IMAGE: A MAP OF THE STARS OF THE ORION CONSTELLATION

Print ISSN: 2631-8490 Online ISSN: 2631-8504

JournalPreview

London Journal of Research in Science: Natural and Formal
Volume 22 | Issue 2 | Compilation 1.0

London Journals Press

WWW.JOURNALSPRESS.COM
© COPYRIGHT LONDON JOURNALS PRESS

JournalPreview

LONDON JOURANALS OF RESEARCH IN SCIENCE: NATURAL AND FORMAL

This document is a pre-published view of London Journal of Research in Science: Natural and Formal Volume 22, Issue 2 and Compilation 1.0. For any minor changes and updations kindly follow your paper's live editing URL given in sent email or get in touch with our support team at support@journalspress.com or visit our website to use live chat support. This is a beta document thus order, content or existence of papers may alter in the published eJournal. You are requested to kindly acknowledge and approve your research paper in this JounalPreview within three days.

*THIS IS A CONFIDENTIAL DOCUMENT UNDER A SOLE COPYRIGHT OF LONDON JOURNALS PRESS. IT IS STRICTLY PROHIBITED TO SHARE THIS DOCUMENT OR ITS COPY IN ANY FORMAT WITH OTHERS OR IN PUBLIC WITHOUT PRIOR PERMISSION OF LONDON JOURNALS

Journal Content
In this Issue

London Journals Press

© 2022 London Journals Press

Scan to know paper details and
author's profile

Where is Way out of Crop Crossing Breeding?

Peizhan Tian

Jilin University

ABSTRACT

Author discussed a series of guiding principle of scientific crossing breeding in future. This paper advanced firstly "Original theory of crop science", "Net system of genetic character of variety yield performance of crops". Stressfully expounded its core concept, variety yield performance; basic contradiction between variety adaptability and yield ability; ecology theory of variety suitable-stable ability; theory of yield ability science; plant type trait and plant type theory. Brief introduced this original theory obtained approving, evaluating and great significance in international academic circles.

Author was on the basis of original theory in breeding practice bring forth new ideas of breeding and obtained outstanding effect, breeding efficiency increased more than four times. Raised some new concepts concerning genetics and breeding science, for example: each other action between suitability and yield ability (character), closed and open breeding (point out: Open nature of sexual crossing breeding decided it will always having a losing not foothold and any breeding way all cannot replace it.), ecology of crop variety, theoretical genetics and breeding science of crops, etc.

Keywords: NA

Classification: DDC Code: 338.16 LCC Code: S494.5.P73

Language: English

London Journals Press

LJP Copyright ID: 925641
Print ISSN: 2631-8490
Online ISSN: 2631-8504

London Journal of Research in Science: Natural and Formal

Volume 22 | Issue 2 | Compilation 1.0

© 2022. Peizhan Tian. This is a research/review paper, distributed under the terms of the Creative Commons Attribution-Noncom-mercial 4.0 Unported License http://creativecommons.org/licenses/by-nc/4.0/), permitting all noncommercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Where is Way out of Crop Crossing Breeding?

Peizhan Tian

ABSTRACT

Author discussed a series of guiding principle of scientific crossing breeding in future. This paper advanced firstly "Original theory of crop science", "Net system of genetic character of variety yield performance of crops". Stressfully expounded its core concept, variety yield performance; basic contradiction between variety adaptability and yield ability; ecology theory of variety suitable-stable ability; theory of yield ability science; plant type trait and plant type theory. Brief introduced this original theory obtained approving, evaluating and great significance in international academic circles.

Author was on the basis of original theory in breeding practice bring forth new ideas of breeding and obtained outstanding effect, breeding efficiency increased more than four times. Raised some new concepts concerning genetics and breeding science, for example: each other action between suitability and yield ability (character), closed and open breeding (point out: Open nature of sexual crossing breeding decided it will always having a losing not foothold and any breeding way all cannot replace it.), ecology of crop variety, theoretical genetics and breeding science of crops, etc. In the end raised transformation present experience breeding into scientific breeding being aimed at difficult problem in experience breeding under leading of original theory and arousing of reformation breeding practice, and objective, assignment, technology key and route, engineer-technology system. Relationship between sexual crossing breeding and transforming gene breeding was also discussed.

Author: Agronomy Department of Jilin University. 5333 Xian main road, Changchun City, China.
Tel:13578939162 email: peizhantian@163.com

I. INTRODUCTION

Crossing breeding of crops passing one hundred twenty two years from 1900 in that Mendel's paper concerning Genetics Law was discovered by De Vris, H. et. three scholars to 2021y provided basic requirement for grain and meat, egg and mink of the human race. But because it was still in experience breeding stage that mainly was dependent on conventional custom and breeder's viewpoints, study on breeding regular pattern fell seriously behind practice and lacked support of bring forth new theories, and moved rapidly fail.

Blind pessimistic morale was produced in many breeders of crops, and they cried out in alarm:" Crossing Breeding of Crops will leave history stage, and surrendered transformation gene breeding!" Crop Crossing Breeding, what course to follow?

Up to now breeding of crops was generally recognized as a technological school subject, having no science, but I think that if had technical practice, also had certainly theories or science.

Passing unremitting efforts in more than thirty years, theory system was set up that was used to answer "difficult problem in the world "," How to form crop yield ?" or that was sought by many researchers " Net system of genetic characteristics of crop yield ". It was possible transforming experience breeding into scientific breeding and obvious increasing breeding efficiency.

II. FIGURE FOUNDING THEORY SYSTEM

Fig.1 [3][4] was crop population having life and it reflected real situation. It included basic contents two newly emerging subjects: "Ecology of crop variety" and "Yielding ability science of crop variety", also included function and main metabolic of all of organs and organizations, organic connections among all characters or genes were described.

London Journal of Research in Science: Natural and Formal

© 2022 London Journals Press

III. CONSISTING PARTS OF THE THEORY SYSTEM

3.1 Core Concept: Yield Performance of a Variety

Yield performance was obtaining actual yield in experiment, test or production. Its expression methods were kg/hm² or kg/mu(667m²). Yield performance of a variety was reality yield of any variety or population under certainly condition.

This core concept expressed that objective of the theory system was revealing objective law forming crop yield. Using popular language said: "Crop yield was how to form?" Using scientific terminology said: "Net system of genetic characters forming crop yield. It included structure and each other relationship, mechanism etc. of this net system. The theory system may reflecting crop yield forming was a vain hope of researchers that had aspiration in agricultural science study, because only such theory or law can be used guiding agricultural technology development and developing sciences.

3.2 Basic Contradiction: Contradiction Between Adaptability or Yield Stability and Yielding Ability of Variety

It was abstracted from large number practice activity in nineteen hundred and seventy four years when first year after I were engaged in soybean breeding studying work. Yield of a variety obtaining under most suitable condition for this variety was called as yielding ability or yield potential. But in production great majority of varieties were under relative unfavourable condition, this time varieties had certain suitability for this condition, strong or weak suitability and high or low yielding ability together acted to form yield performance of a variety under this condition (Formula 1) [5].

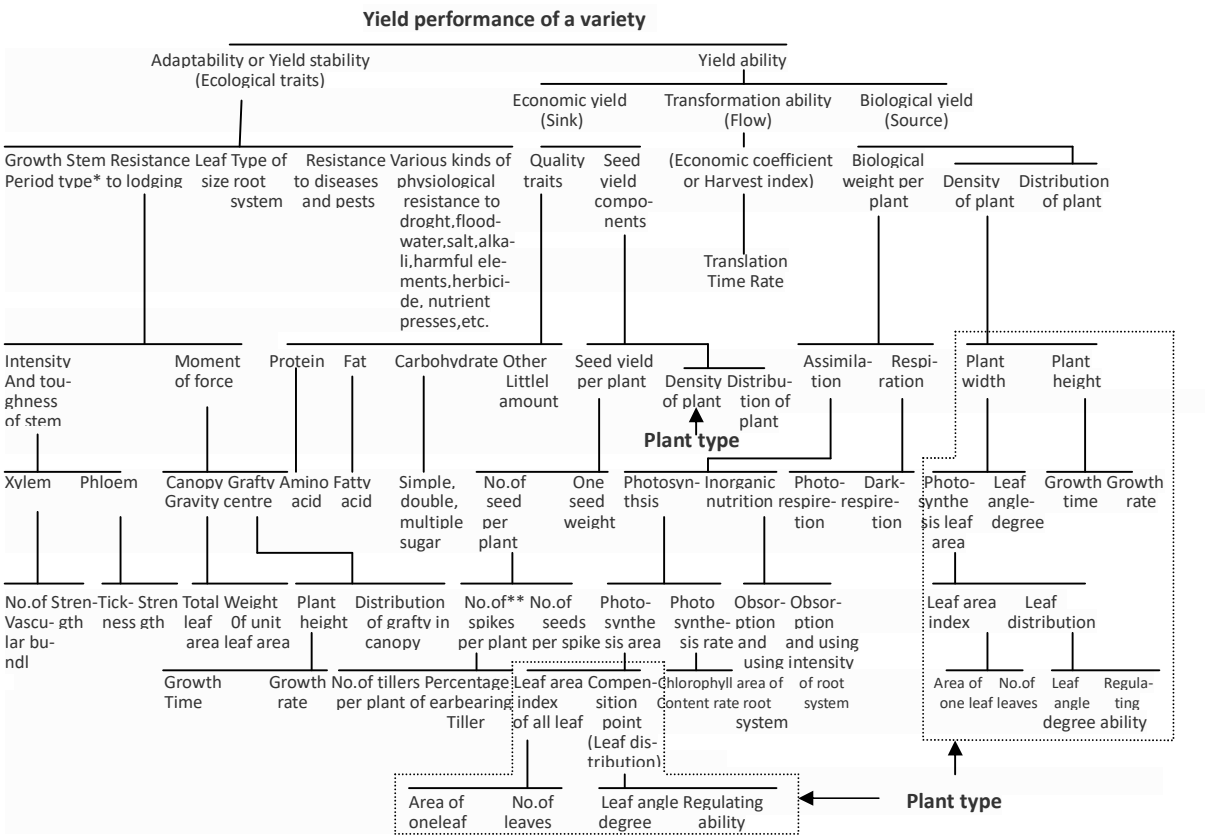
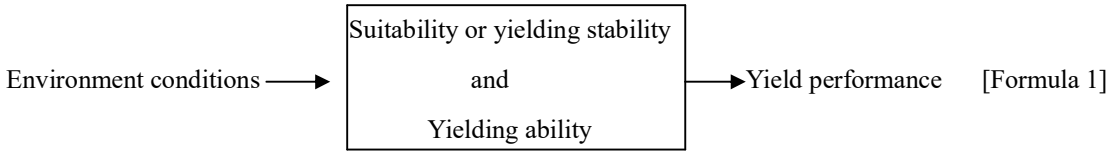


Fig.1: Net System of Basic Contradiction of Variety Performance and Character Composition of Corn and Grass Family Crops

© 2022 London Journals Press

* The stem type was pod-bearing habit in soybean
** There were petiole(and itslength)and nodule, No.of pod per plant,No.of seed per pod in soybean



[Formula 1]

This formula was great development for ”Phenotype＝Genotype＋Environment“, classical formula that followed more than one hundred fifty years, revealed composing of internal contradiction of genotype yield performance.

Thus bases could be well do for dividing two different nature characteristics, setting up genetic character system that decided and influenced belonging to of all of genetic characters of yield performance. This also was main reason of no forming basic principle of crop genetics-breeding in modern times: “lacking analysis of basic contradiction of yield performance”. was very important, may said : ” no this abstract, no this theory system”. This basic contradiction is the starting point of the theory system, if there were not the basic contradiction also there were not the theory system . But there were it, followed and concretely studied what were suitable ability traits or yielding ability traits, also relationship among these traits.

Why a variety could increase yield or decrease yield? Increased or decreased yield was introduced by which trait advantageous or harmful ? This was must clear for each scientific work and technology worker. But if they not mastered the theory weapon that could distinguish“yes”or “no”, facing traits or genes of numerous and of all shades, how made a clear distinction between right and wrong ? thus theory weapon was that theory system was sought by us.

In fig 1 had about forty suitable-stable yield traits and sixty yielding ability traits, seed quality traits were spread out after about one hundred yielding ability traits, two type traits together about one hundred and forty. The one hundred and forty traits contacted together passing different routes, no one no-happening linking with others. Thus all of traits all were determining factors of yield performance, one of them was changed others all happening large or small changing, sometimes very violent. Object of crop breeding was that made all traits achieving new balance on more high energy levels and producing new varieties.

3.3 Theory of Suitable-Stable Yield or Ecology of Variety [6]

All of ecology traits had not subordinating traits (Fig. 1, except growing period and stem type etc. a small number traits could influence to display of other ecology traits, great majority ecology traits were independence (only when using mechanics principle analyzing negative factors of resistance to lodging , several quantity traits were included, but positive factors deciding action: stem intensity and toughness, type of late growing root on stem still were controlled by few genes, belong to quality traits.) These showed that suitable-ecologic traits had more big and more remarkable action for yield performance of variety. Because ecologic conditions deciding forming ecologic traits were nature conditions coming from strong and having force and human action was hard to change, deciding influence of ecologic characters to wave motion of yield performance among different years often having guiding action. Mentioned above showed importance firstly selecting suitable ecologic type. We should be on the bases of stable yielding, seeking high yield.

Must determining: ecologic trait itself was not yield ability trait, it’s function was influence to degree of bringing into play or expressing yield ability of variety. Suitable ecologic type may make

© 2022 London Journals Press

yield ability traits to obtain more abundant bringing into play and not suitable ecologic type contrary, so could not confuse ecologic trait and yield ability trait.

Ecologic trait determined yield stability of variety. Main ecologic traits of grass family crop were growing period, stem type, resistance to lodging, root type, leaf size, resistance to disease and pest, varied physiologic resistance. For soybean and other dicotyledons : growing period, pod-bring habit, resistance to lodging, root type, leaf size, resistance to disease and pests, varied physiologic resistance.

Root type in ecologic traits, and root measure in yield ability traits were two concepts of different nature, the former was difference of " type" or "quality", the latter was weight or surface area et.

Root system of crop was divided into the first time roots, late-growing roots and both all being more developed three types, variety having best resistance to dry possessed developed first time growing roots, after roots growing from embryo axis, stem, tillering node mainly distributed in above twenty to thirty cm of soil, beneficially absorbing water and fertilizer there and having stronger tolerance to water and fertilizer, but not adapting dry area, in general variety with both types root that all were more developed had big planting area.

Researching local varieties and evolving history of extending varieties in varied ecologic area found that all ecologic traits all had difference of types, forming these types were in the final analysis determining by type difference of ecologic environment factors. Corresponding relations between each ecologic trait and environment factor were: growing period-light and temperature from the sun, stem type or pod-bring habit-precipitation and its distribution during growing period, resistance to lodging-absolute level and relative difference of light and soil fertility, root type-water content in varied layers of soil, leaf size-absolute level and relative difference of light and fertility, resistance to disease-disease source biologic-ecologic factor, resistance to pest-harmful pest biologic-ecologic factor, varied physiology resistance-relate to drought, floodwater, salt, alkali, harmful elements, herbicide, nutrient press etc. physical and chemical factors.

If deciding relative factors of ecologic traits could stably and long-term exist, adapting its ecologic type of variety also was stable, for example growing period, stem type etc., contrary environment factor happening change ifs adaptable type also changed, for example exerting large number of chemical made soil fertility rapidly increasing to lead to light/fertility ratio largely declining, former variety with bigger leaf and weaker resistance to lodging was replaced by later variety with smaller leaf, stronger stem and resistance to lodging.

Measuring method of adapting-stable yield ability of variety, firstly was on bases of same yield ability, yield performance and suitable ability being consistency principle, second : yield comparison test of isolocus gene lines among multiple years, third: yield comparison test of similar isolocus gene line from a crosses combination. Concrete norm measuring variety adapting ability was yield stability, except first method, others could not using yield performance to show, because also having action of yield ability in yield performance.

Yield stability was using percentage to show, calculating method was [(highest yield －mean yield)/mean yield＋ (mean yield－lowest yield)/mean yield] ×%, the more larger result numerical value was, the more worse yield stability was. The former numerical value showed reflection to better years, the latter to worse years. Yield performance was norm using absolute number value showing, yield stability was a relative value (percentage), both could not and were unable combining into one, so called "high and stable index" was not correct.

3.4 Yield Ability Traits and Yield Ability Theory [7]

Yield ability (or yield potential) of variety was that yield performance of a variety under most adaptable environment conditions. Only variedly ecologic conditions all were most adaptable for the variety, ecologic traits were unlikely to become

© 2022 London Journals Press

restricting factors of yield ability obtaining full elaboration or expressing and to make varied yield ability traits all fully showing and displaying.

Yields of less area high-yielding model in different regions were similar to theirs yield ability of varieties, so-called high-yield breeding should be improving or increasing yield ability breeding, because ecological breeding improving ecologic traits and variety suitable ability also could increase yield performance of a variety.

Yield ability of variety consisted of economic yield (sink), biological yield (source), economic coefficient (flow, also called: transformation ability) three parts, relationship among them was parallel, position was equal, so could not ignore any respect, also so yield ability of varieties may divided high economic yield type, high economic coefficient type, high biological yield type. We all should pay attention to they, they were impassable, tattention to economic yield, ignored other two respects and that became restricting factors increasing yield ability of varieties.

Breeding of high economic coefficient was important mark transforming quantity type into quality type breeding and very less subordinating traits became of easily obtaining better effect.

Unite area economic yield (sink) decided by synthetic seed quality, seed weight per plant (or per ear), plan type(deciding planting density).

High seed yield varieties may divided more ears(compact planting) type, high yield per plant(or high seed weight per ear) type, middle type, superior quality type, four types.(unite seed weight of superior quality type fixed more sun energy). More ear type and improving plant type had close relationship, big ear type more not closer, middle type gradually clear. They were due to high yield of more ear type variety was close relative with higher population leaf area index, big ear type variety with higher unite leaf photosynthesis efficiency. In above three types of varieties, two extreme types(more ear type and big ear type)were most important, both were unity of opposites, each other were existing and development conditions, only both developed, could drive middle type developing. In crop breeding, should advocate compounding three types crosses: more ear × more ear, big ear × big ear, more ear × big ear.

Superior quality type breeding belong essentially to special type of high-yielding breeding, was important mark of yield ability breeding transforming quantity type into quality type.

Contradiction fighting for energy distribution between yield and superior quality often was very intense, the more superior quality crop was the more intense was. Correct tactics of superior quality breeding only was on basis of higher superior quality traits level to gradually raised yield. Undue haste for high yield, or using sacrificing one superior trait exchanging for raising other superior trait(s) was short-sighted action, final being defeated, whole level had not raised. In soybean breeding in China this phenomenon was more prominent, result was that Chinese soybean was pushed out market in the world.

3.5 Plant Type and its Breeding

3.5.1 Action of plant type and its importance

Population density was decided by plant type, it not only directly influenced economic yield, but also biological yield, it may passing other way: photosynthesis—assimilation—biological yield per plant—population biological yield—yield ability—yield performance(Fig 1), so it was a important factor influencing yield ability of population (Fig 1).

3.5.2 What were Plant Type Traits of a Variety?

Plant type traits were more. For example soybean plant type traits had: plant height, petiole length, petiole angle degree, leaf number, area per leaf, leaf angle degree, leaf angle degree regulating ability. Grass crop had: plant height, leaf angle degree, leaf angle degree regulating ability, leaf number, area per leaf (Fig 1).

3.5.3 Relationship between Variety Evolutionary and Plant Type

Studies proved that from starting planting variety, variety population of same yield ability had from more ear type to middle type again to big ear type,

© 2022 London Journals Press

continuous change, the three types only were indistinct classification. In future along with increasing of yield ability of variety, the three types dividing still were continued, difference range among varieties will gradually enlarge.

In more ear and dense planting type variety breeding contradiction between plant type and dense planting certainly was very prominent. Only out way was improving plant type. Objects were reducing disappear light index of crown and increasing leaf area index of population, dry mater yield and economic yield. The key was outstandingly raising leaf area index of population. Most effective method reducing disappear light index were making leaf to change smaller and more vertical, suitably lower plant height. In breeding of big ear type variety with higher photosynthesis efficiency, traits having larger change were thickness of main function leaf etc. photosynthesis efficiency traits and seed weight per ear, plant type had not marked change. In breeding of middle type variety, both all had change, improvement plant type was gradually obvious.

IV. THIS THEORY SYSTEM BEING GREAT FIND IN CROP SCIENCE STUDIES

The theory system firstly found and determined net system of genetic trait of crop yield performance, on individual, population, molecule (genes) levels, profound mystery of higher plant life activity and product yield forming were explained. Core concept, basic contradiction and starting point of theory system were raised, forming completely logical relation. It was great break through for "phenotype＝genotype＋environment", classic genetics formula following more one hundred years, "genotype" was resolved and concrete traits were made sure, doing well being aimed at breeding. Studied and found this net system must use more methods, abstract and generalizing, experiment, test, axiom et. methods, not a single one could be omitted. This net system was gather together all that total related subject expertise, using science expertise synthesizing a live body. Contrary it also will greatly promote development of these relative subjects and more efficacious development of relative using technology sciences and using tech. It will become important basis of molecule biology and molecule genetics. This theory system was transition milestone from Mendel´s genetics that could only explained characteristics inheritance into both quality and quantity, transition milestone from small workshop type of breeding into collective engineering of technique system, transition milestone from art into science. It initiated a revolutionary road of breeding of living things.

V. NEW ENLIGHTENMENT AND LEADING ACTIONS OF THEORY SYSTEM

5.1 Opening up New Stage of Crop Breeding

5.1.1 Transforming Certainly Experience Breeding into Science Breeding

Crossing breeding of crops passing one hundred twenty two years from 1900 in that Mendel's paper concerning Genetics Law was discovered by De Vris, H. etc three scholars to 2022 provided basic requirement for grain and meat, egg and milk of the human race. But because it was still in experience breeding stage that mainly was dependent on conventional custom and breeder's viewpoints, study on breeding regular pattern fell seriously behind practice and lacked support of bring forth new theories, and moved rapidly fail.

Scientific breeding will certainly replace it, and from now a brand-new times of science breeding will be entered.

