Journal of Natural Sciences Research
ISSN 2224-3186 (Paper) ISSN 2225-0921 (Online)
Vol.4, No.24, 2014
www.iiste.org

COMPARATIVE QUANTITATIVE STUDY OF DIFFERENT BRANDS OFAMOXICILLIN (500mg) TABLET MARKETED IN MAIDUGURI METROPOLIS, NIGERIA

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Abstract

The study involves comparative quantitative study of eight (8) different brands of Amoxicillin, using UV Spectrophotometry and High Performance Liquid Chromatography. All the samples of Amoxicillin tested using UV analysis failed the test as all are above the specified range of 90-120% as stated by USP, 2007. Using the HPLC analysis, only 3 of the Amoxicillin samples passed the test, Healmox (108.3%), Barbimox (117.5%) and Cimoxil (114.98%) while Nemoxil, Amox 500, Cikamox, Climox and Lamox failed the test with 47.17%, 39.7%, 139.4%, 139.4%, and 74.5% respectively using the standard of 90-120% as specified by USP, 2007.

KEYWORDS: Amoxicillin, UV, HPLC

1. Introduction

The proliferation of substandard and adulterated pharmaceutical products is a global phenomenon which has been of great concern to many countries including Nigeria (Clark, 2002). It was not long ago that the World Health Organisation (WHO) rose to the challenge of recommending that all importing countries should protect themselves from this menace by under taking sampling products within the distribution network as an important element in Quality surveillance (WHO, 1988).

1.1 Amoxicillin

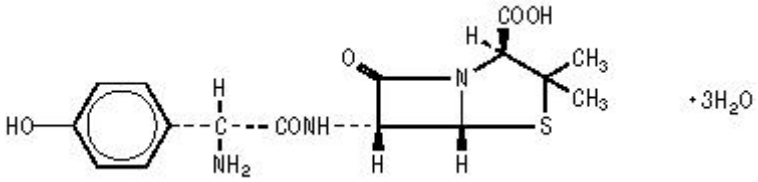
Amoxicillin is one of several semi-synthetic derivatives of 6-aminopenicillanic acid (6-APA) developed at Beecham in the 1960s. It became available in 1972, and was the second aminopenicillin to reach the market (after ampicillin in 1961). Co-amoxiclav became available in 1981 (Raviña E, 2011)

Simar Preet Kaur *et al* (2011) carried out a work on Amoxil as a broad spectrum antibiotic and demonstrated that Amoxicillin has been found to be more effective against gram positive than gram negative microorganisms and demonstrated greater efficacy to penicillin and penicillin V. Moreover, it has been found comparable to other antibiotics, e.g. Ampicillin, Azithromycin, Clarithromycin, Cefuroxime and Doxycycline in treatment of various infections/ diseases. In the past decade, amoxicillin has been reported to be useful in the management of many indications and is used to treat infections of the middle ear (otitis media), tonsils

(Inga Odenholt, 2004) carried out a work to compare the pharmacodynamic effects of a pharmacokinetically enhanced formulation of amoxicillin 2000mg twice daily, with amoxicillin 875mg twice daily, 875mg three times daily and 500mg three times daily against Streptococcus pneumoniae with different susceptibility to amoxicillin in an in vitro kinetic model the strains with an MIC of 1 or 2 mg/L were eradicated at 24 h when the kinetics of the enhanced formulation were simulated. All the other regimens showed a static effect or a slight regrowth (875 mg twice daily) against these strains. Also for the strain with an MIC of 4 mg/L, the enhanced formulation was more effective than the other regimens and resulted in no detectable bacteria after 7 h although regrowth occurred at 24 h. For the strain with the highest MIC (8 mg/L), regrowth was noted for all regimens at that time. However, even for this strain, a substantial initial kill was obtained after both doses of the enhanced formulation. These findings are in accordance with an earlier study with the enhanced formulation of amoxicillin in the same in vitro kinetic model, where standard dosage regimens of amoxicillin gave inferior results in comparison with the enhanced formulation against Haemophilus influenza. (Manimaran, 2010)

1.2 Structure

Chemically, it is (2S,5R,6R)-6-[(R)-(-)-2-amino-2-(p-hydroxyphenyl)acetamido]-3,3-dimethyl-7-oxo-4-thia-1-azabicyclo[3.2.0]heptane-2-carboxylic acid trihydrate. It may be represented structurally as:



The amoxicillin molecular formula is $C_{16}H_{19}N_3O_5S \cdot 3H_2O$, and the molecular weight is 419.45.

