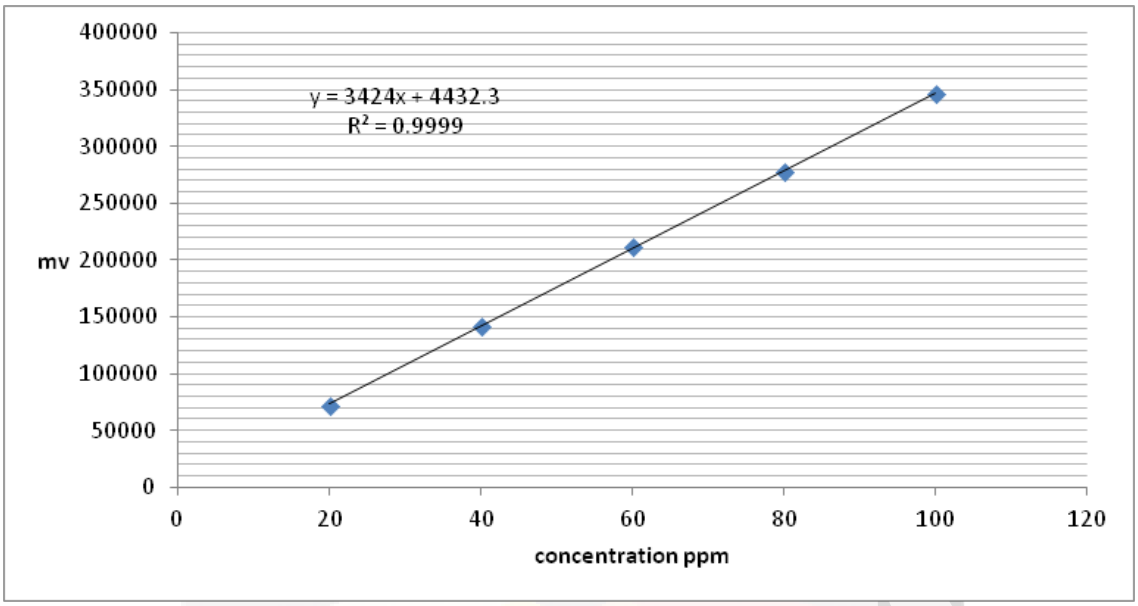


Figure 6: Calibration curve for the determination of IRB by a newly developed method

S. No	*Conc. Of drug (µg.ml^{-1})*	*Peak height (mv)*	*Peak area (mv)*	*Calculated concentration*	*Recovery.%*
1	20	148211	1346827	18.87	94.4
2	20	158133	1346543	20.13	100.7
3	20	159998	1400002	20.37	101.9
4	20	144765	1386351	18.43	92.2
5	20	151542	1390012	19.30	96.5