5.1.2 Scientific Breeding Must Use Science Theory as Leading

Net system of genetic characteristics of yield performance used" yield performance of variety" as core concept, and used its basic contradiction as starting point, respectively expounded "Crop Variety Ecology" "Yield Ability Science of Crop Variety", two new subjects including more than two hundred genetic traits and relations among traits. Ecologic-suitable ability of variety population as a live body to outside and varied environment factors, corresponding adaptable traits and in forming yield ability including important organs, tissue and these functions, metabolism and relation among them were

© 2022 London Journals Press

revealed.Texhe real situation forming crop yield performance was reflected. In order to correctly and perfectly solved stably yielding (resistance to adversities was stable ability trait), high yielding, superior quality etc problem giving way and method, thereby determining only this theory could become leading theory of crop breeding.

5.1.3 This Theory System was Obtained Approving of Academic Circles

Brief producing process of the theory system: Basic contradiction formula of yield performance was first expressed on "Acta Geneta Sinica" in 1975(4) [5]. After passing more time revising and perfecting," net system of genetic characteristics of crop yield performance" theory system was published on "Theoretical Genetics and Breeding Science of Crops", book in 2014 year. English Journal "Open Access Library Journal" published the theory system in 2015 year. American distinguished plant physiology professor Nancy Albert and other four scientists commented and said:" We believe that your contribution to this field is unparalleled and a presentation under any of the sessions will be of great benefit" [1]. In 2018 author was invited as speaker to attend "2018 Global Summit on Plant Science and Plant Physiology, Nancy Albert made charge of summit.

In 2000 will convene "Crop Science Conference in the World" in Canada, in 2019 the conference direct immediately send out invitation to me, but due to epidemic situation the conference convened not. In 2021 paper "Net system of Genetic Character of Yield Performance of Crop and Explanation for It" as a chapter was published on book," Cutting-edge Research in Agriculture Sciences" by the United Kingdom and India operating "BOOK PUBLISHER INTER-NATIONAL" [8].

5.1.4 Experience Breeding Efficiency Lowering

Author summed up variety development regular in eighty years from 1940 to 2020 in middle plain area in Jilin Province showed that each big circle was forty years including four small circle, each small circle was ten years. Big circle was on basis of certain plant type improvement and increasing density, each small circle was mainly increasing seed weight per ear. In the past two big circle, corn doing well, but race only first big circle doing and second big circle not . Plant type of soybean was whole not improved in eighty years, only depended on seed weight per plant to increase yield [9]. Variety yield ability of three crops obvious decreased by degrees (Table 1)

5.2 Leading With Theory to Bring Forth New Ideas and to Obtained Outstanding Effects

From 1990 years starting author was in soybean breeding on basis of theory system to create breeding and obtained outstanding effects. Below examples could explain that scientific breeding may largely raising breeding level.

Table 1: Crop Variety Yield Ability and Its Development in Eighty Years in Middle Plain Area in Jilin Province

Crop	1940 Years (kg/hm²)	2020 Years (kg/hm²)	Increase/each year (kg/hm²)	Total increase (Times)	Plant type improvement situations
Corn	2786	16000	165	5.74	2
Race	3506	12000	106	3.42	1
Soybean	2546	4000	18	1.57	0

5.2.1 Xindadou No 1 Created Highest Yield Record in China and This Record Keeping Eleven Years

It was bred using bumper material (Gongjiao7335) from individual event breeding. In 1999 year, Xindadou No. 1 created 5956kg/hm² highest yield record that was kept eleven years.

5.2.2 Jilin No. 34 (90C1810)

Firstly using progeny of spring soybean×summer soybean, again using spring soybean backcross to

© 2022 London Journals Press

be bred. In 1999 Jilin No. 34 created 5600kg/hm², good result.

Main cause obtaining highest yield in China were 1) improving seed yield ability (sink), 2) method obtaining breeding material of high seed yield was setting up special individual event breeding, 3) improving stem type adapting to high water and fertilizer.

Above two varieties gone through fifteen years from crossing to improved variety, yield ability attained separately 5956kg/hm² and 5600kg/hm², increased average per years 130.4kg/hm² and 107.0kg/hm²,compared with common practice breeding in eighty years, increased112.4kg/hm2 and 89.0kg/hm2. Breeding efficiency raised 6.2 times and 4.9 times.

5.2.3 New Variety Pingandou 8

Tentative plan of this variety was reducing leaf size and increasing population leaf area index, result was having my wish fulfilled. Pingandou 8 had small linear leaf, biggest leaf on whole plant was 15cm length and 4cm width, biggest LAI 6.5 increasing 30% compared with general variety.

Suitable planting density of Pingandou 8 was one hundred thousand plants per hm², right now each plant had 4-5 efficacious branches, them length were similar compared with main stem. Each hm2 efficacious stems (including stem and efficacious branches) were 5.0-5.5 hundred thousand.

Compared test of main commercial soybean varieties in ten years in Changcun city in Jilin province showed that Pingandou 8 not only had highest mean yield (3189kg/hm²) among ten years, but also were most stable yielding, change index of yield performance was most small (42.9%), also reflecting to good or worse years was similar.When this new variety was trial-planted, living example obtaining more than 4000kg/hm² was most, highest yield 4882kg/hm² In 1998. Liuzhanshan obtained 5114kg/hm² high-yielding record in 2004 in Shuangyang district in Changchun city.

Compared with parents, almost all of characteristics changed very largely, Genetic regular of characters was completely different with general crossing combinations. Due to main selection objective was small leaf, so parents all had small leaf genes, individual plant with small leaf in F_2 progeny was obtained more easily. Also due flyield factor traits. This was first model example obtaining breaking through result passing improvement of plant type traits. Men facing thus improvement effect of reducing leaf blade being difficult to ascertain. It aroused us: not rightly selecting seed yield and rightly selecting other yield ability traits also can obtain good effects, thus opening up new road selecting good variety. Its theory support is “Net system of genetic trait of crop yield“. Because this theory said:” Only improving one or more ecologic-adapting trait, or yield ability trait all can increase yield performance.

Using fifteen years this variety was bred, its yielding ability increased 1114kg/hm², mean per year 74.3kg/hm², raising 4.1 times compared with tradition bred variety, breeding efficiency largely raising.

5.2.4 Fasciated Soybean(in China) Being using: Pingandou 1020 New Variety

Fasciated soybean in China was a mutant from well-known soybean variety Jilin No. 20 in China in 80-90 years in twenty century, a very superior and special germplasm. Its biggest superior points were more nodal points on stem and more leaves, nodes on stem were not alternation and were not regulation, had cyclical, opposite, 2-3 bunch, nodes on top of plant were very short and when bloom of top leaf was very small so appearing nest inflorescence. Therefore leaves per plant had fortyfif to sixty, the more leaves, the more inflorescence, the more pod. May said that fasciated soybean in China was a best yielding ability germplasm , but its stem was softer and resistance to lodging worse.

Pingandou 1020 was from a crossing combination of fasciated soybean in China as parent. It was having higher height , concentrated pod-bearing on main stem, thin planting type new variety. In Jilin province, its growing period was 135 days, plant height 140cm, even if planting density one

© 2022 London Journals Press

hundred thousand also happening lodging, only obtaining 3750 kg/hm2 yield. But on the basis of its ecologic traits, introducing from Changchun city to Cifeng city in Inter Mogolia after its growing period had only 125 day, only depending on irrigation in all live of soybean and sufficient sunshine in local area, plants could obtained fully growing and development and hapening not lodging and plant height 125cm. Test planting obtained high yield in 2007. Planting area ten hm^2 in 2008, different peasant family all obtained more than 4500kg/hm^2 good results, highest 5802kg/hm^2 (planting area 1.6mu, 1mn= 667metre^2.

5.2.5 Higher Biological Yield Variety Pingandou 5

Pingandou 5 was also from crossing combination of fasciated soybean in China as a parent. It had higher biological yield, increasing 12.6% compared with check variety, leading seed yield increasing 6-8%. Appearing more lush vegetation body, more leaves and bigger leaf area index(5.8-6.0). These sowed that parents having more superior traits were advantageous to selected more type of superior varieties or material. If gathering more superior traits to a material, making parents becoming material outstanding in one important trait and good at several or more traits, certainly may largely raising breeding effects, and producing breeding notion of "firstly setting up more direction individual event breeding of important traits in science breeding plan and selecting parent material of "varied expert in one thing and good at many."

5.3 Original Theory Bring Forth New Concept of Genetics and Breeding Science

5.3.1 Original theory of crop science

Original theory of crop science was "Net system of genetic traits of crop yield performance." It firstly had a core concept of clear connotation and distinct extension, then basic contradiction using this core as the starting point, from abstract to concrete, on the basis of principle of identity of logic and history, of steps in the process closely linked and spreading a theory system having closed logic and distinct order (Fig. 1). Core of original theory of crop science was unity of scientificness and founding nature. Scientific original theory often was development according with logic of original theory and forefathers ideas.

Developing any science was all passing original theory to realize, no original theory no science development [12]. Our"Net system of genetic trait of crop variety yield performance"was original theory of crop science. It regard to developing of related school subjects: crop ecology, physiology, genetics, breeding science, crop cultivation science, biology, molecular biology, molecular genetics, molecular breeding science etc. all having important significance. Under original theory guiding, certainly producing corresponding new concept, new theory and new theory group.

5.3.2 Interaction Among Adaptable Ability (Trait) and Yield Ability (Trait)

A most model example was soysbean cultivar, Zaofeng No.1 with determinate pod-bearing habit under cultivation condition in Gongzhuling in Jilin province was long-term cultured, its adaptable ability gradually rising, yield ability reducing, from table 2 may see: increasing change index of rainfall in growing period in later ten years, from 31.9% to41.6%; but reducing change index of yield performance, from 97.3% to 84.1%.

This showed that cultivar suitable-ability with regard to less rainfall was rising, but yield in best year reducing and yield ability of cultivar reducing. Mean yield in late ten years was increasing, ssshowing suitable ability increasing, outstanding display of increasing suitable ability was transforming model determinant type into simideterminat type (Fig.2 and Table 2)

Evidently this new concept may using to research changes of crop variety in long term extending process and found reason of long term extending or not.

© 2022 London Journals Press

Table 2: Change of Rainfall in Growing Period in Two Ten Year In1954-1973 and Interaction Among Suitable Ability and Yield Ability of Zaofeng 1 Soybean Variety

Item	Year	Ten year mean	Highest	Lowest	(Highest—Mean)/mean %	(Mean-Lowest) /mean %	Change Index %
Rainfall (mm)	1954-1963	536.8	582.4	410.0	8.5	23.4	31.9
	1964-1973	474.6	531.8	364.8	10.4	31.2	41.6
Yield (kg/hm2)	1954-1963	2156.3	3217	1116	49.0	48.3	97.3
	1964-1973	2265.9	3056	1149	34.9	49.2	84.1

Interaction between suitable ability traits and yield ability also displayed in backcross breeding or transformation gene breeding transforming resistance to disease or resistance to pests, in no disease year, original susceptibility variety increased yield compared with backcross or transferring gene variety, for example yield of resistance to phytophthora rot disease soybean variety reduced 0.1-1.4 bushel/acre compared with former susceptibility variety in no disease in America.

5.3.3 Interaction Among Yield Ability Traits

Eichelberger etc (1989) bred corn line having high nitrate reductase and adapting to lower nitrogen condition and corn line having lower nitrate reductase and adapting to high nitrogen all reduced under general condition. In recent years, bred transformation gene millet serious reducing yield compared with original variety and had to suggest planting in dry region and poor soil region. All of varieties of transformation gene of improvement fatty acid composition all reducing yield. Transformation gene breeding of yield ability trait had more difficult compared with that of suitable ability trait.

Fig. 2: Changes of Pod-Bearing Habit of Zaofeng 1, Soybean Variety Planting in Gongzhuling in Two Ten Years

Left: 1954, typicaldeterminat; Right: 1973, semideterminant

© 2022 London Journals Press

5.3.4 Closed and Open Breeding

Regardless of which interaction among genes, its common ground was that under the genotype background energy absorbing by whole acceptor gene system had not change. If changing a trait and transforming a corresponding gene, in expressing process energy in acceptor was consumed, reducing energy in order to forming yield and leading increase yield. This was result closely moving of this kind of gene system.

Breeding using this way was called as closed breeding. Following situation belong to this breedin:1) natural mutation of gene in a variety, 2) selection of isoline or near isogenic line, 3) backcross breeding for a resistance,4) transforming gene breeding for ecological adaptability and quality character, 5) physical and chemical mutation breeding in general situation, 6)astronavigation breeding (space breeding) in general situation, 7) DNA fragments import in general situation.

Except above breeding ways sexual crossing breeding, breeding of heterosis using, recurrent selection breeding belong to open breeding, its distinguishing feature was whole gene system participating all in recombination, can produce linkage improvement of voluntary selection trait and non-voluntary selection trait, final was due to this improvement, plant absorbed and used more energy from environment conditions, thus assuring improvement of adaptable–ecological trait and yield ability trait, increasing yield or improving quality.

Open nature of sexual crossing breeding decided it will always having a losing not foothold and any breeding way all cannot replace it.

Closed breeding and open breeding were of most intrinsic generalization for varied breeding ways, was theory basis correctly evaluating varied breeding methods and ways. It made people abandon tradition concept that only had variation and also emergence of new variety, also made people refute mythology on basis of theory that depending on closed breeding could obtain higher yield variety. Thus knowledge can produce only on the basis of above original theory, thereby resolved disputing problem in more than one hundred years, for example nonprofessional scientist evaluated non-objectively for mutation breeding.

5.3.5 Ecology of Crop Variety

Ecology of crop variety was studying science of relations between crop variety and ecological environments, a newest school subject, an applying basis subject. Its concrete research contents: forming, action, function, significance in crop production, studying method of ecological trait and its type of crop variety, was theory bases resolving adaptability problem of crop variety with regard to environment. Resolved variety yield stability problem in production practice, but in the final analysis was solving variety more reasonably, abundantly, effectively using nature environment etc. resources, obtaining better economic effect problem.

“Ecology of crop variety” was a composition part of “Net system of genetic character of crop yield performance” so no study of basis contradiction of yield performance, no this original theory, no “Ecology of crop variety”.

Main differences between “Ecology of crop variety” and treatise of other related ecological breeding were: the former was firstly making clearing on the basis of core theory, basic contradiction of yield performance, to produced, ecologic theory only being a part of whole theory.

Ecologic breeders easily produced recognizable limitations, and distinguishing not trait of two type different nature, easily happening unrealistically and including belong not to ecologic trait, all of trait to be involved called all as ecologic trait or “accompany trait”, so much so that resistance to lodging, growing period, resistance to disease etc. important ecologic trait and important yield ability also were called as “accompany trait” [11]. Clearly belong to yield ability trait for example seed size, seed quality, plant type to be called as ecological trait by some ecologic breeder or researcher, this was a wrong overflow ecological concept.

© 2022 London Journals Press

5.3.6 Should Have Concept of" High Yielding Ecologic- Type" "High Yielding Ecologic-Breeding", Yes or Not ?

Ecologic breeding and yield ability breeding were confused by a lot of crop breeder, a statement was "high yield ecologic type" or "high yield ecology breeding". Scholar keeping this statement recognized that high yielding variety all passed certain environment to realize high yielding, adapting different ecology condition of varied high yield ecology type, and forming different shape and characteristic". In practice, suiting ecologic type variety in various places firstly was growing period, stem type, root type, resistance to lodging, resistance to disease etc. type of ecologic trait being suitable, making yield ability traits fully bring into play and expressing. Yield ability characters including all traits of sink, source, flow on different layers had no fixed ecologic model. Same varieties of yield ability may have a lot of combination patterns of yield ability trait.

Ecological type suiting a ecologic conditions strictly had only one of combination pattern. So in regard with high yield variety in different area also had respectively suitable ecologic type of certain difference, significance and function of ecologic type were having best stable yield ability, it was not direct relation with yield ability, but exist not "high yield ecologic- type" or " high yield ability trait ecologic-type.

5.3.7 Seed Quality Traits Were Ecologic Trait? Yes or Not?

Seed quality characters belong to yield ability trait, not ecological character. Reasons 1) Ecological traits were genetic traits forming under long term action of certain ecologic factors, production of seed quality trait had not inevitable relation with certain ecologic condition factors, 2) type of ecologic trait directly influenced to yield stability, suitable variety had stable yield and not-suitable no stable yield, without the slightest difference, seed quality trait had not nature.3) trait happening change under different condition was all called as ecologic character, this recognition confused two type trait of different nature of ecologic trait and yield ability trait, because "variety having different ecologic trait required planting under different condition" this correct theorem, extended " every under different condition trait happening variation called all as ecologic trait" this converse theorem was wrong, if this correct, almost all of yield ability traits all become ecologic traits, no having yield ability trait, 4) mean of a quality trait in certain area may be higher, but comparison among every individual variety was not such, ecologic trait to stable yield ability influence was having being good, no being worse, must was comparison among individual variety, cannot using mean of more varieties.

5.3.8 Theoretical Genetics and Breeding Science of Crops

On the basis of net system of genetic trait of yield performance of crops, original theory of crops, analyzed and studied composition relation and genetic relation among varied traits and on the basis of these laid down new science breeding plan and concrete technology and study method of germplasm resource of relation to breeding, these were study contents of theoretical genetics and breeding science of crops. It was essentially different with experience breeding of crops.

Experience breeding was on basis of experience, point and tradition habit of breeder to lay down breeding plan and concrete technology. Scientific breeding was contrary, It was under leading of original and theoretical genetics and breeding science of crops laid down breeding plan and technology, more according with science development regular and effective. It was high degree developing stage, producing break through nature achievement was big probability things.

On basis of above-mentioned advanced objective and main assignment of scientific breeding:

Using basic contradiction between ecological adaptation ability (yield stability) and yielding ability of crop variety was used as start point to set up genetic characteristic net system it was also called Basic Theory System of Scientific Breeding of Crops. On the bases of it to set up Modern Breeding Technique System that getting together quickening excellent characteristics was used as nucleus, closed combination of individual event

© 2022 London Journals Press

breeding with synthesis breeding of important characteristics was as technology route, unified variety resource evaluation and Preparing Breeding were as bases.

Change passive and non-determinacy selection into voluntary and determinacy. Introducing and utilizing excellent characteristic were as most important way improving and extending genetic bases. Studies on Preparing Breeding and unified variety resource evaluation should be strengthened feasibly, their objective was providing parent materiel for all of individual breeding that combination dispose of main characteristics all attained superior× superior standard on the basis of needs of synthetic breeding objective on this base concentration selecting accurately for important characteristics was conducted and blindness was greatly reduced.

Determining method of additive effects among important yield ability characteristic genes to be showed, distinguished and selected; Through test for F1 generation, excellent combination having bigger additive effects of seed yield will be distinguished and keep back, worse combination having bigger non-additive effects will be sifted out; Yield of self-line of hybrid vigor crop and new variety of self-crossing crop was more quickly and continuously raised.

Source producing hybrid vigor was studied and determined, contribution function of important ecology characteristics for hybrid vigor or non-addition effect was fully brought into play, Opening up and setting up new model of high hybrid vigor, using new method to dispose and select crossbreed and raising hybrid vigor and combing ability.

5.3.9 Two Inferences of Basic Contradiction Formula (1) Yield Performance of Crops

Inference 1: comparison among varieties, if adaptability is same, yield performance is higher, yield ability also higher. Inference 2: comparison among varieties, if yield ability is same, yield performance is higher, adaptability also higher.

These two inferences may use leading varied variety identify test, comparison test, region test, production test etc.. At present, these tests only on the basis of growing period of variety divided test group, but except growing period there were still some important ecologic: stem type, resistance to lodging, leaf size, root type, resistance to disease and pests etc. Should on the basis of climate, soil etc. condition in certain ecologic area concretely provided special type feature, every unit providing variety also should possess variety of same or similar ecologic traits, keeping test materials had all same suitability, thus with regard to varied breeding unit being fair. Besides also according with theory principle on the basis of good adaptability, again comparing and selecting high yield ability.