2. Materials and Method

Eight (8) different brands of Amoxicillin were used for the study

Pure sample of the drugs were obtained from NAFDAC which serve as standard

Writing and labeling materials, Measuring cylinder, Beakers, 1000ml volumetric flask, 100ml volumetric flask, 50ml volumetric flask, Sonicator, Filter paper, Spatula, High performance liquid chromatography set up, UV Visible spectrophotometer (Beckman), Analytical weighing balance, Pestle and mortar, Distilled water

All reagents used were obtained from NAFDAC office, Maiduguri (Sani et al, 2012)1

2.1 Practical Method

The methods employed for the purpose of this study are the UV visible spectrophotometer and high performance liquid chromatographic methods. (Sani et al, 2012)2

2.2 UV Procedure for Amoxicillin (USP, 2007)

The tablets were assayed spectrophotometrically using the following procedures

- The average weight of the tablets from each sample was determined by weighing ten(10) tablets and dividing the results gotten by eight to obtain the average weight
- From the value gotten the equivalent weight of each brand was weighed accurately and transferred into 25ml volumetric flasks. All the eight samples were labelled using pen and masking tape.
- To each volumetric flask, 15ml of 0.001M HCl was poured and sonicated for few minutes to dissolve the drug molecule and made up to 25ml with the same solvent
- The mixture in each flask was mixed well and filtered through a filter paper into clean beakers.
- The UV spectrophotometer was put at zero by running a base line (200-400) using 0.001M HCl solution as blank.
- The absorbance of each sample was determined at the peak wavelength by putting small amount of the sample into a cuvette, and the cuvette was put back into the machine.
- The same procedure was repeated for the standard using 500mg of the powdered standard and the absorbance determined and from which the % content and mg content was determined as:

$$\% \text{ content} = \frac{\text{Absorbance of sample x 100}}{\text{Absorbance of standard}}$$

$$\text{Mg content} = \frac{\% \text{ content x Manufactures claim}}{100}$$

2.3 HPLC Procedure for Amoxicillin (USP, 2007)

Diluents – Dissolve 13.6g of monobasic potassium phosphate in 2000ml of water and adjust with a 45% (w/w) solution of potassium hydroxide to a PH of 5.0 $\pm$ 0.1

Mobile phase – prepare a suitable mixture of diluents and acetonitrile (96:4). Make adjustments if necessary. Decrease the acetonitrle concentration to increase retention time of amoxicillin

Standards' preparation – Quantitatively dissolve an accurate weighed quantity of USP amoxicillin s in diluents to obtain a solution having a known concentration of about 1.2g per ml. use this solution within 6hours

Assay Preparation – transfer about 240mg of Amoxicillin accurately weighed to a 200ml volumetric flask, dissolve in and dilute with diluents to volume and mix. Use this solution within 6 hours

Chromatographic System – The liquid chromatography is equipped with a 230nm detector and a 4mm x 25cm column that contains packing L1 and standard preparation and record the peak response as directed for procedure. The capacity factor K is between 1.1 and 2.8, the column efficiency is not less than 1700 theoretical plates, the failing factor is not more than 2.5 and the relative standard deviation for the replicate inventory is not more than 2.03

Procedure – separately inject equal volumes (about 10µl) of the standards preparation and the assay preparation into the chromatograph, record the chromatograms and measure the response for the major peaks. Amoxicillin Rs in the standard preparation P is the stated amoxicillin content in µg per mg (Sani et al, 2012)3

3. Results

Table :1 name and code for the samples

Brand Name	Brand Code
Healmox	L
Climox	M
Barbimox	N
Cimoxil	O
Lamox	P
Nemoxil	I
Amox 500	J
Cikamox	K

The data below show the result of UV spectrophotometer which is used to calculate the percentage and milligram content of the following drugs.

