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RESEARCH ARTICLE

QUALITYCONTROL OF CLOXACILLIN SOLD IN NIAMEY CITY BYTHIN LAYER CHROMATOGRAPHY

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Abstract

The objective of this study is to control the quality by Thin Layer ChromatographyCloxacillin used in Niamey cityafter carrying out a prospective survey on antibiotics commonly used in health centers and at the same time purchased from street vendors. This quality control aimed to investigate on eleven samples distributed as following as: five samples are from pharmacies; five samples are from street vendors and one sample is the specialty which is used as reference to check their active ingredient. The different reagents used in this research are: Hydrochloric acid (HCl) 37 %, acetone, distilled water, ethyl acetate and acetic acid. All samples migrated in proposed diluent. This shows that all samples contain the active ingredient substance of cloxacillin. The percentage of the active ingredient were calculated as per protocol of Clarke's analysis of drugs and poisons in chemistry guidelines. It varies from 96.87 to 97.91for the pharmacies and 97.91 to 104.17for the street vendors. According to the results of the different frontal reportspercentage, all of themmeet the standards required by the WHO which is 90 to 110 %. This technique can be used for practical work or tutorial and laboratories where drug quality control mechanism is not often checked.

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Introduction:-

The fraudulent sale of drugs in the informal sector, called street drugs, has become a public health problem worldwide, and more particularly in sub-Saharan Africa, including Niger **[1 -7]**. The informal drug network experienced a boom in Niger with the advent of a multiparty system from 1991 and the lifting of the ONPPC (National Office of chemical and pharmaceutical products) monopoly in 1997 **[8 - 9]**. Despite the existence of legislation which specifies the pharmacist's monopoly in the field of drugs, the illicit drug distribution circuit has developed in a diffuse way in all the regions of Niger, by the proliferation of a multitude of street vendors, most often from unemployed youth. The omnipresence of this informal market is a real health problem in Niger **[10, 11]**.Cloxacillin(figure 1) is an antibiotic which is part of the family of beta lactams, of the group of penams and of

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the subgroup of Penicillin M.This family is particularly effective against staphylococci, germs capable of inactivating simple penicillin.It is used in the treatment of skin infections caused by staphylococci or streptococci. Its chemical formula is $C_{19}H_{18}ClN_3O_5S$ and its molecular weight is 435.9**[12 - 14]**.

There is cloxacillin Sodium which chemical formula $C_{19}H_{17}ClN_3NaO_5S$, H_2O and molecular weight of475.9. Its IUPAC Name is (2S,5R,6R)-6-[[[3-(2-Chlorophenyl)-5-methyl-4-isoxazolyl] carbonyl]-amino]-3,3-dimethyl-7-oxo-4-thia-1-azabicyclo [3.2.0] heptane-2-carboxylic acid. Its chemical properties: A white, hygroscopic, crystalline powder. Its melting point is 170° with decomposition. Its ready soluble in water and aqueous acid, slyly in ethanol, and poorly soluble in chloroform. Soluble in pyridine and ethylene glycol**[14].**

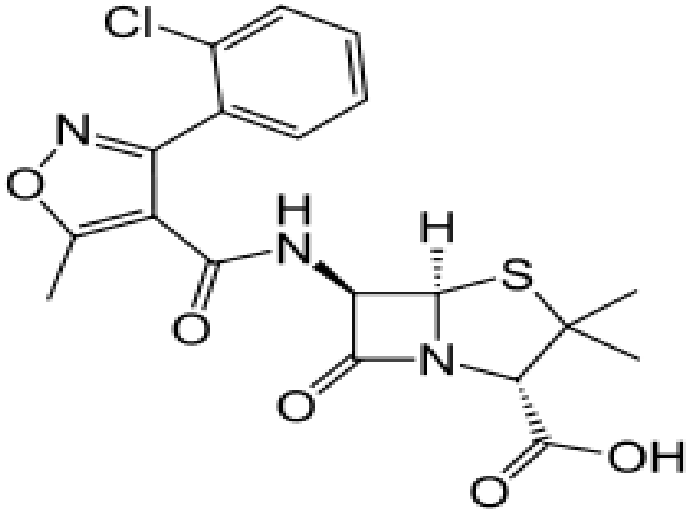

Figure 1:- Chemical structure of Cloxacillin**[12].**

Material and Method:-

Severaldrugs detection methods are used including thin layer chromatography**[15 - 19]**. This study was carried out using a survey sheet containing a few questions and a camera allowing the TLC of the different samples to be photographed [**15, 17].**

Population

The population is represented by the antibiotics (from pharmacies and street vendors) most commonly sold in the Urban Community of Niamey and used in hospitals and health centers (Niamey National Hospital, Amirou Garga Hospital of Lamordé, Poudrière regional Hospital Center and Maternity Issaka Gazobi) **[20 to 23].**

Sampling and Size

Our sample is represented by three (3) types of antibiotics of Amoxicillin, namely:

1. Reference antibiotic;
2. The antibiotics most commonly used in health centers (HNN, HNL, CHR and MIG) sold in pharmacies;
3. Antibiotics sold by itinerants.

Thus, our study extended on the size of eleven (11) samples distributed as follows:

1. 5 samples for pharmacies;
2. 5 samples for street vendors;
3. 1 sample specialty used as reference for the molecules to be analyzed.

Reagents used for Thin Layer Chromatography (TLC) of cloxacillin

The different reagent which have been used for the cloxacillin's TLC are: Hydrochloric acid (HCl) 37 %, acetone, distilled water, ethyl acetate and acetic acid**[19].**

Methodology:-

Before proceeding to the actual operating mode, we made a preliminary test as follows : take a chromatoplate 20 cm * 20 cm which we divide in half and cut the length of the desired chromatoplate, then using the pencil and from the graduated ruler, draw a line of 1.5 cm from the bottom of the sheet that will serve as a baseline.Identify in pencil the different products to be analyzed by personal codes (P for pharmacies and V for street vendors), separating them by one centimeter so as to occupy the entire baseline according to the number of products to be spot on this same baseline. Then prepare the usage and mobile phase solutions, and number the test tubes according to the seller's category.