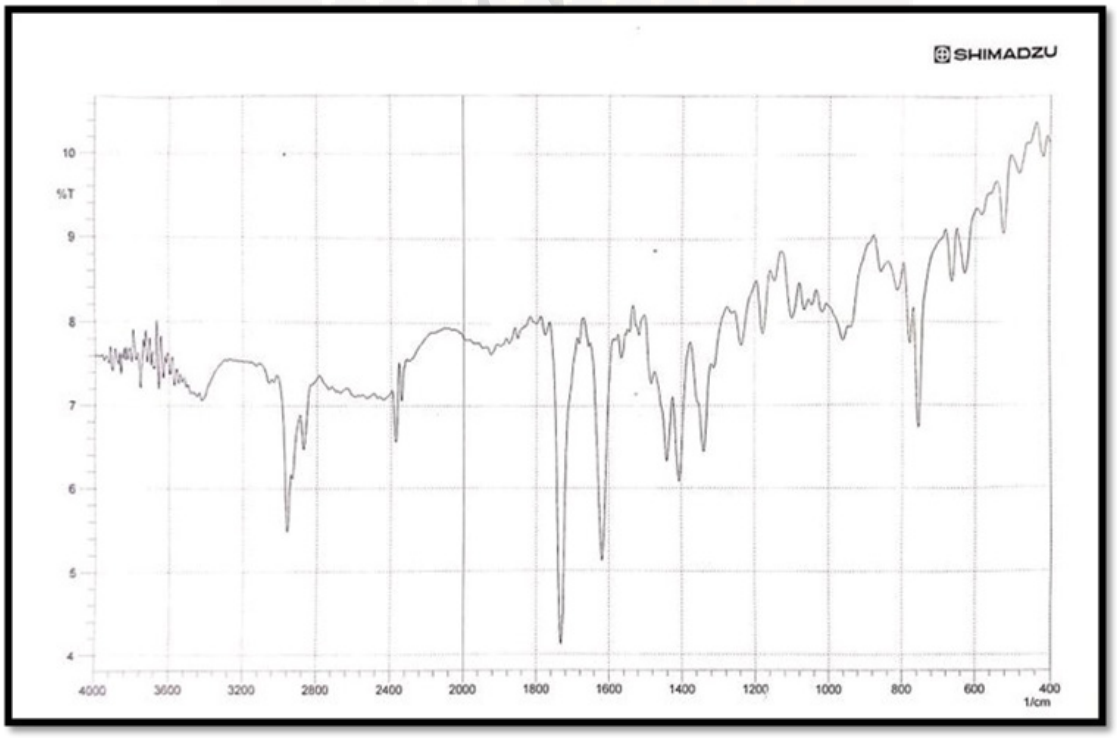


Figure 7: FT.I.R. Spectrum of Irbesartan

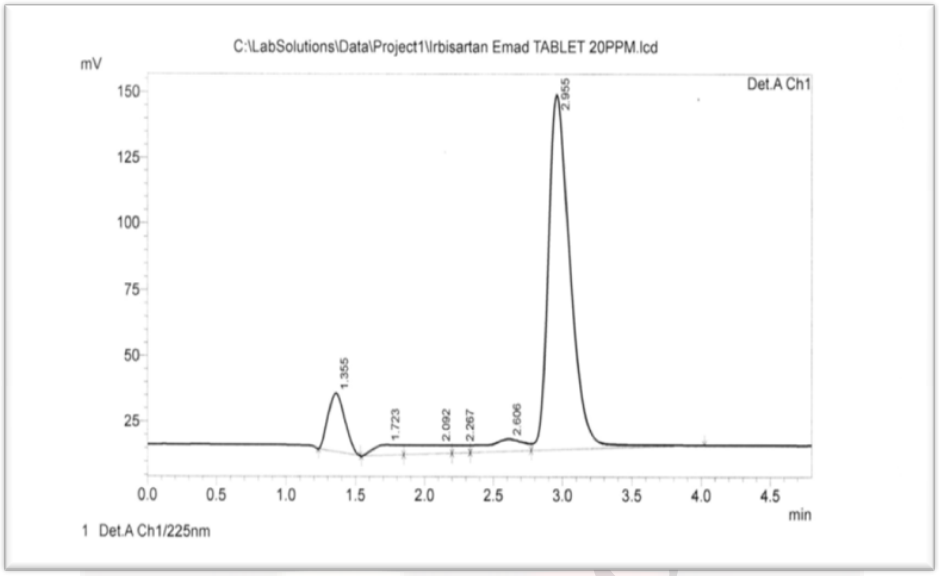


Figure 8: Chromatogram of 20 µl of IRB test at wavelength 220nm

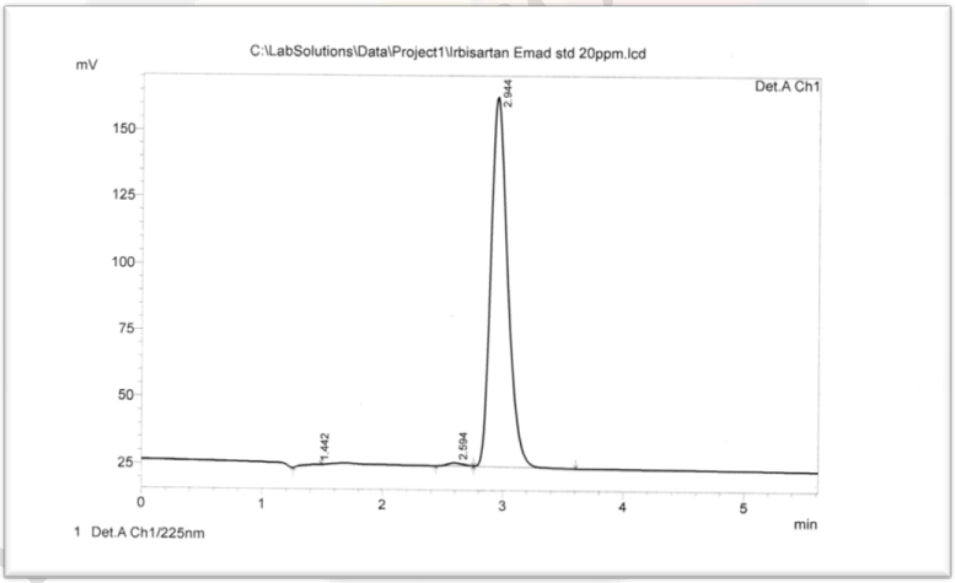


Figure 9: Chromatogram of 20 µL of IRB standard at wavelength 220 nm

REFERENCES

Lewis, EJ; Hunsicker, LG; Clarke, WR; Berl, T and Pohl, MA et al.(2001), "Collaborative Study Group: Renoprotective effect of the angiotensin-receptor antagonist irbesartan in patients with nephropathy due to type 2 diabetes", N Engl J Med, 345(12):851-860.

Rossi, S (2006), "Australian Medicines Handbook".

Massie, BM; Carson, PE; McMurray, JJ, and Komajda, M (2008), "Irbesartan in patients with heart failure and preserved ejection fraction", N. Engl. J. Med., 359(23).

http://www.medicinenet.com/irbesartan/artic le.htm

Suzanne, Oparil and Michael, A (2005), "Renal Out Come Trials", A Weber-2005, 384-872.

Jonathan, Upfal (2006), "The Australian Drug Guide", 372-832.

Aronson, JK (2009), "Irbesartan; Angiotensin II receptor antagonists", General Information, 121-829.

Bae, SK; Kim, MJ; Shim, EJ, and Shin, JG (2009), "HPLC determination of Irbesartan in human plasma: its application to pharmacokinetic studies", Biomedical Chromatography, 23(6):568-572.

Lewis E.J., Collaborative Study Group: Renoprotective effect of the angiotensin-receptor antagonist Irbesartan in patients with nephropathy due to type 2 diabetes, N. Engl. J. Med., 2001;345: 851-860.