The results are as follows:

3.1 UV FOR AMOXICILLIN

I

%content = $\frac{225.87}{160.50}$ x 100 = 140.7%

Mg content = $\frac{140.7}{100}$ x 500 = 703.5mg

J

%content = $\frac{247.28}{160.50}$ x 100 = 154.1%

Mg content = $\frac{154.1}{100}$ x 500 = 770.5mg

K

%content = $\frac{344.06}{160.50}$ x 100 = 214.4%

Mg content = $\frac{214.4}{100}$ x 500 = 1072mg

L

%content = $\frac{336.64}{160.50}$ x 100 = 240.9%

Mg content = $\frac{240.9}{100}$ x 500 = 1204.5mg

M

%content = $\frac{370.72}{160.50}$ x 100 = 212.3%

Mg content = 212.3 x 500 = 1061.5mg
100

N

%content = 319.64 x 100 = 199.2%
160.50

Mg content = 199.2 x 500 = 996mg
100

O

%content = 319.38 x 100 = 198.9%
160.50

Mg content = 198.9 x 500 = 994.5mg
100

P

%content = 327.63 x 100 = 204.1%
160.50

Mg content = 204.1 x 500 = 1020.5mg
100

Table 2: percentage content and mg content of amoxicillin (500mg)

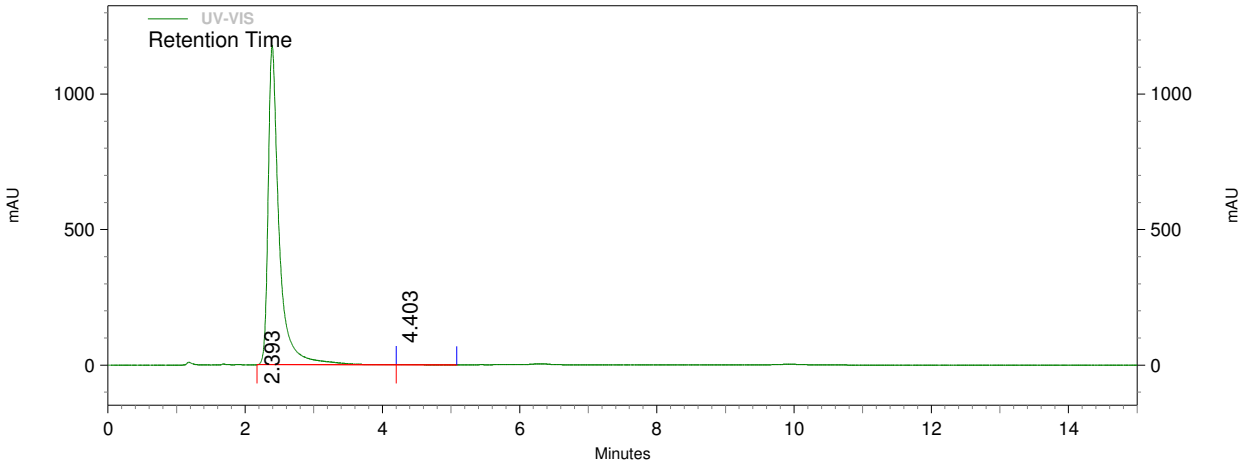
Sample	%content	mg content
I	140.7	703.5
J	154.1	770.5
K	214.4	1072
L	240.9	1204.5
M	212.37	1061.5
N	199.2	996
O	198.9	994.5
P	204	10250

3.2 HPLC for Amoxicilline

Figure 1:

