ANTIBIOTICS PRODUCTION FROM DUMPSITES MICROBES USING BIOASSAY TECHNOLOGY: A CASE STUDY OF ANKA AND TALATA MAFARA LOCAL GOVERNMENT AREAS

BY

ABDULHAYATU MUSA ANKA

Department of Applied Science,

Abdu Gusau Polytechnic, Talata Mafara,

Zamfara State

Abstract

Microorganisms plays a significant roles in the quantitative assay of compounds such as amino acids, vitamins, and antibiotics, while soil is a diverse ecosystem which supports the growth of countless organisms, be it plants, animals, or microbes. Microbes are the internal part of every food chain as they decompose the dead and decay organic matter from refuse dumpsites into simple molecule, which they use for their nutrition. Microorganisms consume wastes, and release toxins to the living cells; they also convert wastes into safe by-products antibiotics. This research assesses some selected refuse dumpsites in Anka, and Talata Mafara local government areas, to investigate the activities of microorganisms for the production of antibiotics from refuse dumpsites, and make constructive recommendations as "these microbes are friends and enemies" in our living habitat.

Keywords: Antibiotics, Dumpsites microbes, Bioassay Technology.

1.0 INTRODUCTION

Antibiotics are natural substance of biological, synthetic and semi-synthetic origin. Soil is a complex and very diverse environment providing source of antibiotics producing organisms. Microorganisms which are capable of producing antibiotics can be found mostly in lakes, refuse, decaying plants and animals remains, but majority of microorganisms that produce antibiotics inhabits soil (william2020). According to the international center of information on antibiotics, 3,380 species of microbes are able to produce antibiotics, for bacterial infections on the skin surface, eye, ear, and various organs of the living cells. Waste/refuse control has played important roles in our environment, most of these wastes are subject to dumping in a specified disposal yards, which pose great challenges to the environmentalist the eco-friendly management of these waste and application of microorganisms (Zhang 2019) when microbes consume waste, convert the waste into safe by-products such as vitamins, enzymes, antibiotics, and in one course of these conversation.

They actually produce several metabolites to break down the complex wastes into simple organic compounds. Microbes are considered highly valuable, as they are used in fermentation process, such as brewing, baking cheeses, and butter-manufacturing during fermentation, the organisms produce economically feasible antibiotics with potential to yield qualitative drugs.

The commercial development of antibiotics is a long and expensive proposal issues, one approach taken by pharmaceutical industries is to focus on the identification of antimicrobials activities with narrow specifications restricted to a single genus or species rather than broad spectrum approaches of the past (Jensen et al, 2019). Soil provides optimum conditions to these microbes such as moisture, temperature, PH, organic matter which are favorable for the growth of microorganisms towards antibiotics production the research work is made to justify. Most microbes are harmless to human, animals and other organisms, but some are economically feasible, while others are pathogenic and can cause infections to the living cells. The growth response of micro organisms using bioassay are extensively used in the pharmaceutical and food industries, therefore it necessary to justify the roles of microorganisms towards making feasible economy. In view of this background one say that apart from poisonous, toxics, or diseases released by the microbes, they are also important in various industries such as food, pharmaceutical industries, refineries, as well as the environment we found in. we can call them friends and enemies to the environment they are pound.

The demand for new antibiotics growing day by day due the emergence of multiple pathogens that are resistant to antibiotics cures, for life-threatening diseases, in recent years several microorganisms that are capable to produce antibiotics are grown on the artificial media for the intensive search for the antibody producing microorganisms (Elasas 2000). Antimicrobial agents include a chemically heterogeneous group of small organic molecules of microbial origin that at low concentrations, are deleterious to the growth or metabolic activities of other microorganisms (Atlas 2003).

This research lead to the awareness of the students, researchers and teachers concerned companies/industries, NGOs, States and federal governments to inculcate and understand the benefits of microorganisms in producing antibiotics from refuse dumpsites for the sustainable economy developments, rather than their harmful impacts.

1.1 STATEMENT OF THE PROBLEM

In the pre-antibiotic era of the early 1900s, people had no medicine (antibiotics) and the knowledge of producing them, against the common germs (microbes), these microbes existed since from human creatures. As a result of serious spread of diseases began to expose globally either endemic, epidemic or pandemic or every individual scientist began to devote time searching for drugs (antibiotics) that would be cidal/static the diseases causing by microbes. In the golden age of the discovery of antibiotics, this potent "miracle" drugs saved millions of lives. According to food and drug administration abort 40% of antibiotics are becoming extremely resistant to existence microorganisms particularly gram positive and gram negative microbes, while 40% of them are used to treat infections in humans. (Magdoff, 2019). Therefore the major challenges we are facing is actualizing quantitative antibiotics that would kill the diseases by microbes, and have significant contributed to the control of infectious diseases that lead to human morbidity and mortality for most of humans and animals existence (Enright, 2018). Microbes accelerate the emergence and spreads of antimicrobial agents into the following in appropriate use or misuse of prescribed medicines, taking substance doses or not finishing a prescribed course of treatment, and lack of government commitment to address these issues, to encourage researchers,, among others.