5.3.10 Scientific Classification of Variety and Germplasm Resource

Along with development and accumulation of varied breeding units varieties and germplasm resources were more and more, using well were wealth not burden, very mach of units only using very less resource, due to attaching not importance to this basis work, lost , mixed, having not name were not less. People of breeding circle said that a important reason was not enough of excavating and using superior germplasm resource, also having certain truth. But due to undue haste for success,

© 2022 London Journals Press

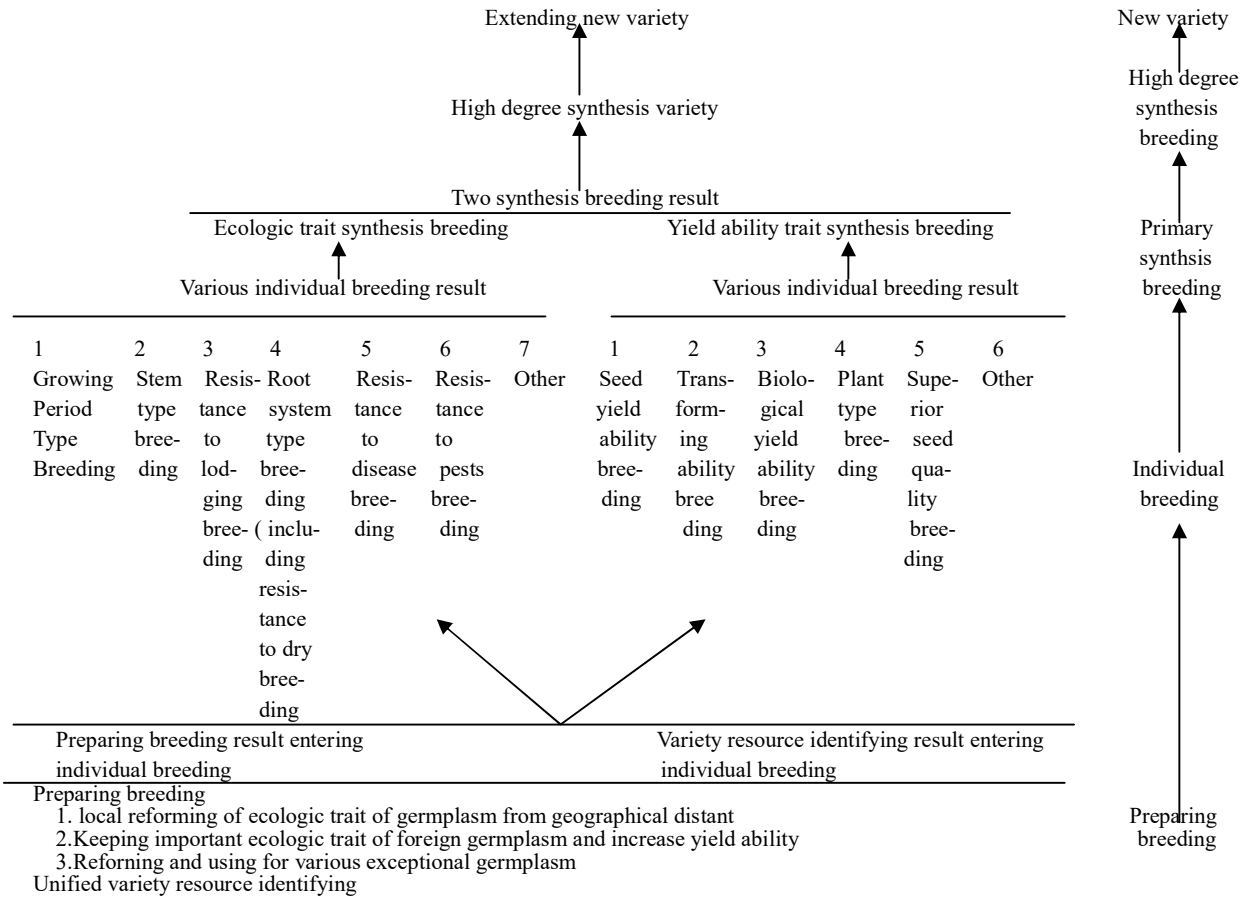


Fig. 3: Scientific Breeding Engineering Technology System Using Individual Event Breeding as Assuring and Close Combination With Synthesis Breeding

paying no attention to basis work being as before may be more important cause. Certainly also having reason of policy and management, and cause of lower systematic nature of science and technology personnel. Above original theory was a can largely raise crop breeding level theory, it same can lead study of variety resources. Firstly set up variety resource classification method fitting science breeding, then on the basis of this classification steady and sure do well unified identification test of variety resources, accumulating and science analysis data, registering etc .On the basis of science breeding to determining investigation and study project, important ecologic trait, yield ability trait, specially setting up project of individual event breeding all were focal point recording [3].

5.4 Using Original Theory as Leading Reforming Breeding Technology System, Transformation Into Science Breeding

If careful think may find: big nature gave man very wonder and ingenious arrangement, make people more having confidence setting up this new theory, for example: 1) adaptability trait and yield ability trait were divided two type trait of different nature, it all have itself place, duty and function, 2) genetic feature of two type trait have basic difference, since having quality trait , also opposite quantity trait, 3) gene controlling ecologic trait was less and action of individual gene was big, gene controlling yield ability trait was more, but action of individual gene was small, 4) big nature actually special arranging two core trait to control heterosis ,this was confirmed in soybean.

Fig.3 was newly set up scientific breeding technology system, focal point was doing well varied individual event breeding, then conducted synthesis. Analysis and synthesis were a objective law of science development, must put into practice. But basis work were variety resource identifying and preparing breeding, their objective was providing parent materiel for all of individual breeding that combination dispose of main

© 2022 London Journals Press

characteristics all attained superior × superior standard on the basis of needs of synthetic breeding objective.

Table 3: Objectives of Various Individual Event Breeding in Science Breeding

Type	Individual event breeding name	First main character	Second main character	Third main character
Ecologic Trait breeding	1.Growing period and its forming a complete set	Growing period	Seed yield ability	Stem type or resistance to lodging or others ecologic character
	2.Stem type or pod-bearing habit and forming complete set	Stem type or pod-bearing habit	Seed yield ability	Growing period or other Important ecologic trait
	3.Resistance to lodging and forming complete set	Resistance to lodging	Seed yield ability	Same above
	4.Root type and resistance to dry and forming complete set	Resistance to dry type is primary root type, broad planting variety primary secondary root system all developed	Seed yield ability	Same above
	5.Resistabce to disease and forming complete set of types	Resistance to disease	Seed yield ability	Same above
	6.Resistance to pests and Forming complete set	Resistance to pests	Seed yield ability	Same above
Yield ability trait breeding	1.Seed yield ability (sink) and firming complete set big, middle more ear	Seed yield ability	Quality lowing not mean of extending variety(P40.5%,F2 0.5%	Same above
	2.Transforming ability breeding	Economic coefficient, harvest index, seed stem ratio	Seed yield ability	Same above
	3.Biological yield breeding	Biggest aerial part dry matter weight in seed growing stage	Seed yield ability	Same above
	4.Plant type breeding	Special plant type or factors	Seed yield ability	
	5.Seed quality breeding (for example soybean)	Protein 41.5% fat ＞ 21.5%	Seed yield ability or Important ecological traits	Seed yield ability or Important ecologic traits

"Leaf size" breeding was included in plant type breeding, yield ability breeding should use guiding growing period and stem type as promising

Leading Think Setting Up Breeding Technology System

Scientific breeding technology system setting up using original theory as leading, using quickening superior trait getting together as core, using individual event breeding of important trait as assuring and closed combination with synthesis breeding as technology route, using unified variety resource and preparing breeding as basis [Fig.3]. Two technology keys Firstly was individual event breeding going ahead, individual event and closed combination with synthesis

© 2022 London Journals Press

breeding. Secondly parents of individual event breeding should being "expert in one thing and good at many" (Table 3).

Technology Methods of Quickening Superior Trait Getting Together

1) continuing raising increase yield trait (sink) level, 2) breeding and selection of increase new raising yield trait (Table 3,Fig 3) 3) setting up individual event breeding, two parents combination should achieve superior×superior of important traits, three main traits all should have strict demand, 4) when compound crossing combination, keeping less or not difference of important ecologic traits (specially growing period and stem type), yield ability must accomplish superior×superior, thus yield trait differences among progeny plant were mainly produced by addition effect of quantitative characters, and reducing interference of non-addition effect of ecologic characters, phenotype and genotype of yield characters were more similar, frequency of superior gene more high, 5) crossing and selecting method of two extreme type: for example big ear and more ear were two extreme types, they supplement each other and each other exist condition. In breeding at the same time compound big ear×big ear, more ear×more ear, more ear ×big ear three type crossing, not only can raise frequency of superior genes but also drive development of middle type.

IV. CROSSING BREEDING AND TRANSFORMATION GENE BREEDING

6.1 Concerning Nature of Breeding

Sexual crossing breeding belong to opening breeding, transformation gene breeding closed breeding. This was most intrinsic difference between two breeding, this theory also enlightened under original theory, " Net system of genetic trait of yield performance of a variety" and produced. Concept of open breeding and closed breeding also were most intrinsic concept by nature (see 4.3.4). Biggest defect of transformation gene breeding was not increasing yield ability of a variety, because transforming gene absorbed energy of acceptor to express itself, reducing energy supplying for yield ability trait, closed acceptor cannot increase itself energy. Transforming gene express required energy the more the more inducing yield.

Sexual crossing breeding belong to open breeding, its distinguishing feature was whole gene system participating all in recombination, can produce linkage improvement of voluntary selection trait and non-voluntary selection trait, final was due to this improvement, plant absorbed and used more energy from environment conditions, thus assuring improvement of adaptable –ecological trait and yield ability trait, increasing yield or improving quality.

Open nature of sexual crossing breeding decided it will always having a losing not foothold and any breeding way all cannot replace it.

6.2 Transforming Gene Breeding Always Leaving Not Sexual Crossing Breeding

At present stage, transforming gene breeding mainly transformed distant plant or crop gene into big area planting crops, thus gene in being transforming crop was not having. But only first being successfully transforming gene variety was true, after this using sexual crossing method transforming into other superior varieties, were not true, because varieties source and breeding method all were sexual crossing, new varieties being transformed always were from sexual crossing breeding. Transformation gene breeding already had close to fifty years history, only two genes were successful transformed and large area planting, also appearing negative effects, the more states the more banning transforming gene grain crops. But here only saying technology, technology difficult degree of transforming gene breeding was very big and big, very long circle, very high cost and being several ten to hundred times of cost of crossing breeding and most invalid cost, these were cause of its always leaving not crossing breeding. At the least developing states should not blindly and positively do transforming gene breeding.

© 2022 London Journals Press

6.3 Sexual Crossing Breeding Must Transforming Experience Breeding Into Scientific Breeding, but Cannot Change Its Guiding Position

Present sexual crossing breeding having ten difficult problems: 1) How to form the yield of a crop variety? What was its importance? Why it was most important theory base of crop breeding? 2) How to solve scientifically problem of yield stability of crop variety? What was its theory base? Which contents Variety Ecology of Crops should include? Why Variety Ecology of Crops con not was early produced? 3) Crossing breeding itself could or could not, should or should not produce its scientific engineering technique system? 4) Lacking high level original materials was a most universal and biggest problem in crop breeding.

For example, before soybean of China was best-selling on international market due to excellent quality, after it was pushed out due to big quality falling back. How to solve such problems? 5) How can make additive effects among yield ability characteristic genes to be showed, distinguished and selected 6) What was source producing hybrid vigor of F1 generation among variety crossing? 7) In breeding of self crossing crop variety and self-crossing line of hybrid vigor utilization crop using F1 generation can or can not test, distinguish, select excellent crossing combinations that had bigger additive effect among seed yield ability genes, worse combinations that had bigger non-additive effect among seed yield genes were sifted out, 8) Which was nature between general blood relationship and characteristic, and which represented even more difference of germplasm(gene)? 9) How can do that important ecological characteristics and yield ability characteristics of material to be selected could all and more quickly reached first-rate or good level? How can do that both germplasm of necessarily excellent character was introduced, and germplasm source was opened up, absolute level of yield ability characteristic of progeny population was also raised? 10) How to reduce population scope, and raised breeding efficiency and lower cost of input?

This article writing just right for solving above difficult problems in experience breeding, after learning and understanding step by step to do.

Doing well sexual crossing breeding can continually give superior variety for transformation gene breeding or molecule breeding, because the latter(two breeding) only always doing spare parts, cannot do whole plant, sexual crossing breeding will always be guiding position, feeling free to have itself problem and shortcoming.

REFERENCES

1. Letter of invitation of Nancy Albert, Scientific Program Coordinator to Peizhan Tian on Global Summit on Plant Science & Plant Physiology during 12-14, 2018, in Kuala Iumpur, Malaysia.
2. Scientific Program of 2018 Global Summit on Plant Science & Plant Phsiology.
3. Peizhan Tian, 2014, Theoretical Genetics and Breeding Science [M]. Jilin Science-Technology Publishing. (Changchun, Jilin, China).
4. Peizhan Tian, 2015, Basic Principle and Technique System of Crop Breeding [J] Open Access Library Journal, 2015, Dol:10. 4206/oalib 1102032.
5. Peizhan Tian, 1975, Pod-bearing Habit Problem in Soybean Breeding [J]. Acta Genetica Sinica, (Beijing, China) 2(4) 337-343.
6. Peizhan Tian, Ecology of Crop Variety, 2018 (no publishing).
7. Peizhan Tian, Science of Yield Ability of Crop Variety, 2018 (no publishing).
8. Peizhan Tian, 2021, Book Publisher International, Cutting-edge Research in Agricultural Sciences [M] Vol. 5, Chapter 9, P116-125.
9. [9] Peizhan Tian, 2015, Improvement Cycle for Yield Ability of Variety [J], Open Access Library Journal, 2015, Dol: 10. 4236/oalib, 1102221.
10. Peizhan Tian, 2013, Difference of Diameter at Top and Base of Main Stem Being Essentially Distinguishing Factor of Different

© 2022 London Journals Press

Pod-bearing Habit in Soybean, Jilin Agricultural Science (Chuangchun, Jilin, China) 38(2)4-6.
11. Buyang Xiao, 2006, Ecologic Breeding of Spring Wheat [M], Agricultural Publishing of China (Beijing).
12. Shiqing Chen. Technical Terms Table of Symmetry Economics, Baidu Net, "Original theory" Technical terms.

© 2022 London Journals Press

Scan to know paper details and
author's profile

A Review - Study on Phytochemical and Neuropharmacological Effects of Cassia Tora Flowers

Tarique Hussain, Dr. Abdul Hafiz, Vishwakarma Ravi, Dr. Deepak Kumar & Dr. Imran Kazmi

Glocal University-Delhi-Yamunotri

ABSTRACT

Cassia tora flowers family-Leguminosae/ Fabaceae has great medicinal properties and used to treat various diseases. Flowers racemes terminal, oblong to rounded corymbose sepals5.petals 5, yellow, perfect stamens 6-7.Contains chemical compounds like: Anthraquinoness, chrysophanol, emodine, rhein, euphol, basseol, iso-istearic, palmatic, behenic acid etc., all chemicals isolated from this plants drugs that effects the nervous system and its functioning, within the brain.there are still no effective therapies Neurological related problems are so common today, that approximately 18% population suffer from disorders each year.

Keywords: phytochemical and neurophar- macological effects, cassia tora.

Classification: DDC Code: 341.1 LCC Code: HA154

Language: English

London Journals Press

LJP Copyright ID: 925642
Print ISSN: 2631-8490
Online ISSN: 2631-8504

London Journal of Research in Science: Natural and Formal

Volume 22 | Issue 2 | Compilation 1.0

© 2022. Tarique Hussain, Dr. Abdul Hafiz, Vishwakarma Ravi, Dr. Deepak Kumar & Dr. Imran Kazmi. This is a research/review paper, distributed under the terms of the Creative Commons Attribution-Noncom-mercial 4.0 Unported License http://creativecom-mons.org/licenses/by-nc/4.0/), permitting all noncommercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

A Review - Study on Phytochemical and Neuropharmacological Effects of Cassia Tora Flowers

Tarique Hussain[α], Dr. Abdul Hafiz[σ], Vishwakarma Ravi[ρ], Dr. Deepak Kumar[Ↄ] & Dr. Imran Kazmi[¥]

ABSTRACT

Cassia tora flowers family-Leguminosae/ Fabaceae has great medicinal properties and used to treat various diseases. Flowers racemes terminal, oblong to rounded corymbose sepals5.petals 5, yellow, perfect stamens 6-7. Contains chemical compounds like: Anthraquinoness, chrysophanol, emodine, rhein, euphol, basseol, iso-istearic, palmatic, behenic acid etc., all chemicals isolated from this plants drugs that effects the nervous system and its functioning, within the brain.there are still no effective therapies Neurological related problems are so common today, that approximately 18% population suffer from disorders each year.

These disorders produces serious health problems like behavioral / cognitive syndrome, sleep disorders, peripheral disorders, epilepsy, neurodegenerative disorders, Parkinsonism, neoplasm and many others. Parts of Cassia tora are used as an antifungal, antihelmintic, diuretic, expectorant, and laxative, treatment of glaucoma, hypertension, and treatment of skin diseases, ringworm and itch. Pharmacological and phytochemical studies of flowers part of Cassia Tora plants which have been done in different parts.

Keywords: phytochemical and neuropharmacological effects, cassia tora.

Author α: Glocal University-Delhi-Yamunotri Marg (State Highwat75) Mirzapur Pole, Dist-Saharanpur-247121, Up, India.
σ: Glocal University-Delhi-Yamunotri Marg (State Highwat75) Mirzapur Pole, Dist-Saharanpur- 247121, up, india.
ρ: Arya College of Pharmacy-Jaipur, Rajsthan- 302028, India.
Ↄ: Jss College of Pharmacy-Ooty, Tamilnaidu-643001.
¥: King Abdul-Aziz University, Jeddah, Saudi Arabia.

I. INTRODUCTION

Medicinal herbs constitute the corner stone of traditional medicinal practice worldwide. These herbs are relatively cheap and easily available.

These medicinal plants represent a great deal of untapped reservoir of drugs and the structural diversityof their component molecule makes a valuable source of novel lead compounds. The world health organization about 80% of living organism like: Human, developing countries almost exclusively on traditional medicines for first health care needs. The present review traditional medicines uses and recent studies on the active isolated compounds. The hole plants as well as specific parts like: Roots, Leaves, Seeds and Flowers have been widely used in Indian and south Asian medicine it is an annual monsoon weed prevalent in wastelands having many antimicrobial properties ,have the problem of pollution and health hazards of conventional agro chemical in view deals with conducted to test its seeds extract against the common aerial fungus, soil fungus and root fungus in forest eco-systems.

Furthermore, about 80% of the world population is dependent on plant-based drugs (WHO, 1996). In Nigeria and most developing countries of the world, rural and urban dwellers, literate or illiterate rely heavily on herbal preparations for the treatment of various diseases despite the availability of orthodox medicinethe alternate system of medicine like Ayurveda, Sidda, Unnani,

© 2022 London Journals Press

and other tribal folklore medicines have significantly contributed to the health care of population of India. Today, these systems are not only complementary but also competitive in the treatment of various diseases. Initially the materials employed in these traditional medicines were almost botanical origin.

II. MATERIALS AND METHODS

MATERIALS

Drug:	*Reagents:*	*Instruments:*
Ibuprofen Pentazocine Chlorpromazine Valproic acid, Diazepam *Plant:* The fresh leaves of*Cassia tora*	Benedict's reagent. Barfoed's reagent. Million's reagent Dragendroff's reagent. Hager's reagent Mayer's reagent. Wagner's reagent *Chemicals:* Petroleum ether Chloroform Ethanol	• Eddy's hot plate- Medicraft Pvt. Ltd, Ambala A-10-042 Whole Board • Soxhlet apparatus- Biotechnics, India. Double distillatory- Infusil-India Pvt. Ltd. Bangalore.(Mark 2000 DDQ-X2) Electronic weighing balance- Citizen scale, India Oral feeding needle- Space Lab, Nasik

PLANT PROFIELE:

Botanical Name- Cassia Obtusifolia

Synonym- Cassia tora, SennaObtusifolia

Family-Leguminosae

Vernacular name- Panwar, Penwaad , Sanjsaboya,

Sangsaboya, Taarutaa, Ringworm plants, foetidecassia etc.

Common (Indian) names:

Hindi: Charota, Chakwad, Chakavat.

Bengali & Oriya: Chakunda

Guajarati: Kawaria

Canarese: Gandutogache

Malayalam: Chakramandrakam, takara

Marathi: Takala

© 2022 London Journals Press

London Journal of Research in Science: Natural and Formal

III. METHODOLOGY

The flowers of Cassia tora are collected and shade dried. Coarse powder is made from these dried flowers and subjected to extraction in increasing polarities. Various extracts are prepared by using suitable solvents like petroleum ether, chloroform, alcohol and aqueous solvent.Each crude extract obtained after evaporating the solvent subjected to preliminary phytochemical screening and these extracts are utilized for neuropharmacological activity. Stock solution of formulation under study was prepared freshly, on the day of experimentation using distilled water.

The dose of formulation-500mg/kg, was selected for the study, the selected doses represent 1/4 of 2000mg/kg. Healthy, Albino Swiss mice- the chosen experimental animals were maintained in our animal house (12:12 dark: light cycle), with adequate ventilation, hygienic conditions maintained on normal palliated diet and water ad libitum. A group of six animals were housed in polypropylene cage of 26 X 19 X 13cm on paddy husk bed and covered with stainless steel wire mesh 28 X 20.5 cm with provision for water and feed. Healthy, Albino Swiss mice, of either sex (unless otherwise specified) weighing between 18-25 gm. were employed for study. All experiments were performed in research lab all parameters of different tests were observed and recorded by person blind to treatment protocol.

For all experiments, group refers to group of six animals (n=6).Data generated from various experimental procedures were analyzed for statistical significance followed by Dennett's multiple comparison tests.

Successive Solvent Extraction: The powdered material was subjected to batch extraction in Soxhlet apparatus. The solvents used were petroleum ether, chloroform, alcohol and. distilled water. The powdered material of Cassia tora leaves were evenly packed in a Soxhlet extractor for extraction for about 36 hours with different solvents.

Preliminary photochemical investigation of extract: Qualitative chemical tests were conducted for Petroleum ether, ethanolic, Chloroform and aqueous extracts of flowers of Cassia tora to identify the various phytoconstituents. The phytochemical investigation showed presence of flavonoids, saponins, carbohydrates, starch, gum, proteins, tannin and phenolic compounds.

Tests for Carbohydrates- Molisch's test (General test)

For Reducing Sugars- Fehling's test, Benedict's test

Test for Monosaccharide's- Barfoed's test

Tests for Non-Reducing Sugars- 1.Test solution do not give response to Fehling's and Benedict's test.2.Tannic acid test for starch: With 20% tannic acid, test solution was observed for precipitate

Tests for Proteins- Biuret test, Millon's test, Xanthoprotein test, Test for protein containing sulphur, Precipitation test,

Tests for Steroids- Salkowski Reaction, Liebermann-Burchard Reaction

Tests for Amino Acids- Ninhydrin test, Test for Tyrosine, Test for tryptophan

Tests for Flavonoids- Shinoda test, Ferric chloride test

Tests for Alkaloids- Dragendroff's test, Mayer's test, Hager's test, Wagner's test

Tests for Tannins and Phenolic Compounds- To 2-3 ml test solution, added few drops of following solutions and was looked for respective colouration or precipitate

5% Ferric chloride solution:- Deep blue-black coloured.

1) *Lead acetate solution: -* White precipitate.
2) *Gelatin solution: -* White precipitate.
3) *Bromine water:-* Decoloration of bromine water.
4) *Acetic acid solution:-* Red colour solution.
5) *Potassium dichromate:-* Red precipitate.

Tests for Vitamins-Test for Vitamin A, Test for vitamin C (Ascorbic acid), Test for Vitamin D

IV. TESTS FOR GLYCOSIDES

General test for Glycosides-Part A: To 2-3 ml of extract dil H2SO4was added and heated on a

© 2022 London Journals Press

water bath for 1-2mins. Neutralise with 10% NaOH, check with litmus paper and to resulting solution add Fehling's A and B. Increased red precipitate in this case shows glycosides are present. Part B: To 2-3 ml of extract, water was added and heated. According to need, NaOHwas added for neutrlaisation and also added equal quantity of water. To the resulting solution added Fehling's A and. Increased red precipitate in this case showed glycosides are absent.