Analyst: manager

Sample ID: AMOXICILLIN STD 110413 **Vial: 200** **Injection Volume: 20**



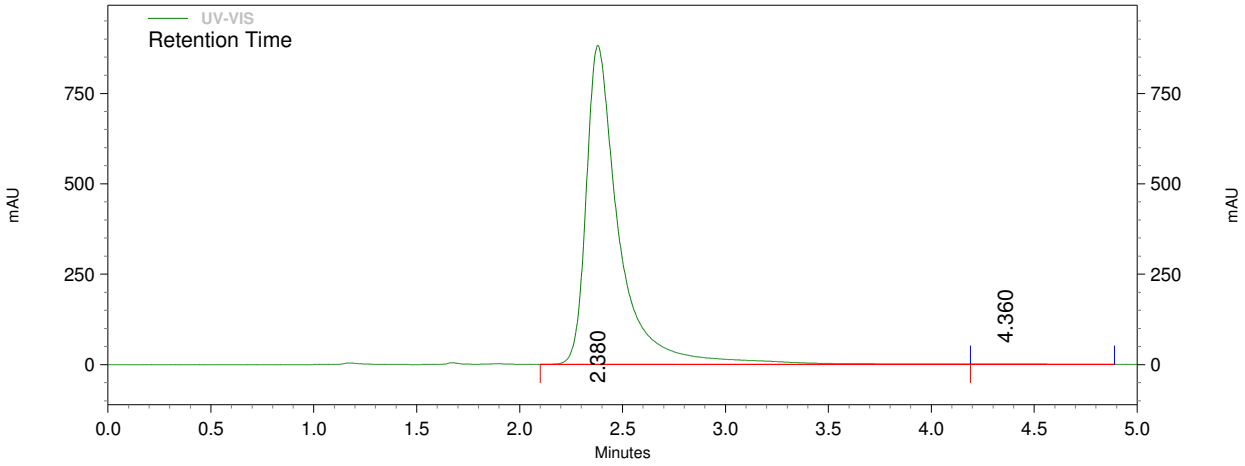
UV-VIS Results

Name	Retention Time	Area	Area Percent	Integration Codes
	2.393	52548746	99.853	IV
	4.403	77123	0.147	VI
Totals		52625869	100.000	

Figure 2:

Analyst: manager

Sample ID: P 110413 **Vial: 180** **Injection Volume: 20**



UV-VIS Results

Name	Retention Time	Area	Area Percent	Integration Codes
	2.380	39184524	99.897	IV
	4.360	40246	0.103	VB
Totals		39224770	100.000	

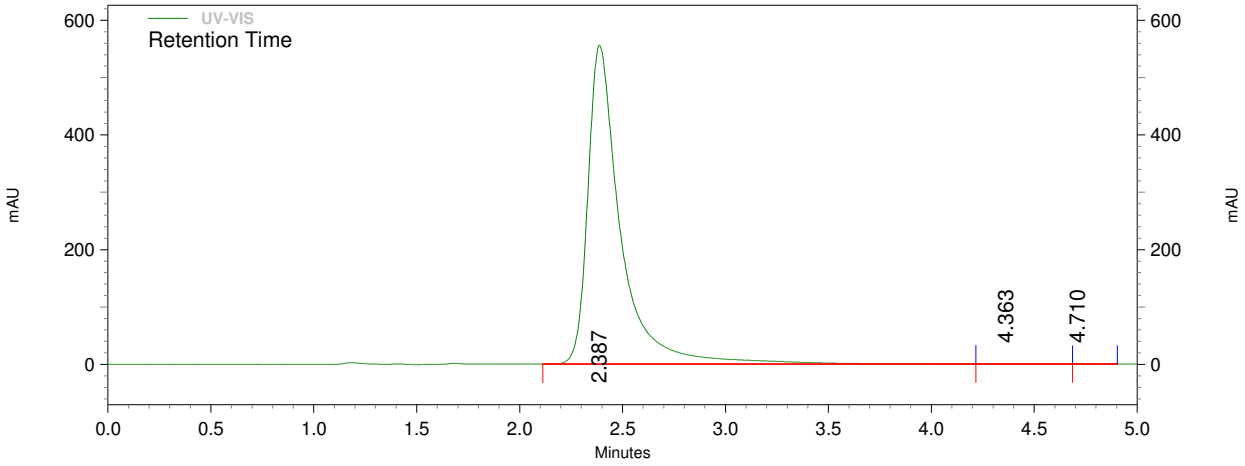
% content = 39184524 x 100 = 74.57%
52548746

Mg content = 74.57 x 500 = 372.85mg
100

Figure 3:

Analyst: manager

Sample ID: I 110413 **Vial: 190** **Injection Volume: 20**



UV-VIS Results

Name	Retention Time	Area	Area Percent	Integration Codes
	2.387	24786855	99.893	IV
	4.363	25039	0.101	VV
	4.710	1398	0.006	VB
Totals		24813292	100.000	

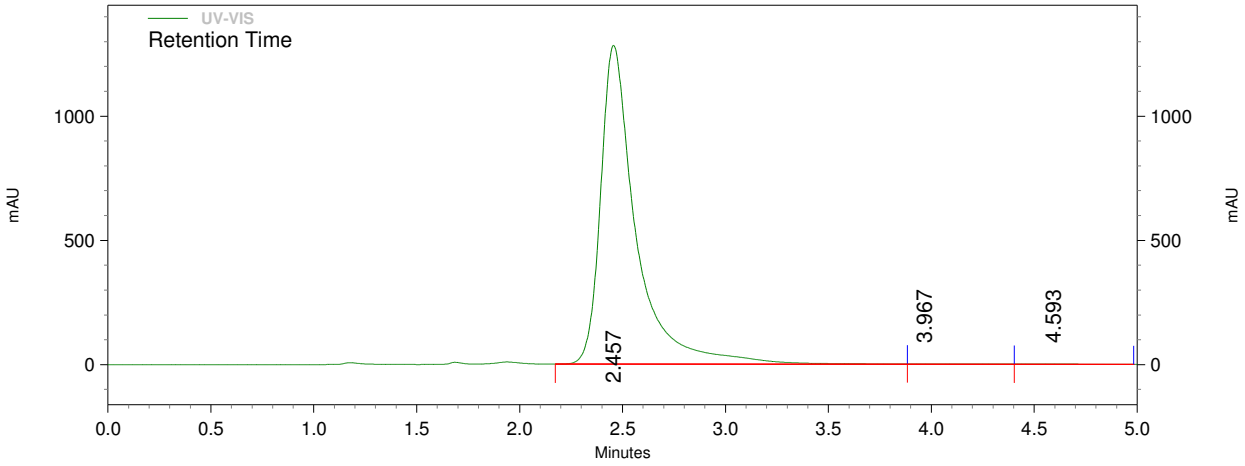
% content = 24786855 x 100 = 47.17%
52548746