Rossi S., "Australian Medicines Handbook" (2011).

Massie B. M., Irbesartan in patients with heart failure and preserved ejection fraction, N. Engl. J. Med., (2008) 359.

"U.S.Pharmacopeia on CD-ROM",30th Ed.NF25,by system simulation ltd. The stationary office, America, 3071,(2007).

M.Silverstein, D.C.Bassler, and T.C. Morrsti spectrometric identification of organic compound 4th ed John Wiley and sons New York (1981).

دراسة طيفية تحليلية الية استخدم فيها طيف الاشعة تحت الحمراء وطريقة كروماتوغرافيا السائل عالي الاداء كدراسة مشتركة لأثبات تركيب وتقدير كمية المركب العضوي (اربيسارتان) كعقار دوائي على شكل اقراص متعددة المكونات

عماد طارق حنون, عبد محمد الظاهر حسن الجبوري

جامعة سامراء , كلية العلوم التطبيقية , سامراء , العراق

جامعة تكريت , كلية الصيدلة , تكريت , العراق

الخلاصة

تم تطوير طريقة جديدة لتقدير دواء اربيسارتان في المستحضرات الصيدلانية حبوب مستخدما عمود فصل من نوع L_1 عند درجة حرارة 30 درجة مئوية وكاشف الاشعة فوق البنفسجية 225 نانوميتر وطور متحرك مكون من اذابة 0.5 غم من بفر فوسفات البوتاسيوم احادي القاعدة في 100 مل ماء خالي من الاملاح وتكملة الحجم الى العلامة مع معادلة الحامضية عند دالة حامضية 2.7ناخذ منه 40 مل مع 30 مل ميثانول و 30 مل من الاسيتونتريل . وكانت سرعة الجريان 1.2 مل/ دقيقة ودالة حامضية 2.7 للطور المتحرك وكانت نسب الاستعادية للدواء 101% كما تم تعزيز طريقة الكروماتوغرافيا من استخدام طريقة التحليل العضوي بواسطة طيف اشعة (FT.I.R.) لاثبات التركيب الكيميائي وبعض الخواص الفيزيائية للمركب العضوي اعلاه فكانت النتائج مطابقة لما موجود في الادبيات . حيث تم تقدير الدواء بنجاح في هذين الطريقتين .