Tests for Cardiac Glycosides- Baljet's test, Legal's test (For cardenoloids), Test for deoxysugars (Kellar Killani test), Libermann's test (For bufadenolids)

Tests for Saponin Glycosides- Foam test, Haemolytic test

V. PHARMACOLOGICAL INVESTIGATION

ACUTE (ORAL) TOXICITY STUDY (Acute oral toxicity Fixed Dose Procedure, FDP)

Acute oral toxicity study for the proprietary formulation was carriedoutusing OECD/ OCEDguideline 420 (modified adopted 23rd march 2006).The test procedure minimizes the number of animals required to estimate the oral acute toxicity of a chemical and in addition estimation of LD50, confidence intervals. Thetest also allows the observation of signs of toxicity and can also be used to identify chemicals that are likely to have low toxicity.

Principle of the FDP- The fixed dose procedure is method for assessing acute oral toxicity that involve the identification of a dose level that cause evidence of non-lethal toxicity(termed evident toxicity) rather than a dose level that cause lethality. Evident toxicity is a term describing clear signs of toxicity following administration of test substance, such that an increase to the next highest fixed dose would result in the development of severs toxic signs and probably mortality.

Procedure: Healthy, young adult Albino Swiss mice (18-25gm), nulliporous and non-pregnant were used for this study Food, but not water was withheld for 3-4 hours and further 1-2 hours post administration of sample under study Fixed dose level of 5, 50, 500 mg/kg were initially chosen as dose level that would be expected to allow the identification of dose producing evident toxicity. During the validation procedure, a fixed dose of 2000mg/kg was added to provide more information on substance of low acute toxicity.

Observation: Animals were observed individually at least every 5 minutes once during first 30 minutes after dosing, periodically at 2hrs during the first 24 hours (with special attention during the first four hours) and daily thereafter, for a total of 14 days

VI. RESULTS

Percentage Yield, Colour, Consistency and Solubility in Water of Different Extracts

PlantPart Used	Extracts	Percentage Yield	Color	Consistency	Solubility in Water
Cassia tora leaves	Petroleum	2.08	Dark green	Sticky	Insoluble
	Chloroform	1.95	Dark green	Sticky	Soluble
	Ethanol	1.96	Dark green	Sticky	Highly soluble
	Aqueous	2.13	Dark brown	Dry powder	Highly soluble

PRELIMINARY PHYTOCHEMICAL SCREENING of *Cassia tora*

Phytocheical constituents	Pet ether	Chloroform	Ethanol	Aqueous
Alkaloids	-	+	+	+
Glycosides	-	++	++	++
Carbohydrates	-	+	+	+

© 2022 London Journals Press

Flavonoids	-	+	+++	+++
Saponins	-	+	+++	+++
Tannins	-	+	+++	+++
Steroids	-	-	++	++
Proteins	+	+	+	+
Fats and oils	++	-	-	-
Starch	-	-	++	++
Gums	-	-	+++	+++
Phenolic compounds	-	-	+++	+++

- absent ++more clarity
+ indicates +++ better response

NEUROPHARMACOLOGICAL STUDY

Effect of EEC and AEC on Exploratory behavior in mice:

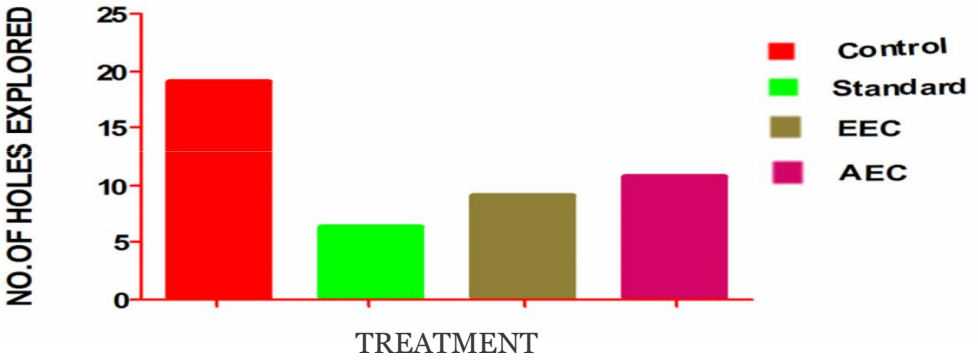
S.NO	Groups	Dose(mg/kg)	No.of Head dip
1	Control	-	19.2±1.12
2	Chlorpromazine	1	6.33±0.66 [c]
3	EEC	500	9.17±7.45 [a,d]
4	AEC	500	10.83±1.95 [a,d]

All values are mean±SEM, (n=6), [a]$P<0.05$, [c]$P<0.001$, when compared with control. [d]$P<0.05$ when compared with standard.

Effect of EEC and AEC flowers on exploratory behavior in mice (Percentage inhibition)

Sr. No.	Groups	Dose(mg/kg)	No, of head dip	Percentage Inhibition
1	Control	-	19.2±1.12	-
2	Standard (Chlorpromazine)	1	6.33±0.66[c]	67.03.52
3	Ethanolic extract	500	9.17±7.45[a,d]	52.23
4	Aqueous extract	500	10.83±1.95[a,d]	43.59

Effect of EEC and AEC leaves on exploratory behavior in mice:

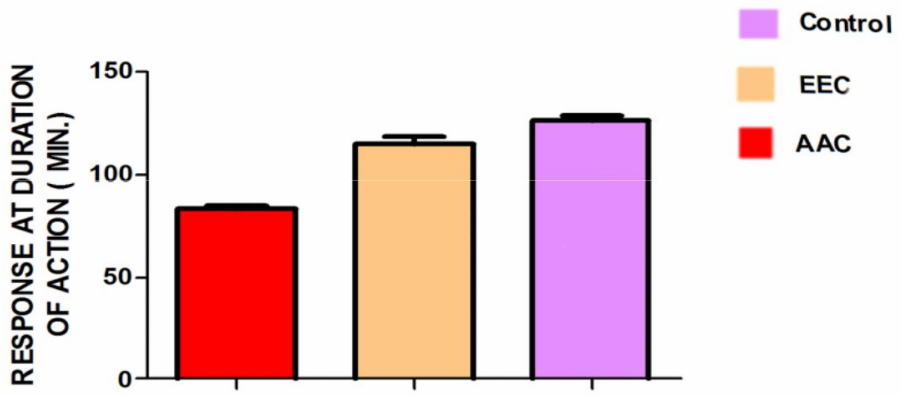


© 2022 London Journals Press

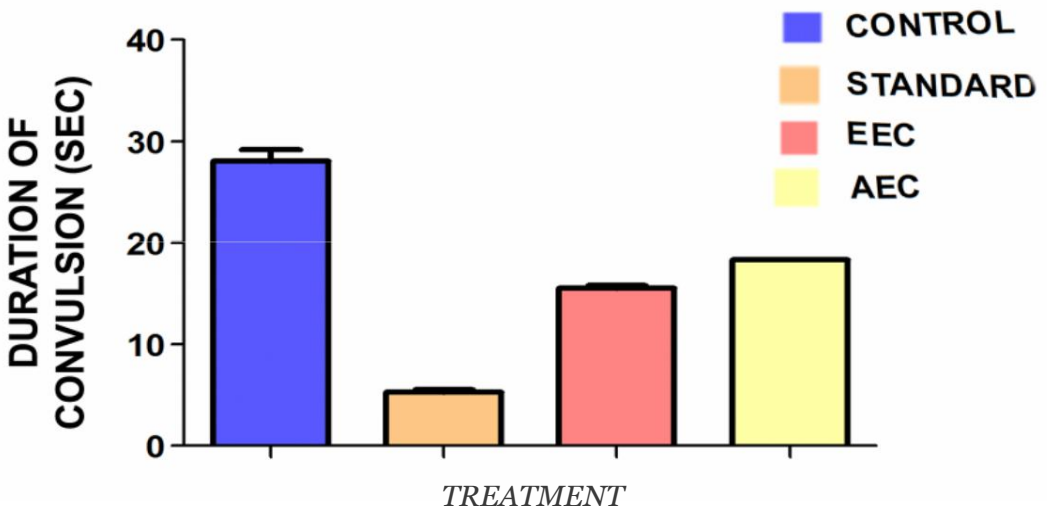
Effect of EEC and AEC on diazepam induced sleeping time:

Sr.No.	Groups	Dose(mg/kg)	Onset of Action (min)	Duration ofAction (min)
1	Control(Diazepam)	5	121.8±5.5	83.00±2.04
2	EEC+Diazepam	500	83.83±2.15[b]	114.7±3.48[b]
3	AEC+Diazepam	500	54.00±1.65[b]	126.0±1.92[b]

all values are mean±SEM, n=6, [b]$P<0.001$, when compared with control
Effect of EEC and AEC on diazepam induced sleeping time:



Effect of EEC and AEC on Maximal Electroshock (MES) Method Graph:



VII. CONCLUSION

The present work suggests that it requires isolating and characterizing the active components responsible for the neuropharmacological activities and further studies to reveal the exact mechanisms of action responsible for the neuropharmacological activities of Cassia tora flowers. Both the extracts EEC and AEC at the dose 500mg/kg body weight along with valproic acid at the dose 300mg/kg body weight showed significant reduction in time to recover

© 2022 London Journals Press

from electrically induced convulsions in mice when compared with control group (15.52±0.22,18.33±0.16 and 28.17±1.01, P<0.001, P<0.001 and P<0.001).The sedative-hypnotic effect of EEC and AEC was assessed using diazepam induced sleeping time. The preliminary phytochemical evaluation of different extracts of cassia toraflowers revealed the presence of flavonoids, carbohydrates, starch, gum, proteins,tannins, saponins and phenolic compounds. The results of phytochemical analysis were significant in ethanolic and aqueousextracts when compared with petroleum ether and chloroform extracts. In the present study effect of EEC and AEC on various parameters like exploratory behavior, analgesic activity, sleeping time and anti-convulsion activity was studied to expose the neuropharmacological property in different animal models.

REFERENCES

1. Dabriyal, RM, Narayana, DBA, Ayurvedic Herbal Raw Material, The Eastern Pharmacist, 1998, 31-35.
2. Nadkarni, R.M., Indian Materia Medica, Vol I, Popular Book Depot, Mumbai, 1954, p.291.
3. Shibata,S., Morishita, E., Kaheda, M., Kimura, Y., Takido, M and Takashashi, S., Pharm.Bull, 1969, 17,454.
4. Green MM, Singer JM, Sutherland DJ, Hibben CR. 1991. Larvicidal activity of Tagtesminuta (marigold) towardAedesaegypti. J Am Mosq Control Assoc7:282–286.
5. Jang YS, Baek BR, Yang YC, Kim MK, Lee HS. 2002. Larvicidal activity of leguminous seeds and grainsagainst Aedesaegyptiand Culexpipienspallens. J AmMosq Control Assoc18:210–213. [13]. Jang, Y. S.; Baek, B. R.; Yang, Y. C.; Kim, M. K.; Lee, H. S.Larvicidal activity of leguminous seeds and grains against Aedesaegyptiand Culexpipiens-pallens(Diptera: Culicidae). J. Am.Mosq. Control Assoc. 2002, 18, 210-213.
6. Zadikoff CM. 1979. Toxic encephalopathy associated with use of insect repellent. J Paediatr95:140–142 [32]. WHO Malaria factsheet, 2014
7. Yen, G. C.; Chung, D. Y. Antioxidant effects of extracts from Cassia toraL. Prepared under different degrees of roasting on the oxidative damage to biomolecules. J. Agric. Food Chem.1999, 47, 1326-1332.
8. WHO [World Health Organization]. 2002. The worldhealth report 2002—reducing risks, promoting healthy life Geneva, Switzerland: World Health Organization [27].
9. Wink M. 1993. Production and application of phytochemicals from an agricultural perspective. In: van Beek TA,Breteler H, eds. Phytochemistry and agriculture Oxford, United Kingdom: Clarendon Press. p 171–213.
10. Choi, J. S.; Lee, H. J.; Park, K. Y.; Ha, J. O.; Kang, S. S. InVitro antimutagenic effects of anthraquinone aglycones andnaphthopyrone glycosides from Cassia tora. Planta Med. 1997,63, 11-14.
11. Jain S, Patil K. Phytochemical and pharmacological profile of Cassia tora Linn-an overview. Indian J Nat Pro Res. 2010; 1(4): 430-7.
12. Froestl W, Pfeifer A, Muhs A. Cognitive enhancers (Nootropic) Part 3 Drug interacting with targets other than receptor or enzymes disease modifying drugs. J Alz Dis. 2013; 34(1): 1-114.
13. Pitchaimani V, et al. Nootropic activity of acetaminophen against Colchicin induced cognitive impairment in rats. J Clin Biochem Nutr. 2012; 50(3): 241-4.
14. Ingkaninan K, Temkitthawon P, Chuenchom K. Screening for acetylcholinesterase inhibitory activity in plants used inThai traditional rejuvenating and neurotonic remedies. J Ethnopharmacol. 2003; 89(2): 261-4.
15. Murray A, Faraoni M, Castro M. Natural AChE inhibitors from plants and their contribution to Alzheimer's disease therapy. Current Neuropharmacology 2013; 11(4): 388-413. 18. Agnati LF, Genedani S, Leo G. Aβ peptides
16. Akbar S.M. Tariq and M. Nisa. A Study on CNS depressant activity of Salviahaematodes Wall. Pharmaceutical Biology 1984; 22(1): 41-44.
17. Varma RK, Garg B.D. and Ahmad A.Pharmacodynamic studies on Kalanchoe integra-an indigenous plant 1986; 18: 78-83.

© 2022 London Journals Press

18. Syed Kamil M, Liyakat Ahmed MD and Paramjyothi S. Neuropharmacological effects of ethanolic extract of Portulaca quadrifida Linn. In mice. International journal of pharm Tech research 2010; 2(2):1386-1390
19. Trease G.E and Evans M.C. Textbook of Pharmacognosy, 14thed. London.2002; 81-90: 269-275,300.http://en.wikipedia.org/wiki/Yhe_ Neurologist.
20. Ganeshchandra Sonavane, Vikram Sarveiya, Veena Kasture, Sanjay B. Kasture. Behavioral actions of Myristica fragrans seeds. Indian Journal of Pharmacology 2001; 33: 417-424
21. Radhakrishnan R., Zakaria M.N.M., Islam M.W. Chem H.B., Kamil M., Chan K and Al-Attas A. Neuropharmacological actions of Portulaca oleraceae L.V.Sativa (Hawk). J. of Ethanopharm. 200;.76: 171-176.
22. Shafiuddin MD., Liyakhat Ahmed MD., Taranalli A.D. and Khaja pasha. Influence of cyclohexanoyl thiosemicarbazide and some anticonvulsant drugs on neurotransmitter levels in rat-brain. Int.J. of Chem.Sci. 2009; 7(1): 264-272.
23. Ganeshchandra Sonavane, Vikram Sarveiya, Veena Kasture, Sanjay B. Kasture. Behavioral actions of Myristica fragrans seeds. Indian Journal of Pharmacology 2001; 33: 417-424.
24. Umar Kyari Sandabe, Patrick Azubuike Onyeyili, and Gregory Anene Chibuz. Sedative and anticonvulsant effects of aqueous extract of Ficus sycomorus L. (Moraceae) stembark in rats. Veterinarski Arhiv 2003; 73 (2):103–110.
25. Tripathi KD. Essential Medical pharmacology, 2nd ed. Jaypee Brothers Publication, New Delhi.1988: 390-91.
26. Rahimi R., Nikfar S. and Abdullahi M. Efficacy and tolerability of Hypericumperforatum in major depressive disorder in comparison with selective serotinreuptake inhibitors: A Metaanalysis. Prog Neuropsychopharmacol. Biol. Psychiatry 2009; 33:118-27.
27. Kokate CK., Purohit AP.,and Gokhale SB. Textbook of Pharmacognosy,36thed; Nirali Publication, Pune.2006:36,126.
28. Everitt B. J and Robbins T. W. Neural systems of reinforcement for drug addiction from actions to habits to compulsion. Nature Neuroscience 2005; 8(11): 1481-1489.
29. Hossein Hosseinzadeh and Vahid Khosravan. Anticonvulsant effects of aqueous and ethamolic extracts of Crocus sativus L. stigmas in mice. Arch. Irn. Med. 2002; 5(1):44-47.
30. Vision 2030, Project Directorate on Poultry. (2011) Available from: http://www.pdon poultry.org/pdpnew/images/extfiles/reports/PDP_Vision_2030.pdf. Accessed on 27-02-2016.
31. McNamee, S.E., Cunningham, R. and Elliott, C.T. (2013).
32. Simultaneous immunochemical detection of four banned antibiotic growth promoters in raw and cooked poultry tis-sue. Food Addit. Contam. A., 30: 1270-1278.

© 2022 London Journals Press

Scan to know paper details and
author's profile

Dynamics of the Drive the Milling Cutter Functional Body of the Combined Sowing Machine

Dimitri Natroshvili, Ivane Kapanadze & Maia Lomishvili

Georgian Technical University

ABSTRACT

The article presents the justification of the dynamic parameters for the drive of the milling machine of the combined sowing machine. The optimal value of the inertia torque for the vertical axis milling cutter is determined according to the conditions of maintaining the degree of soil loosening.

Keywords: sowing machine, milling cutter functional body, inertia torque;

Classification: FOR CODE: 099901

Language: English

London Journals Press

LJP Copyright ID: 925643
Print ISSN: 2631-8490
Online ISSN: 2631-8504

London Journal of Research in Science: Natural and Formal

Volume 22 | Issue 2 | Compilation 1.0

© 2022. Dimitri Natroshvili, Ivane Kapanadze & Maia Lomishvili. This is a research/review paper, distributed under the terms of the Creative Commons Attribution- Noncom-mercial 4.0 Unported License http://creativecommons.org/licenses/by-nc/4.0/), permitting all noncommercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Dynamics of the Drive the Milling Cutter Functional Body of the Combined Sowing Machine

Dimitri Natroshvili[α], Ivane Kapanadze[σ] & Maia Lomishvili[ρ]

ABSTRACT

The article presents the justification of the dynamic parameters for the drive of the milling machine of the combined sowing machine. The optimal value of the inertia torque for the vertical axis milling cutter is determined according to the conditions of maintaining the degree of soil loosening.

Keywords: sowing machine, milling cutter functional body, inertia torque.

Author α: Professor, Doctor of Technical Sciences, Department of Agro-Engineering, Georgian Technical University, Georgia, 0192, Tbilisi, 17 D. Guramishvili Street.
σ: Academic Doctor of Agro-Engineering, assistant professor.
ρ: Academic Doctor of Agro-Engineering assistant professor, Department of Agro-Engineering, Georgian Technical University, Georgia, 0192, Tbilisi, 17 D. Guramishvili Street.

I. INTRODUCTION

The calculating scheme of the drive the milling cutter functional body (Figure 4) of the combined sowing machine may be various according to which parameters of the system are researched. To determine the required capacity developed by the engine for the driving of a milling machine, the degree of inequality of the drive ring and the inertia torque reduced by the flywheel it is sufficient to represent all the driving mechanisms of the research node as one absolutely solid mass by its inertia torque I_1, on which the reduced outer forces have impact, varying according to the given law (Figure 1).

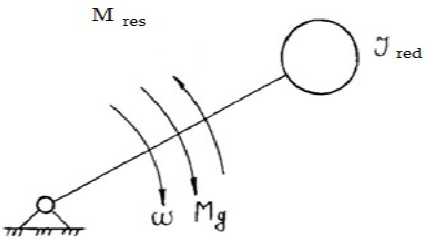


Figure 1: Single calculating scheme.

The equation of motion the rotating mechanisms of the drive the milling cutter functional body may be compiled using the Lagrange second order equation:

$$\frac{d}{dt} \bullet \frac{\partial T}{\partial q_i} - \frac{\partial T}{\partial q_i} + \frac{\partial \Pi}{\partial q_i} = M_i \qquad (1)$$

Where T is system kinetic energy;

© 2022 London Journals Press

London Journal of Research in Science: Natural and Formal

q_i - Generalized ortina;

Π - Potential energy of deformation of flexible elements;

M_i - i-mass added outer torque;

According to the torque s of research the milling body (1), the formula will take the following form:

$$I(f)\frac{d\omega}{dt} + \frac{\omega}{2} \bullet \frac{dI_{(\varphi)}}{dt} = M_g(\omega) - M_c(\varphi, \omega, t) \quad (2)$$

Where ω is the angular velocity of the drive ring;

$M_g(\omega)$- The torque of inertia of the engine, which depends on the speed of rotation and its value is selected according to the mechanical characteristics of the engine;

$M_c(\varphi, \omega, t)$- Resistance reduced torque , by common manner, which is depended on φ, ω, t magnitude, separately or on several simultaneously;

t - Time.

Equation (2) in the frequent cases is better to be presented by the following manner:

$$I(\varphi)\omega\frac{d\omega}{d\varphi} + \frac{\omega^2}{2} \bullet \frac{dI_{(\varphi)}}{d\varphi} = M_g(\omega) - M_c(\varphi, \omega, t) \quad (3)$$

It is known, that milling funct5ional bodies have the permanent inertia torque, then (2) and (3) equation may be represented by simplified manner:

$$I\frac{d\omega}{dt} = M_g(\omega) - M_c(\varphi, \omega, t) \quad (4)$$

or

$$I\frac{d\omega}{d\varphi} = M_g(\omega) - M_c(\varphi, \omega, t) \quad (5)$$

As can be seen from the above differential equation, in order to research the milling cutter functional body of the combined sowing machine it is necessary to know the regularity of the inertia torque for the corresponding mechanism, the regularity of the useful resistance torque on the milling cutter and the mechanical characteristics of the tractor engine.

(3)...(5) The equations are generally linear, which can be solved using approximately numerical and graphical methods.