Mg content = 47.17 x 500 = 235.85mg
100

Figure 4:

Analyst: manager

Sample ID: N 120413 **Vial: 120** **Injection Volume: 20**



UV-VIS Results

Name	Retention Time	Area	Area Percent	Integration Codes
	2.457	61745084	99.804	IV
	3.967	85156	0.138	VV
	4.593	36326	0.059	VE
Totals		61866566	100.000	

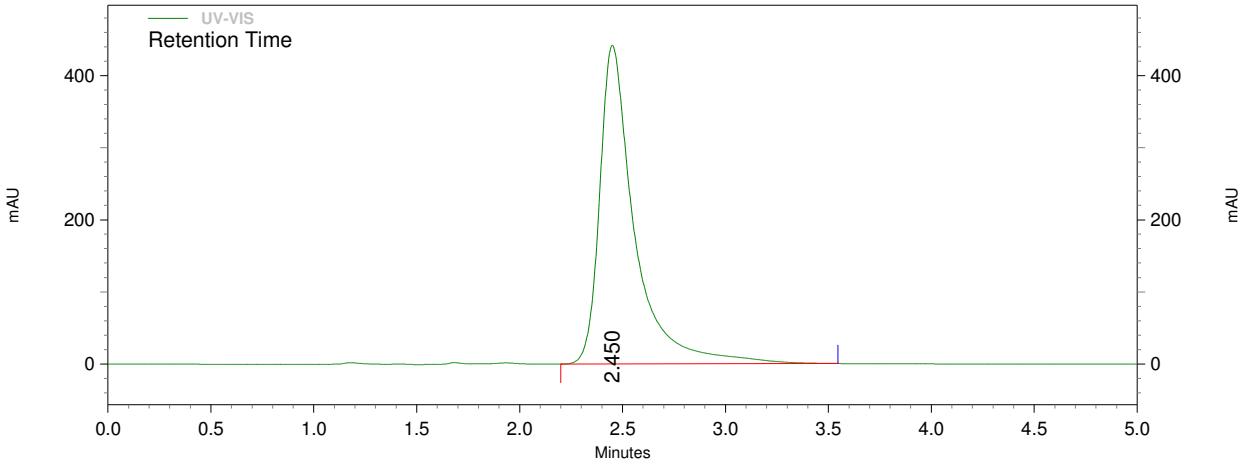
% content = 61745084 x 100 = 117.5%
52548746

Mg content = 117.5 x 500 = 587.5mg
100

Figure 5:

Analyst: manager

Sample ID: J 120413 **Vial: 150** **Injection Volume: 20**



UV-VIS Results

Name	Retention Time	Area	Area Percent	Integration Codes
	2.450	20912659	100.000	II