1.2 OBJECTIVES OF THE STUDY

The specific objectives of this research work are as follows viz:

1. To determine and identify the diversity of microorganisms from refuse dumpsites environment, and making an assessment of their antibiotics producing potentials.
2. To evaluate the potential contributions of microbes towards making economy feasible.
3. To prosper a constructive recommendations to the challenges identified, and also to the claim that they are "friends and enemies".

2.0 LITERATURE REVIEW

Soil is the major reservoir of microorganisms that produce antibiotics, considering that, soil is densely packed with microbes, it is not wonderful for the microbes to develop ways of inhibiting their neighbors for the benefit of their own growth. The commercial development of antibiotics is a long and expensive issue, antibiotics has existed for centuries, while our scientific knowledge of antibiotics has only recently developed. One approach taken by pharmaceutical companies is to focus on the identification of antimicrobials activities with narrow specifications restricted to a single gems or species rather than broad spectrum approaches of the past(Jensen et al, 1999).

The large scale production of antibiotics depends on a fermentation process, during fermentation, the organisms produced the antibiotic materials which can then be isolated or characterization is habitat in the soils.

Antibiotics are useful in many forms, in these cases, the antibiotics is delivered throughout the body by absorption into the blood stream. For new antibiotic to be economically feasible, manufacturer must be able to get a high yield of long resistance from the fermentation process, and be able to easily isolate them (Bayarsaki, 2006 and Zhang, 2007). Apart from antibiotics production ability made by microbes through fermentation process, fermentation technology has contributed to the production of various chemicals, such as mainstay of pharmaceutical industry. In attempt to define antibiotics the term was derived from the Greek word ”anti” meaning against, bio means “life So, antibiotic simply mean against life, but technically antibiotics are chemical compounds produced by microorganisms that are capable of killing the diseases or inhibit the growth. The development of antimicrobial agents of microbial origin is a natural phenomenon, however certain human action and activities accelerate the pathogenic organism to change their ways that render medication used to cure the infections inactive (Elasas J. A. 2000). The demand for new antibiotics grow day by day into the emergence and dissemination factors include inadequate natural commitment to a comprehensive and co-ordinate responses ill-defined accountability and insufficient engagement of communities, inadequate system to ensure quality and uninterrupted supply of medicines, inappropriate and irrational used of antimicrobial medicines, including animal husbandry, poor infection prevention and control and depleted arsenals off diagnostics, medicines, and vaccines as well as insufficient research and development on new products, among others (Gopi 2011). Recent analyses have shown that screening of soil for antimicrobial activities have been carried out in many parts of the world. A teaspoon of soils contain hundred million to one billion of microbes active in each acre of ht soil (Atlas 1993). Antibiotic made by a microbes can inhibits many other soil microbes, the development of pharmaceutical industries to investigates the assay member of organisms becomes of complex process due to complex diversity of the species from the soil habitat.

3.0 METHODOLOGY

3.1 The research area: The geographical areas of this particular research work are Anka, and Talata Mafara towns, in Zamfara state.

3.2 The research site and subject: The research site is refuse dump sites across the selected towns in Zamfara west Zone

3.3 Targeted population size: In order to get genuine, authentic, reliable, educated and unbiased results, the research samples were collected from various refuse dumpsites of about50 samples that were collected across various communities.

4.0 DATA PRESENTATION AND ANALYSIS

The data collected is presented in tabular for easy understanding and analysis will be on the mean microbes count, isolates and antibiotic action on the bacterial isolates in the dumpsites of the two areas.

Table 1 below show the total numbers of microbes collected from Talata Mafara refuse dumpsites in colony forming unit in grams (cfu/g) for refuse 1 and refuse 2 respectively as well as the mean microbes count.

Soil sample	$\square_1$(cfu/g)	$\square_2$(cfu/g)	Mean microbes count (cfu/g)
A	40	32	36×10^{10}
B	36	42	39×10^{10}
C	59	62	61×10^{10}
D	76	82	79×10^{10}
E	98	95	97×10^{10}

Table 2 below show the total numbers of microbes collected from Anka refuse dumpsites in colony forming unit in grams (cfu/g) for refuse 1 and refuse 2 respectively as well as the mean microbes count.

Soil sample	$\square_1$(cfu/g)	$\square_2$(cfu/g)	Mean microbes count (cfu/g)
$\square_1$	32	26	29×10^{10}
$\square_2$	40	39	40×10^{10}
$\square_3$	51	47	49×10^{10}
$\square_4$	62	52	57×10^{10}
$\square_5$	72	65	69×10^{10}

Table 3 shows the morphological characteristics of bacterial isolates from the dumpsites in Anka and Talata Mafara areas

Stain number	Colour of colony	Nature of colony	Gram nature	Shape
$_1$	White	Round shape	Gram +	*Bacilli*
$_2$	Milky	Irregular swammer	Gram +	*Short bacilli*
$_3$	Milky	Round shape, shiny	Gram +	*Bacilli*
$_4$	Cream	Round shape, shiny	Gram +	*Cocci*
$_5$	White	Round shape	Gram −	*Short bacilli*
A	Cream	Irregular shape	Gram −	*Cocci*
B	Cream	Round shape	Gram +	*Cocci*
C	White	Round shape	Gram +	*Bacilli*
D	Milky	Irregular shape, transparent	Gram +	*Bacilli*
E	Milky	Round shape, shiny	Gram +	*Cocci*