Regarding the rotating working bodies driven by a diesel engine, (4) the torque developed by the engine to solve the equation on the driving shaft can be determined by the following equation

$$M_g(\omega) = A - B\omega \quad (6)$$

The parabola equation can be used to approximate the curve of the mechanical characteristics of the engine as well:

$$M_g(\omega) = A - B\omega^2 \quad (7)$$

© 2022 London Journals Press

Coefficients A and B are determined by the curve of the „$T - 25a$" diesel engine mechanical characteristics:

$$\begin{cases} A = \frac{M_{max}\cdot\omega_{nom}^2 - M_{nom}\cdot\omega_{max}^2}{\omega_{nom}^2 - \omega_{max}^2} \\ A = \frac{M_{max} - M_{nom}}{\omega_{nom}^2 - \omega_{max}^2} \end{cases} \quad (8)$$

where M_{max} is the maximum torque of the engine;

M_{nom} – torque;

ω_{max} and ω_{nom} are the angular velocities of the engine corresponding to th M_{max} and M_{nom} torques.

For the rotating functional bodies that are droven from a diesel engine to solve equation (4), the moment Mg (ω) developed by the engine on the driving shaft is better to be expressed by formula (7). According to such condition, (4) the differential equation can be written as follows:

$$I(\varphi)\omega\frac{d\omega}{d\varphi} + \frac{\omega^2}{2}\bullet\frac{dI_{(\varphi)}}{d\varphi} = A - B\omega^2 - M_c(\varphi) \quad (9)$$

(9) All members of the differential equation should be divided by small transformations on $I_{(\varphi)}\omega$ and we should obtain:

$$\frac{d\omega}{d\varphi} + f(\varphi)\omega + \frac{q_{(\varphi)}}{\omega} = 0 \quad (10)$$

$$f(\varphi) = \frac{\frac{1}{2}\bullet\frac{dI_{(\varphi)}}{d\varphi} + B}{I_{(\varphi)}} \quad (11)$$

$$q_{(\varphi)} + \frac{M_{c(\varphi)} - A}{I_{(\varphi)}} \quad (12)$$

If we introduce the marking ω^2=u, then (10) equation is transformed into a non-homogenous linear equation the second order of Bernoulli:

$$\frac{du}{d\varphi} + 2f_{(\varphi)}u = 2q_{(\varphi)} \quad (13)$$

Which common solution has the following form:

$$\omega_{(\varphi)} = \sqrt{exp - \left[2\int_0^{\varphi} f_{(\varphi)}d\varphi\right]\left\{C - 2\int_0^{\varphi} q_{(\varphi)}exp\left[2\int_0^{\varphi} f_{(\varphi)}d\varphi\right]d\varphi\right\}} \quad (14)$$

The angular velocity of the ring $\varepsilon_{(\varphi)}$ is determined by the following figures:

$$\varepsilon_{(\varphi)} = \frac{d\omega_{(\varphi)}}{dt} = \omega_{(\varphi)}\frac{d\omega_{(\varphi)}}{d\varphi} \quad (15)$$

or (14) through usage of the formula we will have

© 2022 London Journals Press

$$\varepsilon_{(\varphi)} = \left\{ f_{(\varphi)} \exp\left[-2\int_0^{\varphi} f_{(\varphi)} d\varphi \right] \left[C - 2\int_0^{\varphi} q_{(\varphi)} \exp\left(2\int_0^{\varphi} f_{(\varphi)} d\varphi \right) d\varphi \right] + q_{(\varphi)} \right\} \tag{16}$$

Depending on the angular velocity, the solution has the following form:

$$\omega_{(\varphi)} = \frac{1}{\sqrt{B}} \sqrt{In\left[\exp\left[-\int_0^{\varphi} f_{(\varphi)} d\varphi \right] \left\{ C + A\int_0^{\varphi} \exp\left[f_{\varphi} df \right] df \right\} \right]} \tag{17}$$

The permanent value C can be determined by review the initial conditions when considering a particular machine.

For rotating type functional bodies the torque of reduced inertia of the engine is permanent, then we will have according to equations (11) and (12)

$$f_{(\varphi)} = \frac{B}{I} \quad q_{(\varphi)} = \frac{M_{c(\varphi)} - A}{I}$$

In the initial conditions $t = 0;\ \omega = \omega_0$ The equation of the angular velocity of the drive ring (14) will take the following form:

$$\omega_{(\varphi)} = \sqrt{e^{-\frac{2B\varphi}{I}} \left\{ \omega_0^2 - \frac{2(M_c - A)}{I} \int_0^{\varphi} e^{\frac{2B\varphi}{I}} d\varphi \right\}}$$

From which

$$\omega_{(\varphi)} = \sqrt{\omega_0^2 e^{-\frac{2B\varphi}{I}} - \frac{M_c - A}{B}\left(1 - e^{-\frac{2B\varphi}{I}} \right)}$$

In the purpose of qualitative loosening the soil by the milling cutter body in the sowing line it is required, that driving ring angular velocity be in the certain limits. Milling cutter functioning body angular velocity variation restriction may be reduced to the inertia torque directly by the selection manner, but if required by the extra mass (by installing the flywheel). Variation limits of the drive ring angular velocity is reflected through the coefficient of the motion inequality:

$$\delta = \frac{2(\omega_{max} - \omega_{\min})}{\omega_{max} + \omega_{min}} \tag{18}$$

In we add value of (17) in formula (18) and conduct transformations we will obtain:

$$\delta = \frac{\frac{2A - M_0}{2B} - \sqrt{\frac{(2A - M_0)^2}{2B} - 4\left(\sum_{n=1}^{m} \sqrt{\frac{a_n^2 + b_n^2}{4B^2 + n^2 I^2}} \right)^2}}{\sum_{n=1}^{m} \sqrt{\frac{a_n^2 + b_n^2}{4B^2 + n^2 I^2}}} \tag{19}$$

In order to detect the optimal I value of the reduced inertia torque according to formula (19) we have the following main cases:

© 2022 London Journals Press

1. When$\left(\frac{nI}{2B}\right)^2 = 1$,of I value is selected before it is not satisfying (19) equality condition.
2. when $\left(\frac{nI}{2B}\right)^2 \geq 1$ this condition is fair when $\rightarrow\infty$, so when we are taking the maximum number of rows to disperse a Fourier row. In this case the task is solved unequivocally. From the formula (19) we can obtain the following inequality.

$$I \geq \frac{B\left([\delta]^2+4\right)\sum_{n=1}^{m}\sqrt{\frac{a_n^2+b_n^2}{n^2}}}{[\delta](2A-M_0)} \tag{20}$$

If we consider, that $\frac{\delta^2}{4} \approx 0$, we will obtain

$$I \geq \frac{4B\sum_{n=1}^{m}\sqrt{\frac{a_n^2+b_n^2}{n^2}}}{[\delta](2A-M_0)} \tag{21}$$

Case, when $\left(\frac{nI}{2B}\right)^2 \leq 1$ is less possible.

The obtained calculation formula (21) will allow us to select the desired value I of the inertia torque of for the given value of the coefficient of movement inequality (δ).

It is possible to determine the Fourier series coefficients when the function is given analytically.

The law of variation the resistance torque is given in the form of a curve, which exact analytical figure is unknown. During determining the coefficients, the integration is changed to the final summary.

Through using the mathematical method of harmonized analysis we can obtain the following formulas:

$$M_0 = \frac{1}{m}(y_1 + y_2 + y_3 + \ldots y_4)$$

$$\left.\begin{aligned} a_n &= \frac{2}{m}(y_1\cos 1\Delta x + y_2\cos 2\Delta x + y_3\cos 3\Delta x + \ldots + y_m\cos m\Delta x) \\ b_n &= \frac{2}{m}(y_1\sin 1\Delta x + y_2\sin 2\Delta x + y_3\sin 3\Delta x + \ldots + y_m\sin m\Delta x) \end{aligned}\right\} \tag{22}$$

Through using the mechanical characteristics of the tractor engine „T-25a“ (Fig. 2) and the graphic representation of the resistance torque (Fig. 3), we select the inertia torque of the milling cutter body of the combined sowing machine on the driving shaft.

According to the curve of the mechanical characteristics of the engine, the coefficients A and B are determined by formula (8).

$$A = \frac{93\cdot 7.62 - 91\cdot 5.34}{7.62-5.34} = 97.68\ nm$$

$$B = \frac{93-91}{7.62-5.35} = 0.88\ nm.sec^2$$

© 2022 London Journals Press

London Journal of Research in Science: Natural and Formal

The corresponding section of magnitude O_{φ} (figure 3) is divided into 24 equal parts (m = 24), we measure the magnitude of the ordinates according to the corresponding split points. (21) The mean value of the resistance torque including in formula Mo and the Fourier series coefficients are defined as follows:

$$M_0 = \frac{1}{24}(18.4 + 14.6 + 16.4 + \ldots + 9.7) = 26.229\ nm\,.$$

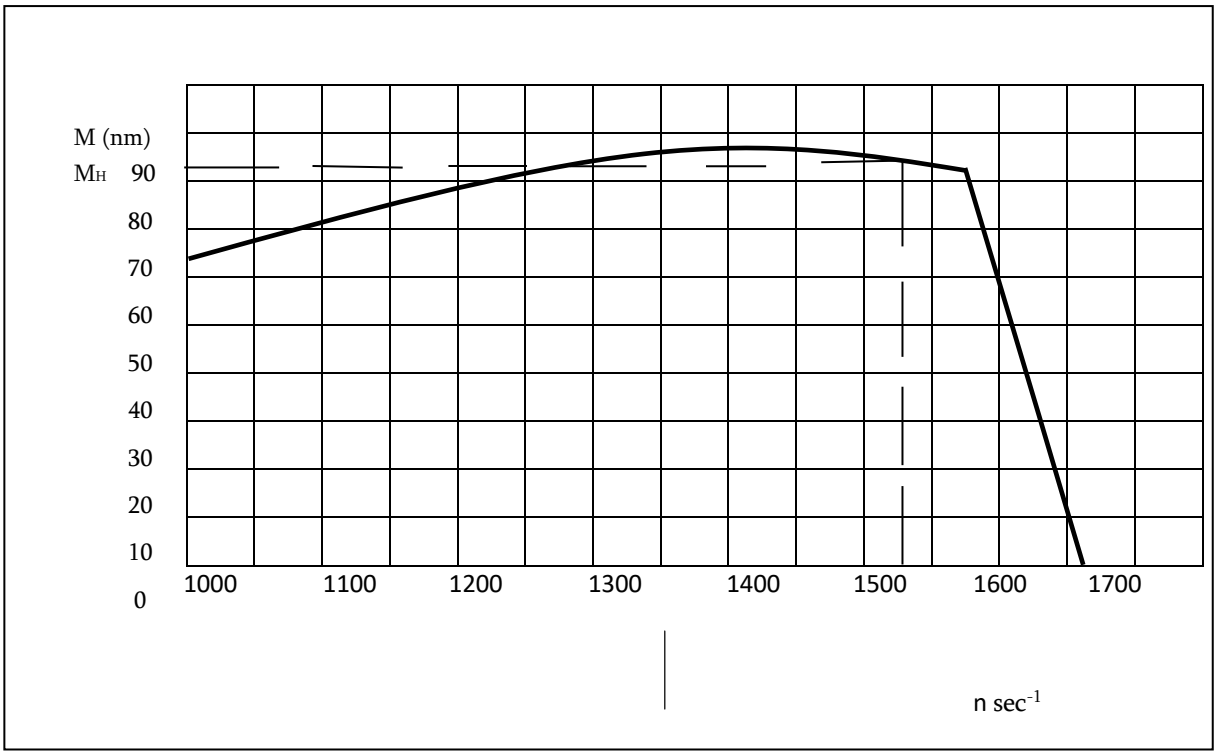


Figure 2: D-21A1 Diesel Engine Mechanical Characteristic.

First row harmonica

$$a_1 = \frac{2}{24}(17.774 + 12.643 + 11.594 + \ldots + 9.7) = -6.732 \text{ nm;}$$

$$b_1 = \frac{2}{24}(4.765 + 7.3 + 11.594 + \ldots + 9.05) = -4.58 \text{ nm;}$$

$$M_1 = \sqrt{a_1^2 + b_1^2} = \sqrt{(-6.732)^2 + (-4.58)^2} = 8.142 \text{ nm;}$$

© 2022 London Journals Press

$$tga_1 = \frac{a_1}{b_1} = \frac{-6732}{-4.58} = 1.469 \qquad a_1 = 56^0 ;$$

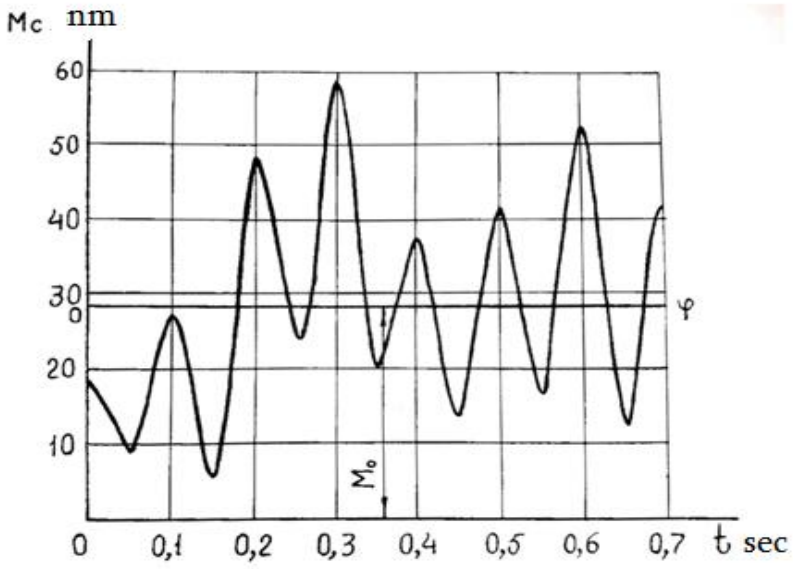


Figure 3: Resistance Torque Curve Valid on the Milling Cutter Functioning Body of the Combined Sowing Machine Resistance Torque Curve .

Second row harmonica

$$a_2 = \frac{2}{24}(15.934 + 7.3 - 7.65 + ... + 9.7) = 1.776 \text{ nm} ;$$

$$b_2 = \frac{2}{24}(9.2 + 12.643 + 16.4 + ... - 18.35) = -7.062 \text{ nm} ;$$

$$M_2 = \sqrt{a_2^2 + b_2^2} = \sqrt{(1.776)^2 + (-7.062)^2} = 7.448 \text{ nm} ;$$

$$tga_2 = \frac{a_2}{b_2} = \frac{1.776}{-7.062} = -0.251 \qquad a_2 = 166^0 ;$$

Third row harmonica

$$a_3 = \frac{2}{24}(13.008 - 11.594 - 15.3 - ... + 25.946) = -2.12 \text{ nm} ;$$

$$b_3 = \frac{2}{24}(13.008 + 14.6 + 11.594 - ... - 25.946) = 1.273 \text{ nm} ;$$

© 2022 London Journals Press

$$M_3 = \sqrt{a_3^2 + b_3^2} = \sqrt{(-2.12)^2 + 1.273^2} = 2.472 \text{ nm};$$

$$tga_3 = \frac{a_3}{b_3} = \frac{-2.12}{1.273} = -1.665 \quad a_3 = 121^0;$$

Fourth row harmonica

$$a_4 = \frac{2}{24}(9.2 - 7.3 - 16.4 - ... + 9.7) = -0.226 \text{ nm};$$

$$b_4 = \frac{2}{24}(15.934 + 12.643 - 13.249 - ... - 31.782) = 3.29 \text{ nm};$$

$$M_4 = \sqrt{a_4^2 + b_4^2} = \sqrt{(-0.266)^2 + 3.29^2} = 3.3 \text{ nm};$$

$$tga_4 = \frac{a_4}{b_4} = \frac{-0.266}{3.29} = -0.08 \quad a_4 = 175^0;$$

The equation of the curve the given resistance torque can be approximated as follows:

$$M_c = 26.229 + 8.142 \sin sin\left(x + 56^0\right) + 7.448 \sin sin\left(2x + 166^0\right) + 2.472 \sin sin\left(3x + 121^0\right) + 3.3 sin(4x + 175^0)$$

If we take into account, that $[\delta] = 0.16$ (20) according to the formula we will obtain:

$$I \geq \frac{4 \cdot 0.88\left[\sqrt{(-6.732)^2 + (-4.58)^2} + \sqrt{\frac{1.776^2 + (-7.062)^2}{2^2}} + \sqrt{\frac{(-2.12)^2 + 1.273^2}{3^2}} + \sqrt{\frac{(-0.226)^2 + 2.29^2}{2^2}}\right]}{0.16 \cdot (297.68 - 26.229)} =$$

$$= 1.742 kg.m^2$$

In the result of the theoretical report there is obtained the reduced inertia torque value $I \geq 1.742\ kg.m^2$.

Following this through the experimental manner, there is determined the reduced inertia torque on the driving shaft of the tractor power, which may be reflected as follows:

$$I_1 = I_{01} + I_{02} \tag{23}$$

© 2022 London Journals Press

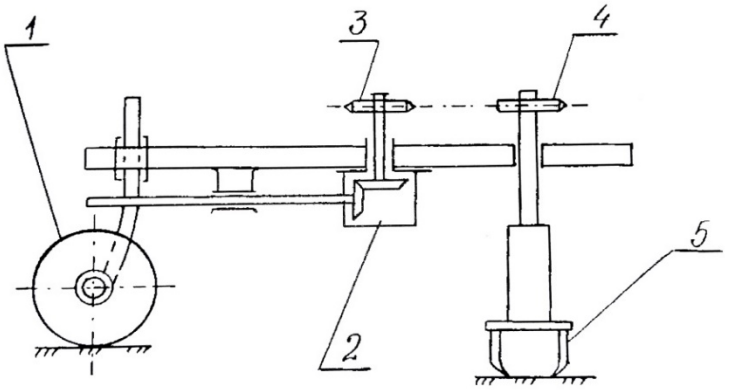


Figure 4: Kinematic Scheme of Driving the Milling Cutter Functioning Body of the Combined Sowing Machine

1-Support Wheel; 2- Code Reducer; 3- 3 and 4 Driving and Reveal Stars; 5- Milling Cutter; Total reduced inertia torque according to the formula (23) is equaled to":

$$I_1 = 1.80245 kg.\ m^2$$

II. CONCLUSION

Kinematic and dynamic parameters of the milling cutter functioning body of the combined sowing machine were determined through the analytical manner. Through applying the harmonized analysis method the reduced inertia torque optimal value ($I > 1.742$) of the milling cutter functioning body was determined. Through the experimental manner the reduced inertia torque optimal value $I_1 = 1.80245\ kg.\ m^2$ of the milling cutter functioning body was determined, which meets the given optimum condition, what is required for qualitative loosening the soil by the milling cutter body in the sowing line.

REFERENCE

1. Artobolensky I. I. Theory of mechanisms and machines. M. Nauka, 1975;
2. Makharoblidze R. - Optimization of dynamic processes in agricultural machinery. Moscow, 1981;
3. Natroshvili D.V. Dynamic parameters of the drive of the cutter of the combined seeder. Tractors and agricultural machines, Moscow, 2000;

© 2022 London Journals Press

This page is intentionally left blank

© 2022 London Journals Press

Scan to know paper details and
author's profile

Study and Modeling of Human Biological Tissue Exposed to High Frequency Electromagnetic Waves

Dr. Bassesuka Sandoka

ABSTRACT

The main objective of this proposed article is to provide explanations to justify the validity of the results of the studies of the interaction between the electromagnetic fields and the human body.

It can also find direct applications in the characterization and modeling of the macroscopic electrical properties of the biological media for assessing the effects of fields induced by electromagnetic radiation sources in the human body to set up new standards on the Human exposure to electromagnetic fields. To do this, we have taken into account the different physical phenomena of propagation of a hyper-frequency electromagnetic plane wave and on the other hand, the experimental values in order to model the electrical behavior of human biological tissues based on An equivalent electronic circuit model composed of capacities, resistance and reel, which assimilates the biological tissues of the skin, grease, blood.

Keywords: modeling, equivalent electronic circuit, biological tissue, microwave electromagnetic wave, maxwell equations.

Classification: DDC Code: 530.141 LCC Code: QC665.E4

Language: English

London Journals Press

LJP Copyright ID: 925644
Print ISSN: 2631-8490
Online ISSN: 2631-8504

London Journal of Research in Science: Natural and Formal

Volume 22 | Issue 2 | Compilation 1.0

© 2022. Dr. Bassesuka Sandoka. This is a research/review paper, distributed under the terms of the Creative Commons Attribution-Noncom-mercial 4.0 Unported License http://creativecommons.org/licenses/by-nc/4.0/), permitting all noncommercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Study and Modeling of Human Biological Tissue Exposed to High Frequency Electromagnetic Waves

Dr. Bassesuka Sandoka

ABSTRACT

The main objective of this proposed article is to provide explanations to justify the validity of the results of the studies of the interaction between the electromagnetic fields and the human body.

It can also find direct applications in the characterization and modeling of the macroscopic electrical properties of the biological media for assessing the effects of fields induced by electromagnetic radiation sources in the human body to set up new standards on the Human exposure to electromagnetic fields. To do this, we have taken into account the different physical phenomena of propagation of a hyper-frequency electromagnetic plane wave and on the other hand, the experimental values in order to model the electrical behavior of human biological tissues based on An equivalent electronic circuit model composed of capacities, resistance and reel, which assimilates the biological tissues of the skin, grease, blood. This model using the characteristic impedance of the dielectric support makes it possible to evaluate the voltage induced by the electromagnetic waves of the hyper-frequencies in the studied biological system. The results of the simulations obtained from computer tools demonstrate that the hyper-frequency electromagnetic waves can result in an elevation of the electrical potential of the biological tissues. Despite this potential is a decreasing function of the penetration depth.

Keywords: modeling, equivalent electronic circuit, biological tissue, microwave electromagnetic wave, maxwell equations.