Totals		20912659	100.000	

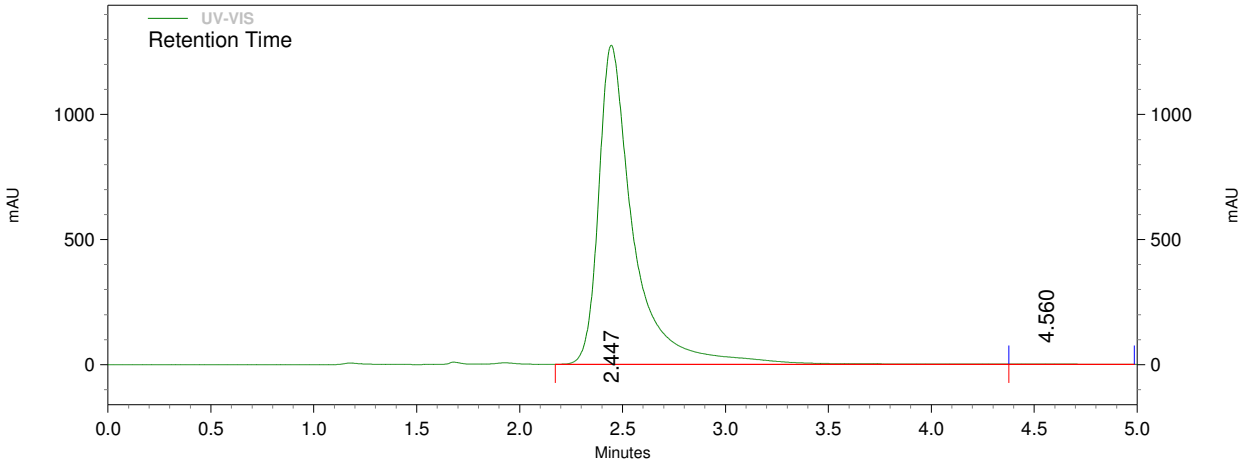
% content = 20912659 x 100 = 39.79%
52548746

Mg content = 39.79 x 500 = 198.95mg
100

Figure 6:

Analyst: manager

Sample ID: O 120413 **Vial: 170** **Injection Volume: 20**



UV-VIS Results

Name	Retention Time	Area	Area Percent	Integration Codes
	2.447	60420081	99.916	IV
	4.560	50571	0.084	VE
Totals		60470652	100.000	

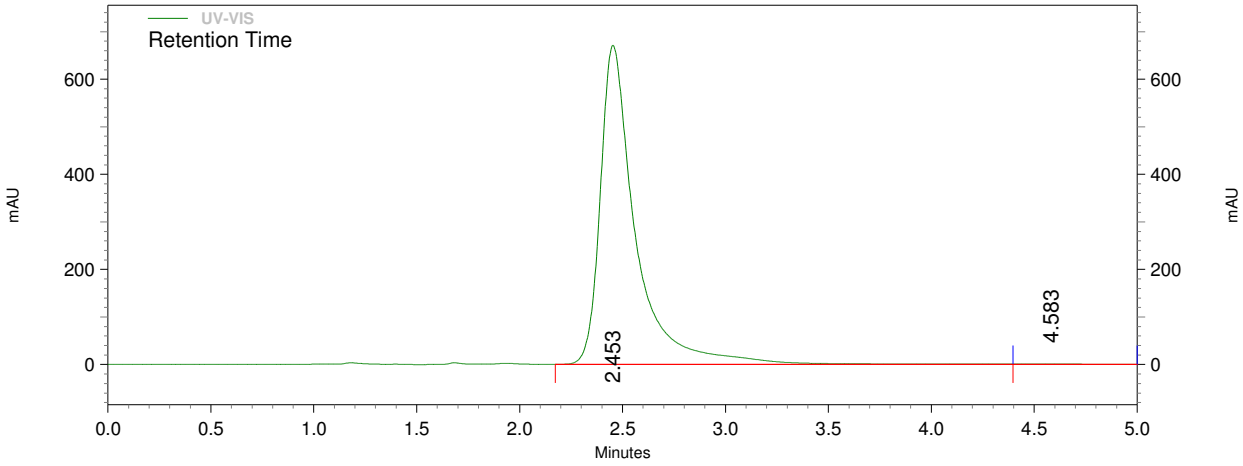
% content = 60420081 x 100 = 114.98%
52548746

Mg content = 114.98 x 500 = 574.9mg
100

Figure 7:

Analyst: manager

Sample ID: K 120413 **Vial: 140** **Injection Volume: 20**



UV-VIS Results

Name	Retention Time	Area	Area Percent	Integration Codes
	2.453	32113216	99.924	IV
	4.583	24544	0.076	VE