Extraction solvent for Cloxacillin TLC

Theextraction solvent was carried like this: in a 100 mL flask were introduced18 mL of distilled water, 2 mL of 37 % of hydrogen chloride acide (HCl) and 80 mL of acetone**[19].**

We weighed a powder test sample corresponding exactly to 25 mg by using the average weight of each sample (table I), which we introduced into a 10 mL flask, then complete with the extraction solvent up to the dipstick and shake it.

Table I:- Average of weights of the different samples of Cloxacillin.

SamplesIdentity	Weight (mg)	Average (mg)
Reference	560;580; 570	570
P_1	590;600; 570; 620; 630; 640;600; 590; 570; 550	596
P_2	580; 610; 640; 580; 630; 630; 530; 570; 620; 570	596
P_3	600;600; 630; 560; 610; 610; 620; 600; 600; 600	603
P_4	590; 630; 570; 620; 620; 580; 580; 580; 550; 550	587
P_5	610; 610; 640; 640; 550; 620; 590; 630; 660; 610	616
V_1	580; 730; 400; 760; 400; 550; 760; 360; 550; 540	563
V_2	660; 400; 770; 300; 480; 630; 450; 560; 620; 450	532
V_3	560; 650; 470; 570; 630; 400; 740; 330; 570; 570	549
V_4	560; 670; 450; 680; 480; 750; 350; 750; 400; 550	564
V_5	620; 450; 640; 470; 650; 400; 490; 800; 340; 490	535

P: pharmacy; V: street vendor

The mobile phase was prepared in the chromatographic tank. Introduce in it 60 mL of ethyl acetate, 20 mL of acetic acid and 20 mL of distilled water **[19].**

Figure2:-Weighing and solutions of the different samples in test tubes ready for TLC spotage.

The tank was closed and well agitated. Wait at least 15 minutes for the chromatographic chamber to be saturated and at the same time place the different samples on the chromatoplate (figure 2)[**19].**

Finally, the chromatographic sheet was immersed in the chromatographic tank and wait for migration (figure 3). The chromatoplate was taken out of the chromatographic chamber to dry it in the free area, then put it in the chromatographic tank in order to observe and verify the migration of stains.

Figure 3:-Chromatographic plate immersed in the chromatographic chamber.

After TLC, the RF of each sample was calculated by the following formula:

$\boldsymbol{RF = \frac{X}{Y}}$ **[24]**, where

RF: is the frontal report

X: Distance traveled by the solute

Y: Distance traveled by the solvent

After this the active ingredient content of each sample was calculated by the following formula:

$\boldsymbol{T = (\frac{RF\ éch}{RF\ réf})}$ **×100 % [25],** where

RF éch: is the frontal report of the sample;

RF réf: is the frontal report of the reference.

Results and Discussion:-

To date, no research has been done on the TLC of cloxacillin, since the TLC is still a qualitative analysis, a test to identify the presence or not of the desired active ingredient.

Presentation of TLC analysis results

After having carried out the procedure from the spotage to the observation of the iodine chromatograms, the plates were photographed and represented in the form of the figure below.

the plates of the iodine chromatograms were photographed and represented in the form of the figure below (Figure 4).

Figure 4:- TLC plate photograph of deCloxacillin samples.

Through the photographs of the various thin layer chromatography's (TLC) of the samples per molecule, it has been observed that the samples of all the molecules have migrated; which leads us to conclude that the active ingredient exists in these samples and that whatever the content.

After presenting the TLC photographs of the different samples by molecule, we measured the distances traveled by the different solvents and samples in cm (Table II), then we calculated the RF of each sample (Table III).

Table II:- Presentation of the distances covered by the samples (cm).

Samplesidentity and solvent	**Distance (cm)**
Solvent	7.2
Ref	4.65
P_1	4.7
P_2	4.7
P_3	4.7
P_4	4.7
P_5	4.7
V_1	4.7
V_2	4.7
V_3	4.9
V_4	4.9
V_5	5

Ref: specialty; P: pharmacy; V: street vendor

The table above shows that all the samples have nearly traveled the same distances like the reference.

Table III:- Presentation of frontal reports of the Cloxacillin samples.

SamplesIdentity	**RF**	**% a.i.**
Ref	0.6666	
P_1	0.6458	96.87
P_2	0.6527	97.91
P_3	0.6527	97.91
P_4	0.6527	97.91
P_5	0.6527	97.91
V_1	0.6527	97.91
V_2	0.6527	97.91

V_3	0.6805	102.08
V_4	0.6805	102.08
V_5	0.6944	104.17

RF: frontal reports; P: pharmacy; V: street vendor; % a.i.: percentage active ingredient;
Ref: specialty

The table above shows that all the samples of pharmacies traveled on average the same distances, they have lower than 100 %. For the street vendors forty percent of the samples have the same percentage active ingredientas the pharmacies but the sixty percent of them have percentage active ingredient higher than 100 %.

Conclusion:-

The results of the study reveal that in the two cases (pharmacy and street vendors)that the migration was effective for all the samples.Therefore, this reveals the presence of Active Ingredient in all the samples.Theymeet the standards recommended by WHO which is between 90 and 110 %.Cloxacillinsamples from pharmacies have Active Ingredient Content lower than 100 % like the forty percentsamples from street vendors while the sixty percent of these have percentage active ingredient higher than 100 %.

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6. Street vendors

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