Author: ISTA Kinshasa, Electrical Engineering, Kinshasa, DR Congo, bass_sandoka@yahoo.fr

I. INTRODUCTION

The omnipresence of sources of electromagnetic fields in industrialized countries means that people residing in these countries are exposed to them on a daily basis, both in their domestic and professional environment [1][2]. However, it is in the professional environment that these sources are most common and also most intense [3] . The potential risks for people exposed to interactions between electromagnetic fields and the human body are real and therefore require protective measures [3]. Exposure to these sources may be voluntary in the case of medical diagnosis such as an NMR imager, hyperemia therapy, ablatherapy or involuntary mobile telephony, radio or television transmitters, household appliances, computer screens, televisions, security systems in shops and airports, high voltage lines, transformers, etc [4]. Exposure to electromagnetic fields generates currents inside the body, the corresponding absorption of energy in the tissues results in an increase in temperature [5]. The health effects generated are mainly a function of the coupling mechanism, the nature of the fields and the duration of exposure [6]. These phenomena are all the more important as the intensity and / or the frequency of the signal are high [3][7]. Apart from the effects observed on biological functions and on health, electromagnetic fields and waves also act on electronic devices [8]. Therefore, it is important during the construction of the latter to ensure that their operation does not interfere with that of other devices or is not itself a victim of other devices that are sources of fields. To avoid all forms of electromagnetic compatibility [9][10][11].

© 2022 London Journals Press

Several epidemiological and experimental studies have been conducted on this and they led for most to establish biological effects that may mean risk or long-term health of a living being [12]. Theoretical studies have also made it possible to estimate doses of electromagnetic energy absorbed by animals and humans.

The effects of electromagnetic fields on a biological cell being the objective of this article, it seems essential to us to describe the biological cell and the molecular structure of the plasma membrane to underline the difficulties related to their electrical characterization [13]. This is how we have taken into account the analyzes of some of the authors cited below to help us orient our work [1][12][9][14][15].

According to an evaluation of the power distribution induced by an electromagnetic wave in a spherical model of the brain allows to say that[8], the quantity of energy received by the brain from the electromagnetic waves is very high compared to that which emerges from it by radiation, and that almost all of the energy received is transformed into heat.

According to D.V. Land [3], microwave thermography techniques have been used extensively in medical applications to monitor tissue temperature and detect the electromagnetic field in biological tissues. Since the temperature increases in the resulting tissue from the deposition of energy and is proportional to the square of the electric field in the tissue; the response to thermal radiation must have the same sample.

The various studies carried out on the subject have shown that the electrical impulses induced by microwave electromagnetic waves can cause cell death. The mechanisms leading to this destruction may differ depending on the characteristics of the pulse, the number as well as the frequency of repetition [16][17].

According to KH Schoenbach, S. Xiao, RP Joshi, JT Camp, T. Heeren, JF Kolb and SJ Beebe [2012][18], the duration of the pulse is close to a nanosecond and the applied field is of the order of MV / cm. The death of illuminated cells is caused purely by modifications of the different electrical potentials of the different membranes. The study JT Camp, Y. Jing, J. Zhuang, JF Kolb, SJ Beebe, J. Song, RP Joshi, S. Xiao and KH Schoenbach [2012] [18]show that, cell death is caused by electrical effects, but also by thermal effects.

A biological system irradiated by an electromagnetic wave is crossed by induced currents of significant density [19][18][20]. The use of high frequencies, of the order of tens of gigahertz and more, can cause non-thermal effects that are damaging to the health of an exposed biological system. This depends on the frequency, intensity of these waves and the duration of exposure to them.

Thus, the mathematical and numerical approach that we propose in our article is intended to be at the same time analytical, comparative and critical [12]. The aim is not only to analyze, but also to compare the various theories of specialists in the field in order to draw useful lessons for analyzing and evaluating the voltage induced by microwave waves in the various biological tissues studied.

Our work is aimed at complementing and reinforcing the veracity of some of the results already obtained. For our application, we will consider the particular case of skin, blood and muscle subjected to electromagnetic radiation from microwave frequencies.

II. DEVELOPMENT

2.1 Study Method

To analyze the electrical behavior of biological tissue exposed in an electromagnetic environment of high frequency and predict possible consequences on health, we will proceed by a mathematical and numerical analysis based on the equivalent electronic circuit method, using the characteristic impedance of the media. Biological by involving bioelectrical parameters (capacitance, resistance and coil). This is a study based on solving Maxwell's equations that govern the behavior of an electromagnetic plane wave in the deferent models used. We will then proceed by modeling and simulating the voltage and current induced for biological media.

© 2022 London Journals Press

There is some need for approximation in this study. Biological systems are quite complex due to their geometric shape and the inhomogeneity of their internal constitution. This is how we consider a living, lossy, homogeneous and isotropic biological system in order to simplify the resolution of wave equations. Knowing that biological tissue is divided into two broad categories, tissue with high water content such as skin, blood and muscle and tissue with low water content such as fat and bone, the characteristics of which vary from a different way.

These approaches will allow us to make an analytical and theoretical approximation of this article as listed above.

2.2 Brief Description of the Biological Cell

Since the effects of electromagnetic fields in a biological cell are the focus of this article, we believe it is essential to describe the biological cell and the molecular structure of the plasma membrane. The biological cell is the structural and functional unit of all living things, it is characterized by its nucleus, cytoplasm and plasma membrane [21]. The cell plasma membrane plays an essential role in the life of the cell, it delimits the cell and separates the cytoplasm from the external environment. It surrounds the cytosol (i.e. the liquid phase in which the cytoplasmic organelles bathe) and forms a very thin protective layer made up of lipid and protein molecules. It thus presents a heterogeneous molecular structure allowing it to play a double role: The phospholipids which are the essential constituents of its basic material, make it insulating, while the protein molecules which are scattered, ensure the exchange between the cytoplasm and the environment extra cellular[22].

The cell is the basic structural and functional unit of all living things. The cells are very small and very complex in organization. Knowledge of their structure, chemical composition and functioning (physiology) is very critical in biology and biomedical science. Studies on cellular functionality and behavior have been widely applied in many clinical and biomedical applications, such as disease diagnosis and knowledge of their degree of evolution, drug development and cancer research [19][23].

This is how knowledge of their component and their characteristic is important for the further development of our research and especially for the study and modeling of human biological tissue exposed to microwave electromagnetic waves.

2.3 Brief Description of the Biological Cell

In the case of biological media, the phenomena of energy absorption in tissues can be relatively complex and depend on many factors. They are primarily linked to the type of coupling between the emission source and the biological medium.

Galvanic coupling corresponds to the case of physical contact between the source and the medium. This contact causes an ohmic-type current to flow through the person's body.

Depending on the intensity and frequency of the contact current, the consequences can result in tissue heating or even a burn.

Radiated coupling comprises three fundamental mechanisms by which electric and/or magnetic fields, of variable frequency over time, interact with biological media.

- Coupling with low-frequency electric fields: The external electric fields induce, on the surface of the exposed body, a surface charge which causes, inside the body, the appearance of currents whose distribution depends on the conditions of exposure, the size and shape of the body as well as the position of the body vis-à-vis the field.

- Coupling with low frequency magnetic fields: The physical interaction between magnetic fields of variable frequency and the human body creates induced electric fields and causes the circulation of electric currents. The magnitude of the fields and the density of the induced current are proportional to the strength and frequency of the magnetic field B, the radius of the current loop in the body, and the electrical conductivity of the exposed tissues.

© 2022 London Journals Press

- It should be noted that exposure of the human body to low-frequency electric or magnetic fields generally results in only negligible energy absorption and no measurable temperature rise.

On the other hand, exposure to electromagnetic fields with a frequency greater than 100 kHz can cause energy absorption and a significant rise in temperature. In general, exposure to electromagnetic fields results in a highly inhomogeneous deposition and distribution of energy within the body which must be assessed by dosimetry.

Finally, it remains to underline the indirect consequences caused by exposure to electromagnetic fields of people with active medical implants (cardiac pacemaker, cardiac defibrillator, insulin pump, etc.) which result in malfunctions of the implanted equipment.

These different phenomena can be analyzed mathematically in detail from Maxwell's equations by defining each parameter and its role, some details of which are not given.

III. BIOLOGICAL TISSUE MODELING

3.1 The Human Body and Sources of Electromagnetic Fields

Humans live in an electromagnetic environment created by many field sources. These sources can have very different characteristics of frequency, voltage levels, current or power [20]. They come in a variety of forms such as the power line, telecommunication relays, induction welding tools, cell phones or household electrical devices (hair dryer, induction hob, microwave oven) [24].

In many situations, the presence of the human body in the radiation area of the source does not affect the power emitted. If the source of the electromagnetic field is known (following in situ measurements or a preliminary calculation), it is possible not to explicitly model the source but only the human body [17]. This feature is often taken advantage of in models to limit their complexity [25].

The difficulties in modeling human exposure to electromagnetic fields are due to the particular electrical and geometric properties of the body and the variety of radiation sources.

The response of a cell in the presence of an electric field depends on two parameters which are the relative dielectric permittivity which reflects the capacity to polarize a material by accumulation of charges and the electrical conductivity which reflects the capacity to pass an electric current with minimal losses. The fundamental concepts of dielectric phenomena in biological media and their interpretation of interactions at the cellular level are well established [26][27][28]. Based on the work of Prof. Schwan [29], [30] and Foster [331], the dielectric properties of cells depend on frequency and exhibit relaxation and resonance phenomena, which are a function of different polarizations.

The relaxations are named α, β and γ and are more often referred to by the term dispersion because the resulting dielectric absorption is observable over a wide range of frequencies [29][31][27][28][25].

Different empirical models can be used to approximate the frequency variations of the electrical properties of cells. Electrical modeling of cells was first proposed by R. Höber in the 1910s, who studied the evolution of the resistivity of a blood sample at low and high frequencies. As a result of these early observations, several electrical models of the cell were constructed in the mid-twenty-second century, such as the Fricke, Debye and Cole-Cole model. These models are still widely used today in studies of the electrical behavior of biological media.

In this paper, the modeling of human biological tissue is based on the equivalent electronic circuit model shown below, similar to any dielectric medium and able to model all related properties[32][33][34][35].

© 2022 London Journals Press

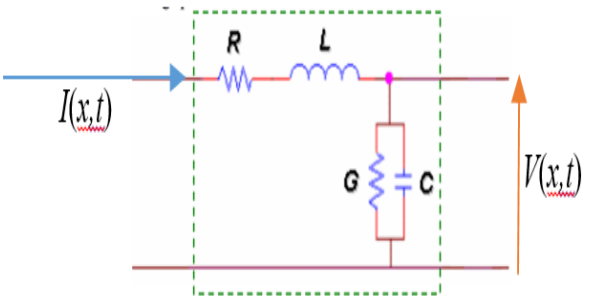


Fig 1: Circuit Electronic Equivalent of a Biological Tissue

In Figure 1, R: represents resistance in Ohm per meter [Ω m^{-1}], G : conductance in Ohm^{-1} per meter :, L: inductance in micro Henry per meter [µH m^{-1}], and C: Capacitance in Pico Faraday per meter [pF m^{-1}][36].

Table 1 assembles the values of the parameters R, G, L and C modeled for different media. These are the electrical parameters, used in our model that make up the electronic circuit as shown in Figure 1, which is similar to any biological dielectric medium[30][36][37].

Table 1: Values of Bioelectric Parameters R, G, L and C

Table 1.	blood	Muscle	Skin
R	0	0	0
G	2.623	4.037	3.533
L	1.257	1.257	1.257
C	6.72	6.552	3.542

3.2 Reliability of the Model

From a reliability point of view, this equivalent electronic circuit model reproduces the electrical behavior of a biological tissue with maximum precision, without taking into account its internal structure. It also reduces simulation time and gives the possibility of simulating complex systems like the one being the subject of our study [27].

3.3 Voltage and Current Induced in the Biological Tissue by the Progation of Microwave Waves

The model of figure 1 above makes it possible to indirectly obtain the mathematical expressions of the voltage V (x, t) and of the current I (x, t) thus induced from the propagation impedance of the wave by involving the model electrical parameters (R, L, C and G) [38][8][39][40].

In order to define the different equations to obtain an adequate analytical model (see equations 1-7), Kirchoff's laws (mesh and node laws) have been used, see figure 1. Thus, the following mathematical expressions are deduced:

$$V(x,t) = (R + jL\omega).I(x,t) \quad (1)$$

$$I(x,t) = (G + jC\omega).V(x,t) \quad (2)$$

$$V(x,t) = V_0.exp(-\alpha x).Cos(\omega t - \beta x) \quad (3)$$

$$I(x,t) = \frac{I_0}{Z_0}.exp(-\alpha x).Cos(\omega t - \beta x) \quad (4)$$

$$\gamma = \sqrt{\frac{(R+jL\omega)}{(G+jC\omega)}} \quad (5)$$

$$\gamma = \alpha + j\beta \quad (6)$$

$$Z_0 = (R + jL\omega) \quad (7)$$

These equations are used to simulate the electrical behavior of the biological tissues studied.

© 2022 London Journals Press

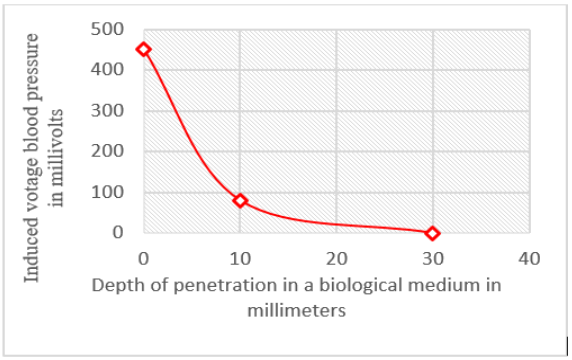
IV. ELECTRICAL BEHAVIOR SIMULATION

4.1 Calculation of Bioelectronic Parameters

By using computer tools such as Matlab and others for the evaluation of bioelectronic parameters, we obtained the following results: $\alpha = 79$; $\beta = 81$; $R_e(Z_o) = 167\ Ohm$; $Im(Z_o) = 8\ Ohm$; $R_e(\gamma) = 79$; $Im(\gamma) = 4$.

V. RESULTS

Considering the frequency of 3.2 Gigas Hertz [Ghz] of the propagation of electromagnetic waves and the depth of penetration of electromagnetic waves in a biological medium varies from 0 to 30 millimeters. The results of the simulation of the voltage induced by electromagnetic waves in the different biological media are in the figures 2, 3, 4 and 5 below:



Figures 2: Evolution of the Reflected Voltage as a Function of the Depth of Penetration Into the Blood

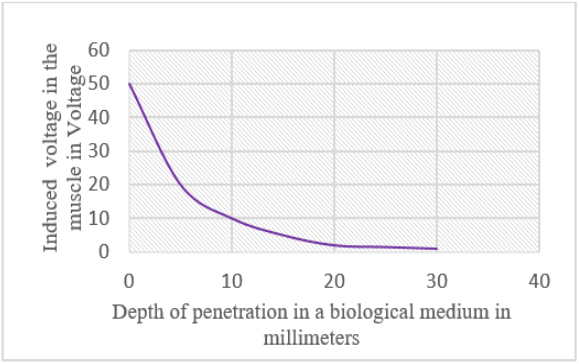


Figure.3: Evolution of the Reflected Voltage as a Function of the Depth of Penetration Into the Skin

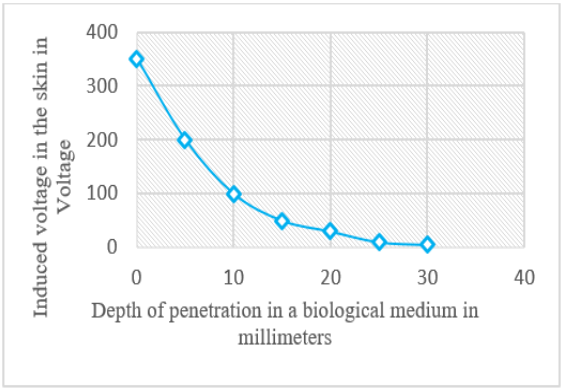


Figure 4: Evolution of the Reflected Tension as a Function of the Depth of Penetration Into the Muscle

© 2022 London Journals Press

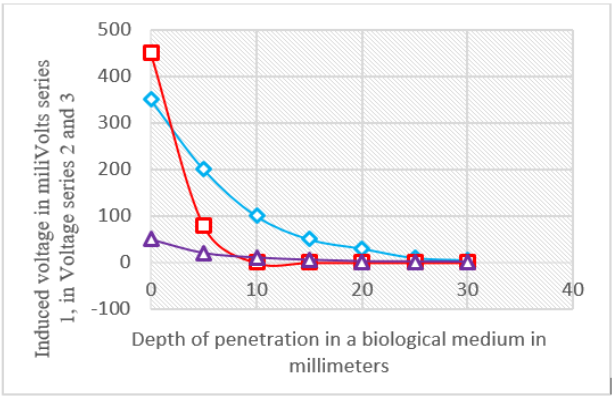


Figure 5: Superposition Curve of the Evolution of the Reflected Voltages as a Function of the Depth of Penetration Into the Biological Tissues Under Study

Figure 6 below presents the results obtained experimentally in the work of M.Mimi and D.V.Land [1991] [41].

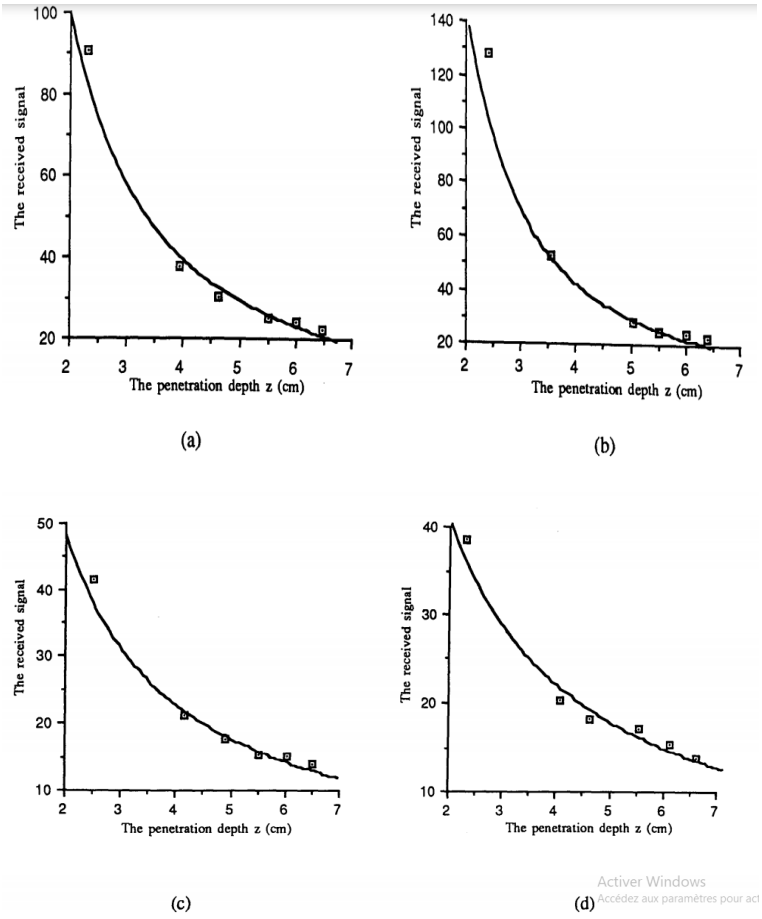


Figure 6: The Penetration Depth for Muscle Phantom Material at 3.2 GHz of Crossed-Pair Antenna

VI. DISCUSSION

By simulating different biological tissues (blood, muscle and skin) we see that, the voltage induced by the electromagnetic wave of the microwaves increases, the thickness decreases as a function of the depth of penetration see figure 2.

It has also been observed that the more the muscle thickness increases, the induced tension decreases. See figure 3 and 4 except that, the numerical values are different.

These results can be compared with those obtained experimentally in the work of M. Mimi and D.V. Land [1991] in FIG. 6 above. We note

© 2022 London Journals Press

from the above that the electrical impulses of microwave electromagnetic waves cause an increase in potential in the different biological media studied. This potential is a decreasing function of the penetration depth and it is very high at the end of the biological tissue.

However, the use of high frequencies, of the order of tens of gigahertz, can cause non-thermal effects which are harmful to health.

The various studies carried out on the subject have shown that the electrical impulses induced by microwave electromagnetic waves can cause cell death. The mechanisms leading to this destruction may differ depending on the characteristics of the pulse, the number as well as the frequency of repetition.

VII. CONCLUSION

In this article we have chosen the modeling approach based on the equivalent electronic circuit of a human biological tissue, taking into account on the one hand the physical phenomena of the propagation of a microwave electromagnetic plane wave and on the other hand the values experiments in order to simulate the electrical behavior of human biological tissues exposed in a microwave electromagnetic environment.

The proposed work aims mainly to provide arguments to justify the relevance of the results of studies of the interaction between electromagnetic fields and the human body. It can also find direct applications in the precise characterization of biological media and in the establishment of new standards on human exposure to electromagnetic fields.

We have tried to take advantage of the many advantages of this method, namely the reduction of simulation time, the possibility of simulating complex systems like the one being the subject of our study.

The simulation result obtained in this article approaches that obtained experimentally in the work of M. Mimi and D.V. Land. We note from the above that the induced tension is important in the different biological media studied in this article, and is a decreasing function of the depth of penetration as the thickness of biological tissue is reduced.

As a result, we therefore deemed it useful that the modeling based on the equivalent electronic circuit of a human biological tissue analyzed from Kirchhoff's laws is more suitable for the study of a system as complicated and disparate as a tissue complex biological.

Of all the analyzes and modeling, Maxwell's equations can also be used in detail for modeling human biological tissue exposed to microwave electromagnetic waves, taking into account all of these parameters.

REFERENCES

1. P. Zoltowski. “On the electrical capacitance of interfaces exhibiting constant phase element behavior”. Journal of Electroanalytical Chemistry, 443 (1): 149–154, 1998.
2. P. Wanichapichart, S. Bunthawin, A. Kaewpaiboon and K. Kanchanapoom. "Determination of Cell Dielectric Properties Using Dielectrophoretic Technique". Science Asia, 28 (2): 113–119, 2002.
3. M.Mimi and D.V. Land “Measurement of non-resonant disturbance of antenna electromagnetic field configurations for biomedical applications” The Journal of Photographic Science, Vol.39, No. 4, 1991, pp 172.
4. N. Simicevic and D.T. Haynie. “FDTD simulation of exposure of biological material to electro-magnetic nanopulses”. Physics in Medicine and Biology, 50 (2): 347–360, 2005.
5. Y. Wang, PH Schimpf, DR Haynor and Y. Kim. “Geometric effects on resistivity measurements with four-electrodeprobes in isotropic and anisotropic tissues”. Biomedical Engineering, IEEE Transactions on, 45 (7): 877–884, 1998.
6. MA Stuchly and TW Dawson. “Interaction of low-frequency electric and magnetic fields with thehuman body”. Proceedings of the IEEE, 88 (5): 643–664, 2000.