Totals		32137760	100.000	

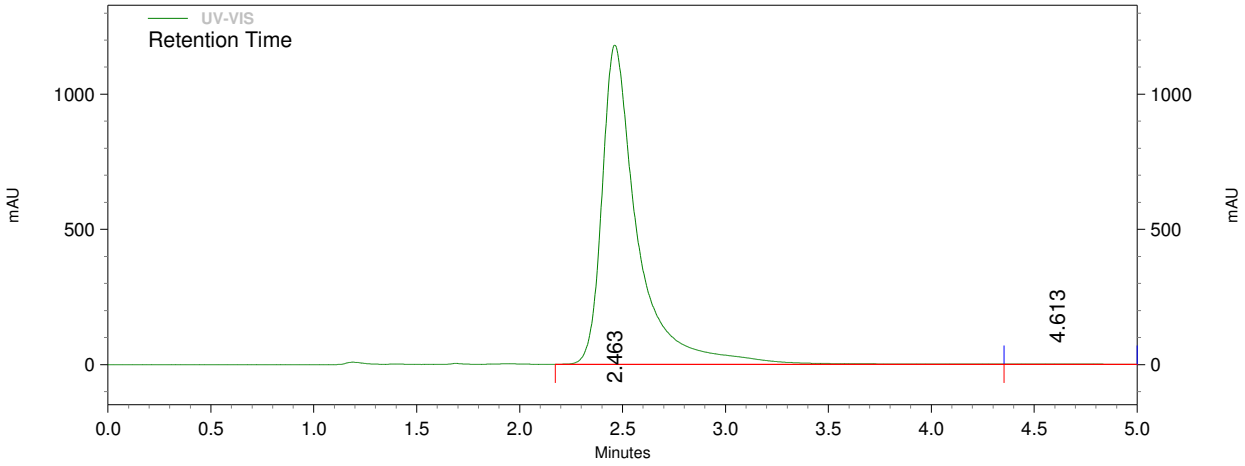
% content = 32113216 x 100 = 61%
52548746

Mg content = 61 x 500 = 305mg
100

Figure 8:

Analyst: manager

Sample ID: L 120413 **Vial: 130** **Injection Volume: 20**



UV-VIS Results

Name	Retention Time	Area	Area Percent	Integration Codes
	2.463	56901408	99.858	IV
	4.613	80775	0.142	VE

Totals		56982183	100.000	

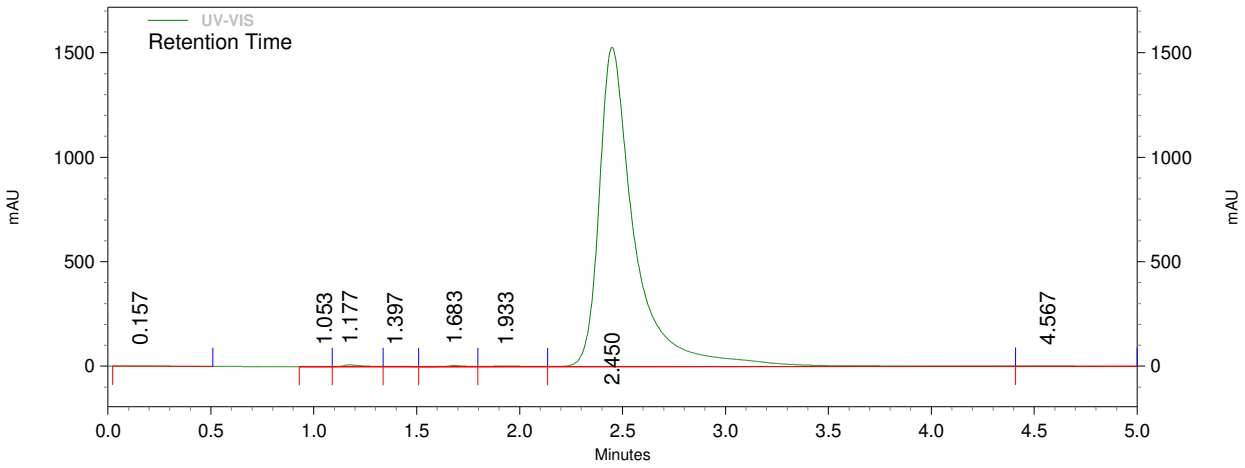
% content = 56901408 x 100 = 108.28%
52548746

Mg content = 108.28 x 500 = 541.4mg
100

Figure 9:

Analyst: manager

Sample ID: M 120413 **Vial: 160** **Injection Volume: 20**



UV-VIS Results

Name	Retention Time	Area	Area Percent	Integration Codes
	0.157	54210	0.073	BB
	1.053	2341	0.003	BV
	1.177	192729	0.261	VV
	1.397	27128	0.037	VB
	1.683	110458	0.150	BV
	1.933	129313	0.175	VV
	2.450	73262004	99.191	VV
	4.567	81262	0.110	VE
Totals		73859445	100.000	

% content = $\frac{73262004}{52548746}$ x 100 = 139.4%

Mg content = $\frac{74.57}{100}$ x 500 = 697mg

Table3: percentage content and mg content of amoxicillin 500mg using hplc analysis.