Table 4 shows the Biochemical characterization of isolates in Anka and Talata Mafara dumpsites

dumpsite	Grams reaction	Urease	Motility	Citrate	Indoles	$_2$ production	Glucose	Lactose	Sucrose	$_2$	Gas production	Bacterial Isolates
$_1$	−	+	+	+	−	+	+	−	+	+	−	*Bacillus polymxa*
$_2$	+	+	+	+	+	+	+	−	+	+	−	*Cocci*
$_3$	−	+	+	+	+	+	+	−	+	+	+	*Bacillus licheniformis*
$_4$	+	+	+	+	+	+	+	−	+	+	−	*Cocci*
$_5$	+	+	+	+	+	+	+	−	−	+	−	*Bacillus subtilis*
A	+	+	+	+	+	+	+	−	−	+	−	*Bacillus licheniformis*
B	+	−	+	+	+	+	+	−	−	+	−	*Bacillus polymxa*
C	−	+	+	+	+	+	+	−	+	+	−	*Cocci*
D	+	+	+	−	+	+	−	−	−	+	−	*Bacillus subtilis*
E	+	+	+	+	−	+	+	−	−	+	+	*Bacillus polymxa*

Table 5 shows the Antibiotics action of isolates on some test organism

Bacterial Isolates	Test Organisms			
	Staphylococcus aureus	*Salmonella spp*	*Pseudomonas aeruginosa*	*Escherichia coli*
Bacillus subtilis	+	+	+	+
Bacillus licheniformis	+	+	+	+
Bacillus polymxa	−	−	−	−
Cocci	+	+	+	+

Key : - (positive indicates inhibition) (negative indicates no inhibition)

4.1 DISCUSSION OF THE RESULTS

The total viable bacteria count of the soil samples screened the course of this research revealed that the bacteria collected from the dumpsite varies from 29 X 10^{10} (cfu/g) to 97 X 10^{10} (cfu/g) which is quite high, and this might be due to the soil type and composition. Five of the isolate *bacilli* are gram positive while one is gram negative, equally three of the *cocci* isolate were gram positive while one isolate *cocci* is gram negative. The predominant bacteria isolated from the dumpsite soil sample were bacillus species and these include *bacillus subtilis, bacillus lichenifromis, bacillus polymxa* and *staphylococcusspecies* among others.

The outcome of the research shows that, the highest bacterial count were recorded in sample E, similarly, soil sample A_1 has the least bacterial count. However, the result of biochemical test indicated that, all the isolates were motile and lactose negative, nine of the isolate ferment glucose, five ferment sucrose. The result of antibiotic sensitivity test of the isolate of the perpendicular streak plate method shows that*Bacillus subtilis, Bacillus licheniformis and Cocci* shows growth inhibition for all the test organism, while *Bacillus polymxa*does not show any growth inhibition. This might be clear that, the test organisms *Staphylococcus aureus, Salmonella spp, Pseudomonas aeruginosa,* and *Escherichia coli* are not effective in providing the information on the antibiotic producing organisms.

5.1 CONCLUSION

It can be concluded from the analysis above that, *Bacillusspecies* were predominant bacteria that are found from the dumpsites of the two areas. It should be noted that, the preliminary screening of the isolates for antibiotics production shows that *Bacillus subtilis, Bacillus licheniformis and Cocci* exhibit growth inhibition for all the test organisms, while *Bacillus polymxa* does not show any growth exhibition.

5.2 RECOMMENDATIONS

The following recommendation are hereby made

1. That the dumpsites should always be cleared from the community so that to prevent the effect of microbes from being spreading among people.
2. The dumpsites should be used as a source of organic manure for crops production.
3. There should be limitation of dumpsites in the community so as to reduce the microbial population

References

Atlas et al (1993). the magnitude of fungal diversity: the 1.5 million species estimate revisited mycological research, volume 105pg. 1422 to 1432.

Bayarski (2006). Antibiotics classification and side effects. Ezine articles. https://Ezinearticles.com/expert=Yury-bayarski.accessed 22/09/2011.

Elasas (200). Biological diversity: fungus, November, 2014 retrieved from emc.maricopa.edu/faculty/farabee/biobook diversity 4.html

Gopi K.D (2011). the production, extraction and assay of antibiotics from bacterial and fungal isolates. Journal of pharmacology applied science research 2(5):- 161 to 167.

Jensen(1997). Chemotherapeutic agents, in microbiology.

Williams (2020). building soil for better sustainable soil management, the living soil (3rd Edition) sustainable agriculture, network, hand book series book 10.SARE sustainable agricultural research and education: Belt ville, Maryland.

Zhang, Y (2007). mechanism of antibiotics resistance in the microbial world. Clinical and pharmacological journal, 82: 595-600.