© 2022 London Journals Press

7. K. H. Schoenbach, S. Xiao, R. P. Joshi, J. T. Camp, T. Heeren, J. F. Kolb and S. J. Beebe, "The Effect of Intense Subnanosecond Electrical Pulses on Biological Cells," IEEE Transaction on Plasma Science, vol. 36, n °% 12, pp. 414-422, April 2008.
8. S. Reivonen, T. Keikko, J. Isokorpi and L. Korpinen. "Internal currents in a human body with spheroidal model in 400 kVswitching substation". High Voltage Engineering, 1999. Eleventh International Symposium on (Conf. Publ. No. 467), 2, 1999.
9. P. C. Miranda et al, " The electric field induced in the brain by magnetic stimulation: A 3-D Finite Element Analysis of the effect of tissue heterogeneity and anisotropy ", IEEE transactions on Biomedical Engineering, vol. 50, No. 09, September 2003.
10. V. Raicu, N. Kitagawa and A. Irimajiri. "A quantitative approach to the dielectric properties of the skin". Phys. Med. Biol, 45: L1 – L4, 2000.
11. A. L. galeev, "The effects of microwave radiation from mobile telephones on human and animals", Neuroscience and Behavioral Physiology, Vol. 30, No. 2, 2000.
12. T. Matsumoto, A. Chiba, N. Hayashi and K. Isaka. "Effect of competitor ELF electric and magnetic fields on induced current density in biological model in the vicinity of the ground". High Voltage Engineering, 1999. Eleventh International Symposium on (Conf. Publ. No. 467), 2, 1999.
13. K. Yamazaki, T. Kawamoto, H. Fujinami and T. Shigemitsu. "Investigation of ELF magnetically induced current inside the human body: Development of estimation tools and effect of organ conductivity". Electrical Engineering journal, in Japan, 134 (2): 1–10, 2001.
14. A. A. Gurtovenko and J. Anwar, "Modulation of the structure and properties of cell membranes: molecular mechanism of action of dimethyl sulfoxide", J. Phys. Chem. B, vol. 111, no. 35, p. 10453-10460, September 2007). F. Gustrau, A. Bahr, M. Rittweger, S. Goltz and S. Eggert. "Simulation of induced current densities in the human body atindustrial induction heating frequencies". Electromagnetic Compatibility, IEEE Transactions on, 41 (4): 480–486, 1999.
15. PN Robillard and D. Poussart. "Spatial resolution of four electrode array. ". IEEE Trans Biomed Eng, 26 (8): 465–70, 197
16. F. Jaspard, M. Nadi and A. Rouane. "Dielectric properties of blood: an investigation of haematocrit dependence". Physiological Measurement, 24 (1): 137–147, 2003.
17. J. Jossinet. "The impedivity of freshly excised human breast tissue". Physiol Meas, 19 (1): 61–75, 1998.
18. JT Camp, Y. Jing, J. Zhuang, JF Kolb, SJ Beebe, J. Song, RP Joshi, S. Xiao and KH Schoenbach, "Cell Death Induced by Subnanosecond Pulsed Electric Fields at Elevated Temperatures," IEEE Transactions on Plasma Science, vol. 40, n °% 110, pp. Mathieu Croizer | Doctoral thesis | University of Limoges | 2015 256 2334-2347, October 2012.
19. J. Wtorek, A. Bujnowski, A. Poli ski, L. Jozefiak and B. Truyen. "A probe for immittance spectroscopy based on the parallel electrode technique". Physiological Measurement, 25 (5): 1249–1260, 2004.
20. R. Scorretti. "Numerical and experimental characterization of the LF magnetic field generated by electrotechnical systems with a view to modeling the currents induced in the human body". PhD thesis, Ecole Centrale de Lyon, 2003.
21. M. Purschke, H.-J. Laubach, R. Rox Anderson and D. Manstein, "Thermal injury causes DNA damage and lethality in surrounding unheated cells: heat spectator effect active ", J. Invest. Dermatol., Vol. 130, no. 1, p. 86-92, January 2010).
22. E.C. Fear and M.A. Stuchly. Modeling of assemblages of biological cells exposed to electric fields. IEEE Trans.Bio.Eng, 45 (1)., Pages 1259-1271, 1998.)
23. J.C. Bowers and H.A. Neinhaus, "SPICE2 computer models for HEXFES, Application", 1989.
24. Hermann Schharfetter, "Structural modeling for non-invasive impedance-based diagnostic methods", Habilitation thesis, Faculty of

© 2022 London Journals Press

Electrical Engineering, Technical University of Graz (United Kingdom), 1999.Antoni Ivorra, "Bioimpedance Monotoring for Physicians: an Overview", Groupe d'applications biomédicales, Centre Nacional de Microeletronica (Espagne), 2002.
25. F. Jaspard and M. Nadi. “Dielectric properties of blood: an investigation of temperature dependence”. Physiological Measurement, 23 (3): 547–554, 2002.
26. A.H. Kyle, C.T.O. Chan and A.I. Minchinton. “Characterization of Three-Dimensional Tissue Cultures Using Electrical Impedance Spectroscopy”. Biophysical Journal, 76 (5): 2640–2648, 1999.
27. M.-A. deMénorval, L. M. Mir, M. L. Fernández and R. Reigada, “Effects of dimethyl sulfoxide in lipid membranes containing cholesterol: a comparative study of experiments in silico and with cells”, PLOS ONE, vol. 7, no. 7, p. e41733, July 2012.
28. D. Haemmerich, ST Staelin, JZ Tsai, S. Tungjitkusolmun, DM Mahvi and JG Webster. “In vivo electrical conductivity of hepatic tumors”. Physiol. Meas, 24 (2): 251–260, 2003.
29. MA Stuchly and S. Zhao. “Magnetic field-induced currents in the human body in proximity ofpower lines”. Power Delivery, IEEE Transactions on, 11 (1): 102–109, 1996.
30. D. Haddar, EM Haacke, V. Sehgal, Z. Delproposto, G. Salamon, O. Seror and N. Sellier. "Magnetic Susceptibility Imaging: Theory and Applications". Journal of Radiology (Paris), 85 (11): 1901–1908, 2004.
31. Z. W. Yu and P. J. Quinn, “The effect of dimethyl sulfoxide on the structure and phase behavior of palmitoleoyl phosphatidylethanolamine”, Biochim.Biophys.Acta, vol. 1509, no. 1–2, p. 440–450, Dec. 2000.
32. F.Dorel, M.Declerq, “A prototype for the design-oriented symbolic analysis of analog circuits”, Proc. IEEE Conference on Custom Integrated Circuits, pp.12.5.1-12.5.4, 1992.
33. B.A.A. Antao, F.M. El-Turky, “Automatic Generation of Analog Models for Behavioral Simulation”, Proc. IEEE Custom Integrated Circuits Conference, pp.12.2.1-12.2.4, 1992.J. A.Connelly, P.Choi, « Macromodeling with SPICE », Prentice Hall, Englewood Cliffs, New Jersey 07632, 1992.
34. U.Kemper, H.T.Mammen, "Netlist and Behavioral Description of Macromodels for Analog Circuits", Proc. Conference on modeling and simulation, 1-3 juin 1994, Barcelone, pp. 979-984.
35. T.Koskinen, P.Y.K.Cheung, “Analysis of hierarchical tolerance using behavioral models”, Proc. IEEE Conference on Custom Integrated Circuits, pages 3.4.1-3.4.4, 1992.
36. J. Yang, Y. Huang, X. Wang, X.B. Wang, F.F. Becker and P.R.C. Gascoyne. "Dielectric Properties of Human Leukocyte Subpopulations Determined by Electrorotation as a Cell Separation Criterion". Biophysical Journal, 76 (6): 3307–3314, 1999.
37. ZS Sacks, DM Kingsland and R. Lee. “A perfectly matched anisotropic absorber for use as an absorbingboundary condition”. Antennas and Propagation, IEEE Transactions on, 43 (12): 1460–1463, 1995.
38. V. Raicu. “Dielectric dispersion of biological matter: Model combining Debye-type and universal responses”. Physical Review E, 60 (4): 4677–46.
39. W. Wang and SR Eisenberg. “A three-dimensional finite element method for computingmagneti cally induced currents in tissues”. Magnetics, IEEE Transactions on, 30 (6): 5015–5023, 1994.
40. P. Steendijk, G. Mur, ET Van Der Velde and J. Baan. "The four-electrode resistivity technique in anisotropic media: theoretical analysis and application on myocardial tissue in vivo". Biomedical Engineering, IEEE Transactions on, 40 (11): 1138-1148, 1993.9.
41. M.Mimi « An Investigation of Radiometer and Antenna Properties for Microwave Thermography », doctoral thesis, University of Glasgow (UK), 1990.

© 2022 London Journals Press

Scan to know paper details and
author's profile

Geospatial Assessment of the Impingement on Electric Overhead Power-Line in Akure, Nigeria

Olamiju, Isaac Oluwadare, Oyinloye, Michael Ajide & Julius Duerimini

Federal University of Technology

ABSTRACT

Geographic/Geospatial Information System (GIS) can show different kinds of data on one map which enables people to more easily see, analyze, and understand patterns and relationships. This study uses both questionnaire and GIS methods to assess the level of impingement on electric overhead power-line corridor in Akure, Nigeria.

The socio-economic characteristics of residents in the study area were captured using a structured questionnaire; the GIS method was adopted to delineate four buffer corridors of 50m, 100m, 150m and 200m in order to identify encroaching buildings on them. The GIS analysis shows that a total number of 1101 buildings were trapped in the power-line corridor. A 20% sample size of 221 buildings was adopted for the questionnaire administration due to homogeneity characterizing the study area. Empirical analysis shows that: majority of respondents are within the age bracket of 26-40; 66.1% married while 3.2% are widowed.

Keywords: GIS, overhead power-line, encroachment, akure, nigeria.

Classification: FOR CODE: 090903

Language: English

London Journals Press

LJP Copyright ID: 925645
Print ISSN: 2631-8490
Online ISSN: 2631-8504

London Journal of Research in Science: Natural and Formal

Volume 22 | Issue 2 | Compilation 1.0

© 2022. Olamiju, Isaac Oluwadare, Oyinloye, Michael Ajide & Julius Duerimini. This is a research/review paper, distributed under the terms of the Creative Commons Attribution- Noncom-mercial 4.0 Unported License http://creativecommons.org/licenses/by-nc/4.0/), permitting all noncommercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Geospatial Assessment of the Impingement on Electric Overhead Power-Line in Akure, Nigeria

Olamiju, Isaac Oluwadare[α], Oyinloye, Michael Ajide[σ] & Julius Duerimini[ρ]

ABSTRACT

Geographic/Geospatial Information System (GIS) can show different kinds of data on one map which enables people to more easily see, analyze, and understand patterns and relationships. This study uses both questionnaire and GIS methods to assess the level of impingement on electric overhead power-line corridor in Akure, Nigeria.

The socio-economic characteristics of residents in the study area were captured using a structured questionnaire; the GIS method was adopted to delineate four buffer corridors of 50m, 100m, 150m and 200m in order to identify encroaching buildings on them. The GIS analysis shows that a total number of 1101 buildings were trapped in the power-line corridor. A 20% sample size of 221 buildings was adopted for the questionnaire administration due to homogeneity characterizing the study area. Empirical analysis shows that: majority of respondents are within the age bracket of 26-40; 66.1% married while 3.2% are widowed.

Most property owners in the study area got their properties through outright purchase from family land owners while; over 77% of respondents have lived in the corridor for more than 25 years. This paper recommends that all buildings in the corridor should be demolished and compensation paid where applicable; and the corridor be planted with short trees and or grasses under the management of the State Government.

Keywords: *GIS,* overhead power-line, encroachment, akure, nigeria.

Author α σ ρ: Department of Urban and Regional Planning School of Environmental Technology Federal University of Technology, Akure, Nigeria.

I. INTRODUCTION

An overhead powerline is a structure used in electric power transmission and distribution to transmit electrical energy across large distances which consist of one or more conductors suspended by towers or poles (Wikipedia, 2021).

The purpose of overhead transmission lines is to transmit electricity in large quantities between the points of generation (power stations) to an electricity substation close to load (demand) centers where the electricity is consumed. This is commonly achieved at voltages of 132 kV, 275 kV or 400 kV. Ramunas and Robertas (2020) submitted that one 400 kV double-circuit quad-conductor transmission line is, for instance, equivalent to three 275 kV double-circuit twin-conductor lines or twenty-one 132 kV double-circuit single conductor lines; also, the double-circuit 400 kV overhead power line can be used for the identification of hazardous areas and cases of electromagnetic pollution. Transmission lines equally provide interconnection between power stations, load centers and other supply systems, forming what is commonly termed 'the grid'. At the electricity substation, the power is either transmitted on to another substation, or transformed to a lower voltage-33 kV or 11 kV-and distributed through the distribution network to the customers (Marshall and Baster, 2002). High population growth is an indicative of the pace of social and economic change, coupled with a corresponding increase in infrastructural development around or under power transmission lines (PTL) has caused numerous adverse effects to humans including damage to the body tissues,

© 2022 London Journals Press

cardiovascular disorders, low sperm counts and many other effects on live-line workers who regularly service the lines resulting from electromagnetic radiation emitted from the transmission lines (Aliyu and Ali, 2011)

Regarding the high rate at which city populations grow and countries urbanize, Oyinloye and Olamiju (2015) noted that, London was the only city in the world as at year 1800 with a population of a million people, while the 100 largest cities altogether had a population of only 20 million.

And in 1990 the world's largest 100 cities had a combined population of 540 million with 220 million of these living in the twenty largest cities.

In 2006, the world urbanization figure rose beyond 3.3 billion constituting about half of the entire humankind; and by the target year for the Millennium Development Goals (MDGs); cities in the world are estimated to grow to two-third or 6 billion people by 2050 with most of such taking place in developing countries. Thus, the importance of cities has increased significantly over the centuries, and the current dramatic growth of urban populations is seen as critical to the future of Earth by some (Oloto and Adebayo, 2007). The development from village and rural life to urban civilization has had both social and environmental impacts; the growth of urban populations and associated industrialization has resulted in a range of detrimental and often de-humanizing outcomes resulting to the encroachment of public utilities such as the power-lines.

Oyinloye and Olamiju (2015) pointed out that the population explosion in Akure as a result of massive institutional, commercial, industrial and infrastructural development activities lead to a wide range of urban problems such as acute housing shortage, poor street layout with little or no consideration for setbacks and open space, traffic congestion, disease outbreaks and many other environmental related problems. Such environmental problems are some of the factors that can result to a widespread environmental deterioration and pollution as well as encroachment on the overhead electric power-lines. This paper attempts to assess the encroachment of buildings on overhead electricity power-lines in Akure using GIS techniques to investigate the characteristics of houses, level of encroachment of buildings and infrastructure in the power line corridor with a view to protecting health of residents and ensuring sustainable urban development by proffering mitigating measures at preventing encroachment on the electric power-line corridor.

II. REVIEW OF RELEVANT LITERATURE

Akintonwa and Busari et al, 2009) identified serious health implications for living very close to nonionizing radiation of telecommunication masts (cellular towers) in an urban area of Lagos.

Also, Olapeju and Farotimi (2016), investigated the profiles of buildings located within the setback of high-tension power-lines in Agbado, Ogun state, Nigeria and discovered that buildings were sited within the right-of-way of power-lines in violation of building codes, rules and regulations.

In their study, two residents were discovered to suffer from *acute lymoblastic leukemia* which is associated with *EMF* radiations from the power-lines.

From the on-going, it is pertinent to maintain safe distance from electric power-lines. However, it is difficult to do this due to variations in EMF emissions from various sources. Therefore, a special instrument - *Gauss-meter*- was used by Neuert (2012), who discovered that electric transformers are more dangerous to human health than power-lines. In addition, Neuert and Michael (2012), discovered that stray electricity current from metal water pipes of the neighborhood could aggravate the effect of EMF emissions from overhead power-lines.

It is pertinent at this point to ask why people encroach on marginal lands? Agbola (2001) attributed this phenomenon significantly to urbanization. The authors posited that, the process of urbanization is a global phenomenon caused by migratory movement, natural increase and the globalization of the world economy. For instance, the projected urbanization for Nigeria

© 2022 London Journals Press

between 2010 and 2020 was 3.39%. The National Population Commission (NPC) put the reviewed population of Nigeria at 167,000,000 (Oketola, 2012). Notwithstanding its constantly increasing population, its total land area is still fixed at 923,700 square kilometers. Hence population density, in the face of competing uses of land will continually soar. This explosion had caused unusual land and demographic pressure directing migration and development towards the fringes.

This invasion usually leads to uncontrolled and unorganized development. The encroaching communities lack basic infrastructure and are developed chaotically (Oloto and Adebayo, 2007).

The second factor accounting for land use encroachment is the absence of sound institutional arrangement to manage urban fringe growth (Fahria, 2009).

One of the effect of **e**ncroachment on electric power-line corridors is land use change. Land use change occurs when the utilization of which land is put is contrary to what it was planned for. For instance, a power-line corridor which is expected to be an open space, or a forested zone could transform into a developed zone. Abolade and Adeboyejo (2006) observed that urban communities in most non-industrial nations like Nigeria have been going through extraordinary changes both in populace and spatial degree and subsequently are confronted with an assortment of issues like awkward land improvement, clashing area and high densities in specific pieces of the metropolitan region.

In Akure, observations show that set backs to high tension power-lines are expected to remain green and planted with trees that are properly managed.

Unfortunately, this marginal land has been partly converted to residential, commercial and industrial land uses occupied by illegal developments such as commercial and residential buildings, makeshift shops and mechanic workshops among others. On the contrary, Ojambati (2007), noted that the history of cities is the story of invasion of one landuse by another and that a viable city is always in the process of change and cities that do not change become historical tourist attractions or stagnant backwaters. This author however, did not consider awful developments such as encroachment on marginal lands (e.g setback to power-lines) that should have been preserved for safety, beauty and health reasons.

III. DATA AND METHODS

3.1 Research Locale

Akure is the administrative capital of Ondo State since 1976. It is situated on Latitude 7°17' N and Longitude 5° 4' E of the Greenwich Meridian. It is about 370m above the mean ocean level. The city is situated within a 48-kilometer sweep to significant towns in Ondo State which are Ondo toward the South, Owo toward the East and Iju/ItaOgbolu toward the North. The zone towards Ado – Ekiti and Idanre are sloppy and studded with enormous stone development, ascending to 410 meters and 496 meters above the sea level separately. The simple access and topographical centrality of Akure close to towns like Ondo, Owo, Ilesa and Ado-Ekiti., have upgraded the development possibilities of the city.

3.2 Population

Akure is the administrative capital of Ondo State since 1976. Akure is situated on Latitude 7°17' N and Longitude 5° 4' E of the Greenwich Meridian. It is about 370m over the mean ocean level. Akure is situated within a 48-kilometer sweep to significant towns in Ondo State which are Ondo toward the South, Owo toward the East and Iju/ItaOgbolu toward the North. The zone towards Ado – Ekiti and Idanre are slopy and studded with enormous stone development, ascending to 410 meters and 496 meters above the sea level separately. The simple access and topographical centrality of Akure close to towns like Ondo, Owo, Ilesa and Ado-Ekiti., have upgraded the development possibilities of the city.

The number of inhabitants in Akure was put at 38,852 in 1952. In 1961, it was 71,000; 109,000 in 1980; 112,000 in the year 1981; 114,000 in year 1982, 117,000 in 1983; 120,000 between the year 1984; and 123,000 in 1985. The total number of populations in Akure as at 1991 was 239,712

© 2022 London Journals Press

individuals. The National Population Projection for the year 1996 and 2000 put the Akure populace at 269,207 and 298,712 respectively (Olamiju and Oyinloye, 2015). In 2006, the population had expanded to 3,441,024 with 1,761,263 male and 1,679,761 females, which address 2.46% of the all-out populace of Nigeria.

This phenomenal increase in population had hitherto increased land value and demand for land at the suburb and rural-urban fringes of Akure. In addition, marginal lands such as river floodplains, mountain tops and set back to electric power-lines had been encroached upon due to increase in population and land value (Olamiju, 2014).

Enhancements in transport facilities were given conspicuousness in Akure not long after 1976 when the city turned into the seat of government.

The diverse functions of administrative and commerce, performed by Akure, impact the longing to develop new streets and restore the old ones to deal with the conceived new jobs and status of the city. Consequently, houses were crushed along significant streets to accommodate dual carriage ways (Oyinloye and Olamiju,2015).