Sample	%content	mg content
I	47.17	235.85
J	39.79	198.95
K	61	305
L	108.28	541.4
M	139.4	697
N	117.5	587.5
O	114.98	574.9
P	74.57	372.85

4. Discussion

As stated by united state pharmacopoeia (USP 2007 VOLUME II), an amoxicillin capsule should contain not less than 90% and not more 120% of labeled amount of amoxicillin.

The standard amoxicillin capsule has an absorbance of 160.5.from the results obtained using UV spectrophotometer I with percentage content of 140.7%, J 154.1, K 214.4, L 240.9%, M 272.3%, N 199.2%, O 198.9% and P 204.1%. Many fell above the range specified by the U.S Pharmacopoeia.

For Amoxicillin, the percentage content of L is 108.3%, O 114.98% and N 117.5% are the only samples that passed as compared to the specified limit in the USP, I 47.17%, J 39.7%,K 139.4%, , and P 74.5% failed because they contain above or below the specified limit by the USP.

5. Conclusion

It can be concluded that in the analysis of amoxicillin using HPLC, only three (3) samples passed because they are within the specified limit as laid down by B.P and 6 samples failed. Using UV spectrophotometry, all the samples failed.

6. Recommendation

When a drug taken does not contain the specified amount of active principle, and due to the great association between dose and response, the response may not be obtained which may require increase or decrease in dose.

Considering the toxic effect of amoxicillin, it should be recommended that each batch of the tablet or capsules produced by every company undergoes quantitative assay, to ensure that they contain the right amount of the active principle as specified by the official books.

References

British Pharmacopoeia (2008). Volume 111, Her Majesty Stationary Office, London. pp 2525, 2781, 3013

Clarke S. (2002). A case study and report presented at the global forum on Pharmaceutical counterfeiting held in Geneva.

Manimaran, V., Mothilal, M., Damodharan, K. and Ruby, M.C. (2010) Enhancemnt of dissolution rate of glibenclamide by solid dispersion technology. International Journal of Current Pharmaceutical Research. 2(3): 14-17

Odenholt I., Cars O., and Lowdin E. (2004) Pharmacodynamic studies of amoxicillin against *Streptococcus pneumoniae*: Comparison of a new pharmacokinectically enhance formulation 2000mg twice daily with standard regimens. Journal of Antimicrobial Chemotherapy 54(6): 1062- 1066.

Ravina, E., (2011). The Evolution of Drug Discovery. Weinheim: Wiley-VCH. p. 262

Sani Ali. Audu, Alemika Emmanuel. Taiwo, Usman Kauna, Sani Musa,and Ilyas Mohammed (2012)1: Comparative Study Of High Performance Liquid Chromatography And Ultraviolet Spectrophotometry Methods

On Different Brands Of Metronidazole Tablets Marketed In Maiduguri Metropolitan Council Of Borno State, International research Journal of Pharmacy; 3, 8, Pp 157-164

Sani Ali. Audu, Alemika Emmanuel. Taiwo, Khalil Osedinese Saidu, Sani Musa, Abdulraheem Rafat. Ojuolape, Abdulkareem Sikirat. Sani, Abdulraheem Ramat Bukola. and IlyasMohammed (2012)2: Quantitative Analysis Of Ten (10) Different Brands Of Chlorpheniramine Tablet Marketed In Maiduguri Metropolitan Council (MMC), Journal of Chemical and Pharmaceutical Research ; 4, 7, Pp 3637-3650

Sani Ali Audu, Alemika Emmanuel Taiwo, Fatima Ibrahim Waziri, Abdulraheem Rafat Ojuolape, Abdulkareem Sikira Sani, Abdulraheem Ramat Bukola, and Ilyas Mohammed (2012)3: Comparative Evaluation Study on Different Brands of Lisinopril Tablet Using HPLC and UV Spectrophotometer, Journal of Natural Sciences Research 2, 7, Pp 18-25

Simar, P.K., Rekha, R., and Sanju, N., (2011). Amoxicillin: A broad spectrum antibiotics. International Journal of Pharmacy and Pharmaceutical Science. 3(3): 30-37

(USP, 2007) http://www.usp.org/azindex

World Health Organisation (1988). World Health Assembly Resolution entiltled “Rational use of drugs” WHA 41.16.