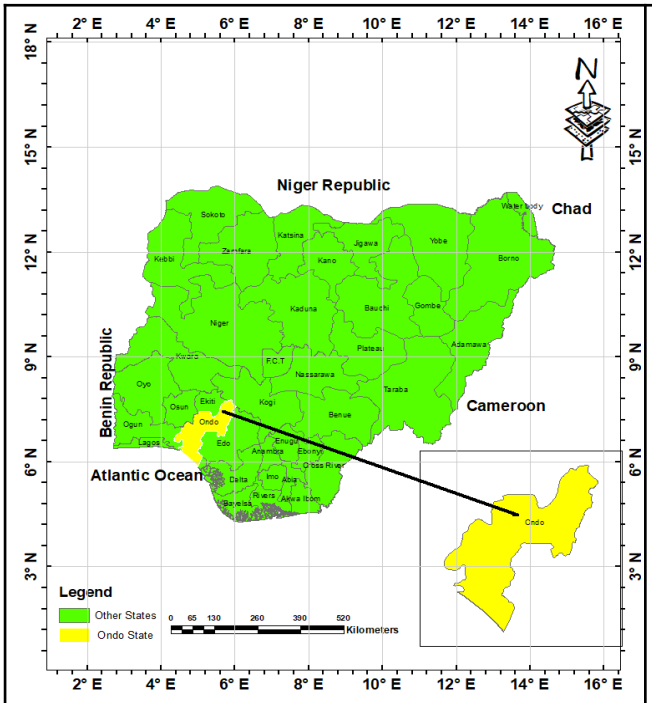


Figure 1: Akure in its National Setting

Source: GIS Map Extract, 2021

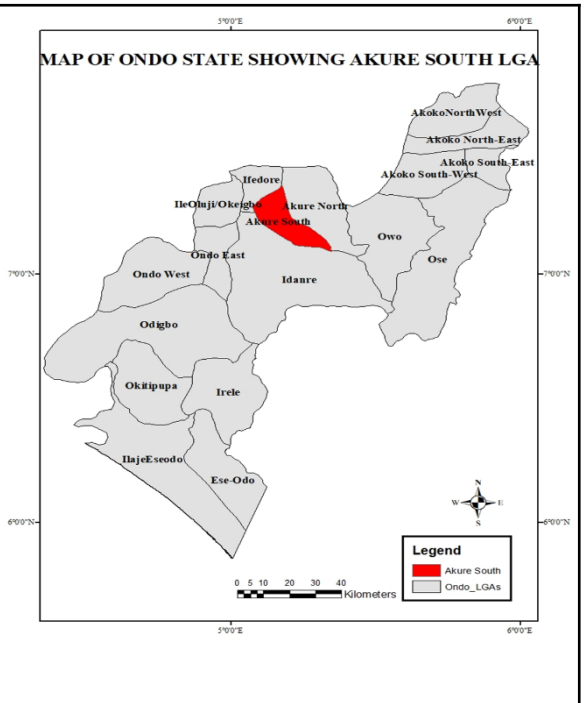


Figure 2: Akure in its Regional Setting

Source: GIS Map Extract, 2021

© 2022 London Journals Press

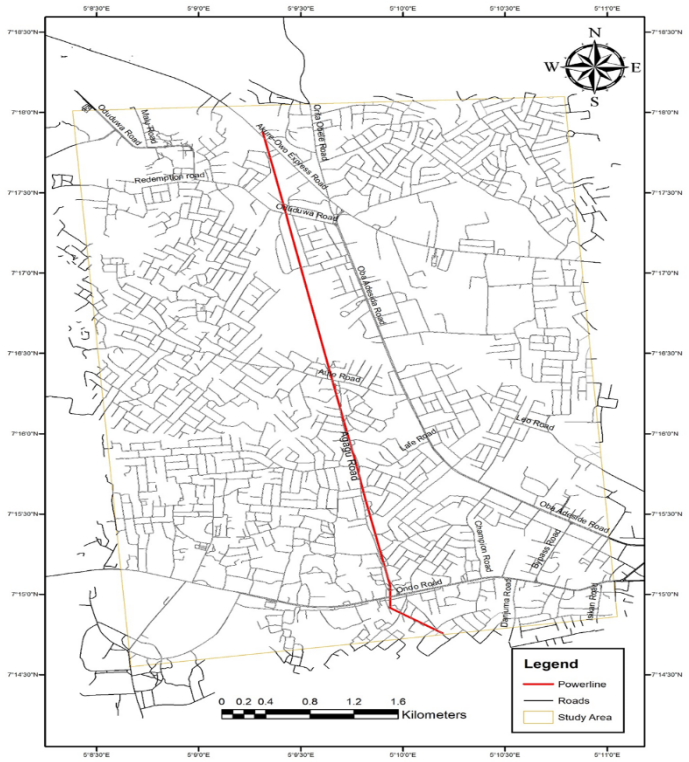


Figure 3: Akure Street Guide Map Showing the Power-line Location

Source: GIS Analysis, Author's Fieldwork, 2021

3.3 Methods

This paper combines the primary and secondary data sources in its analysis. The primary source included direct observations, photographs of scenic locations and the use of structured questionnaires; while the secondary data sources included data collected from the Ondo State Ministry of Works and Housing (ODSMWH), relevant journals, textbooks, coordinate points from GPS and Google earth map extracts of the study area. Four buffer corridors of 50m, 100m, 150m and 200m respectively, were created along the power-line to identify buildings encroaching on it (Table 1). The number of buildings identified along the corridors were 206, 267, 313 and 315 respectively. Cumulatively the total number of buildings was 1,101 with a purposive 20% sample size of 221. Two hundred and twenty-one (221) questionnaires were administered to the most senior household member in each building (Table 1).

Table 1: Sampling along Power-line Buffer Corridors in Akure

S/N	Buffer Distance	No of buildings	20% of Buildings
1	50m	206	42
2	100m	267	53
3	150m	313	63
4	200m	315	63
Total	-	1101	221

Source: Author's Fieldwork, 2021

© 2022 London Journals Press

IV. FINDINGS AND DISCUSSIONS

4.1 Socio-Economic Characteristics of Respondents

Table 2 shows the socio-economic characteristics of respondents resident in the study area.

Table 2 shows that about 70% of respondents are male while 30% are female. This data confirms that the study area is a male dominated household neighborhood which is typical of households in the western part of Nigeria.

On the age of respondents, it is apparent that 6.3% are within the age bracket of 15-25 years; 43.9% of the respondents are within the age group of 26-40 years; 39.8 % falls between 41-65years while; 10.0% falls between the age range of 65 years and above. This implies that majority of the respondents are in the economically energetic age range of adulthood (18years) and retirement (65 years). Again, Table 2 shows that 66.1% of the respondents are married, 27.6% are single, and 3.2% are divorced, while 3.2% are widowed. Since majority of the respondents are married, it is implied that there is a likelihood of population explosion which can further aggravate the impending impingement on sustainable livelihood in the study area.

Table2: Socio-Economic Characteristics of Respondents. N=221

Variable	Frequency	Percentage (%)
Sex		
Male	154	69.7
Female	67	30.3
Age		
15-25 years	14	6.3
26.40 years	97	43.9
41-65 years	88	39.8
65 years above	22	10.0
Marital Status		
Single	61	27.6
Married	146	66.1
Divorced	7	3.2
Widow/widower	7	3.2
Education		
None	28	12.7
Primary	63	28.5
Secondary	81	36.7
Tertiary	49	22.1
Occupation		
Farming	30	13.6
Trading	110	49.8
Public Service	38	17.2
Artisanal	36	16.3
Unemployed	7	3.2
Income		
Below 20,000	46	20.8
20,000-40,000	86	38.9
40,000-60,000	53	24.0
Above 60,000	36	16.3

Source: Authors' Fieldwork, 2021

© 2022 London Journals Press

Additionally, it is obvious from Table 2 that 12.7% of the respondents has no formal education, 28.5% were primary school leaving certificate holders, 36.7% secondary school leavers and 22.2% had tertiary education. From the on-going, it is clear that encroachment on power-line corridor by the residents was not out of ignorance; about 80% of them could read and write, hence, choosing to live under this hazardous condition could be as a result of reasons beyond their control: such as poverty, lack of access to buildable land and joblessness among others.

Table 2 equally shows that 13.6% of respondents were farmers; 49.8 %, traders; 3.2%, unemployed; 17.2%, public servants and 16.3 % engaged in artisanal works. From the analysis, over 66% of respondents are into artisanal works and trading which implies that the power-line corridor is majorly pre-occupied by commercial activities.

This phenomenon could be due to the recent posture of the State government at prohibiting illegal trading and enforcing it along major roads in the city.

On the income status of respondents, Table 2 also shows that 20.8% of the respondents earned below ₦20,000; 38.9% earned between ₦20,000 - ₦40,000; 24.0% earned between ₦ 40,000 – ₦ 60,000 and 16.3% earned above ₦ 60,000. This implies that with the current exchange rate of NGR411.499 to 1USD, less than 50% of respondents earn between $40 and $50 per month. This amount is about 1.33 USD per day, which is below the universal standard of S1.9 per day for measuring global poverty line (World Bank, 2016). This shows that residents along the power-line corridor are among people living under extreme poverty.

4.2 Length of Stay of Respondents

Figure 1 shows the length of stay of respondents in the study are.

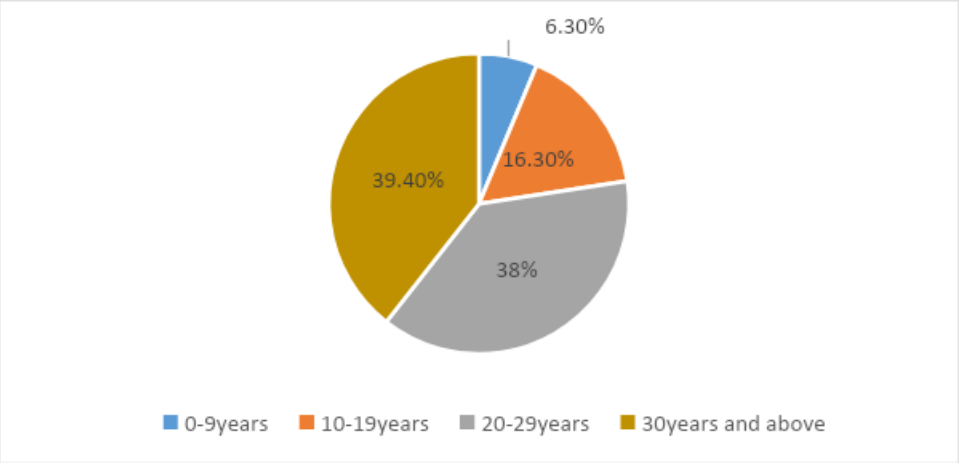


Figure 4: Length of Stay of Respondents in the Study Area

Source: Author's Fieldwork, 2021

From Figure 4, it is obvious that respondents who have stayed in the study area between 0-9 years constitute about 6.3% of the total number of respondents, 77% of them have stayed in the study area for over 25 years. This phenomenon shows that contravention in the Corridor had been an incessant and protracted one.

4.3 Delineating the Buffer Corridors in Akure

In order to mark out purposively, in details, the extent or edge of the powerline corridors in the study area, the GIS and Remote Sensing technologies were adopted. The corridors were delineated using different buffer widths of 50, 100,150 and 200 meters. In each corridor, the total number of buildings identified and the percentage of the total are as shown in Table 3

© 2022 London Journals Press

Table 3: Buffer Corridors and Total Number of Buildings

S/N	Buffer Corridor	No of Buildings	Percentage
1	50m	206	18.7
2	100m	267	24.3
3	150m	313	28.4
4	200m	315	28.6
Total	-	1101	100.0

Source: Author's Fieldwork, 2021

Moreover, Figures 5, 6, 7 and 8 show the buffering operations at 50m, 100m, 150m and 200m distances respectively. From Table 3 the total number of buildings encroaching on the powerline corridors are 206, 267, 313 and 315 with percentages of 18.7, 24.3, 28.4 and 28.6 respectively. The trend reveals that the farther one moves away from the center of power-line the more the number of buildings. The implication of this is that the people are conscious of encroaching on the power-line.

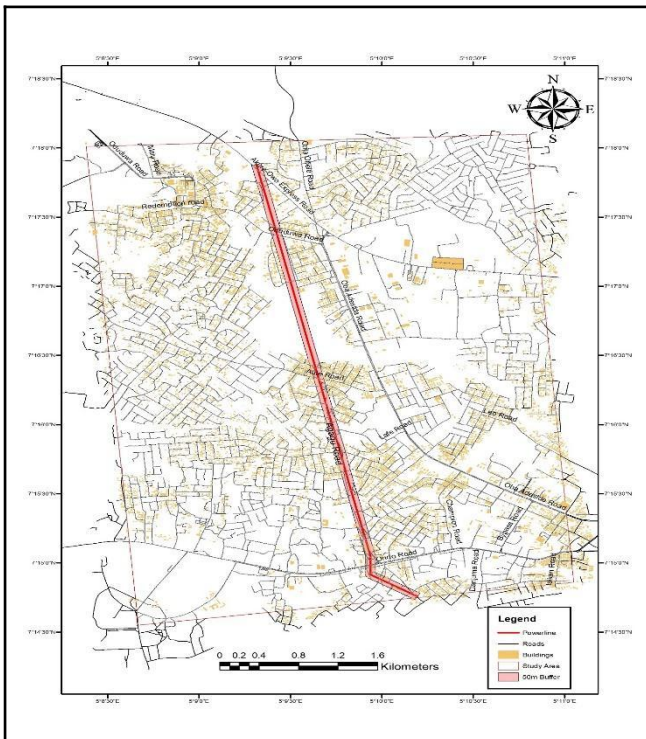


Figure 5: 50m Buffer on Powerline Corridor in Akure

Source: GIS Analysis, Author's Fieldwork 2021

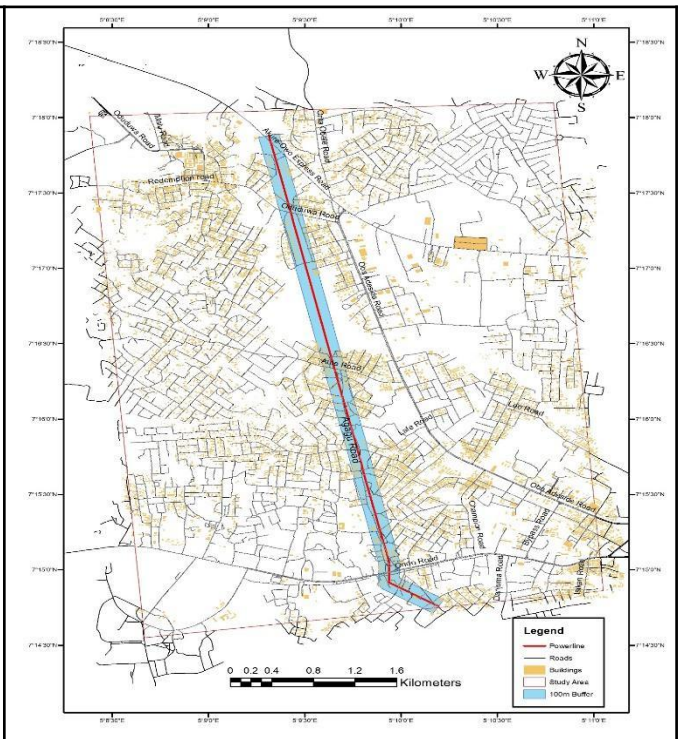


Figure 6: 100m Buffer on Powerline Corridor in Akure

Source: GIS Analysis, Author's Fieldwork 2021

© 2022 London Journals Press

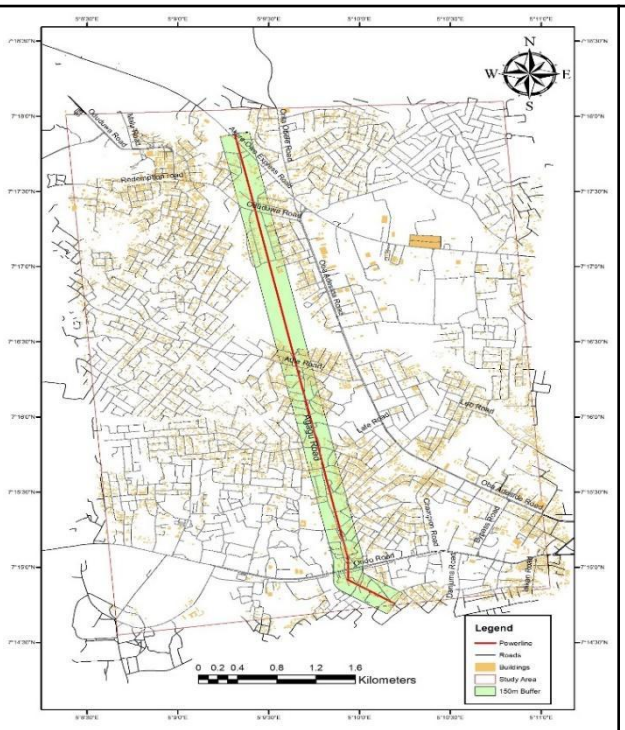


Figure 7: 150m Buffer on Powerline Corridor in Akure

Source: GIS Analysis, Author's Fieldwork 2021

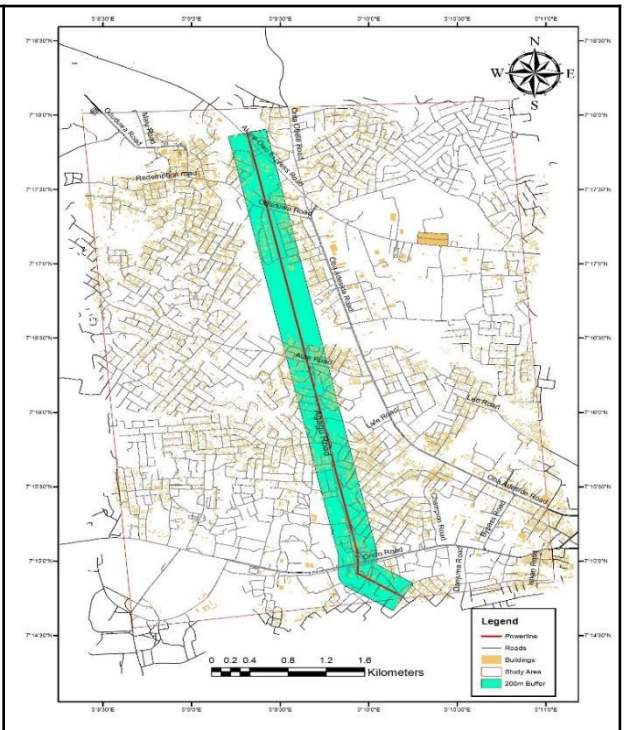


Figure 8: 200m Buffer on Powerline Corridor in Akure

Source: GIS Analysis, Author's Fieldwork 2021

In addition, Figure 9 shows the combined sections of the 50, 100, 150 and 200m buffer corridors in the study area. The total number of buildings in the combined buffers is 1,101.

© 2022 London Journals Press

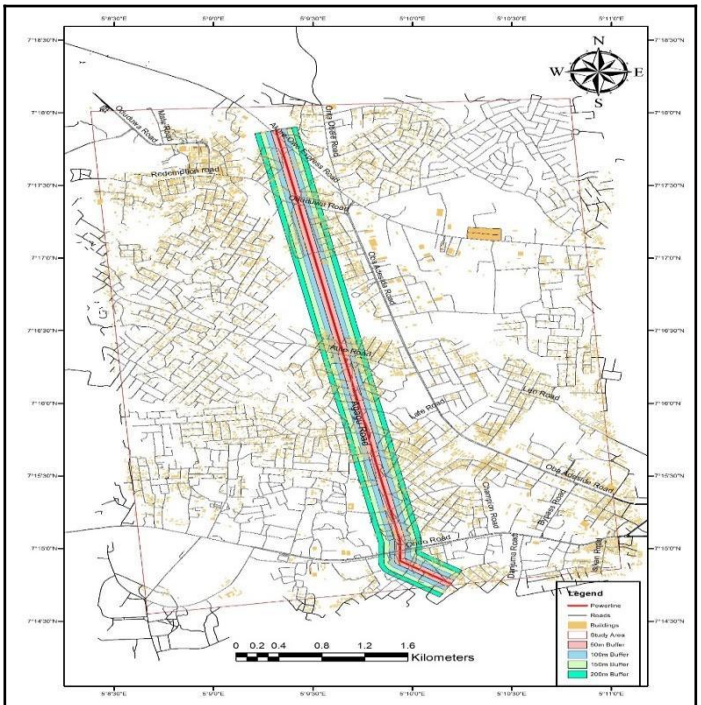


Figure 9: Combined Sections of 50, 100, 250 and 200m Buffer on Power-line Corridors in Akure

Source: GIS Analysis, Author's Fieldwork 2021

4.4 Ownership Status of Buildings on the Power-line Corridors

Figure 10 shows that about 60.60% of the respondents attested that the apartments they are occupying were rented out to them by the original owners; while 29.90% got theirs through inheritance and 9.50%, by outright purchase from the original owners.

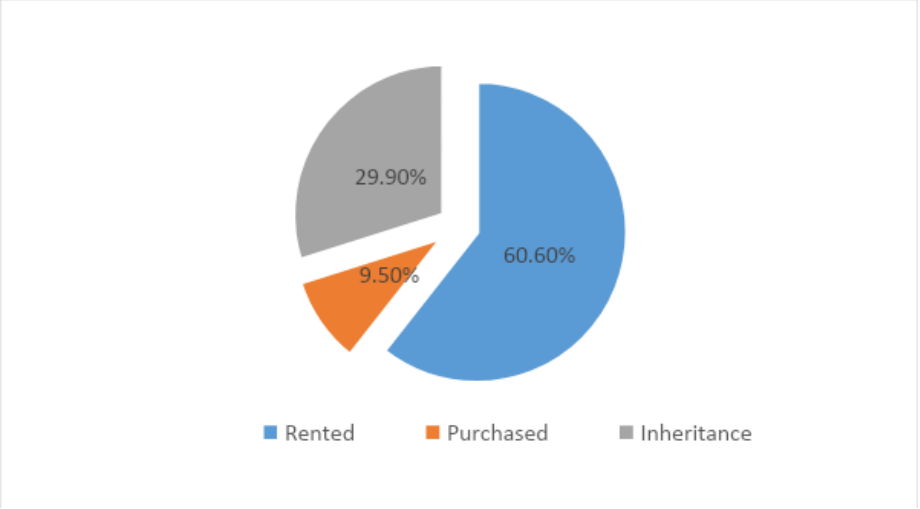


Figure 10: Ownership Status of Buildings in the Study Area

Source: Authors' Fieldwork, 2021

From the data presented, it is obvious that the power-line corridor which is expected to be government acquisition area is still being owned by individuals who claimed to be *'omo oniles'* (original land owners), and still rent such lands out or sell it out by outright purchase to unsuspecting, innocent buyers. On the year of construction of buildings in the Corridor,

© 2022 London Journals Press

empirical analysis shows that 33.9 % respondents adjudged that buildings in the study area have been constructed before year 1980 while 24.4 % were built between year 1981-1990, 19.5 % were erected between the year 1991-2000 and 22.2% were built in year 2000 till date.

Table 5: Year of Construction of Buildings in the Power-Line Corridor

Year of Construction	Frequency	Percentage (%)
Before 1980	75	33.9
1981-1990	54	24.4
1991-2000	43	19.5
Year 2000 till date	49	22.2
Total	221	100.0

Source: Authors' Fieldwork, 2021

V. MAJOR ACTIVITIES IN THE POWER-LINE CORRIDOR

Table 4 shows the major activities directly operating in directly under the Power-line. Respondents perception of the major activities under the Power-line shows that welding works account for 20.4%; auto-repairing, 30.8%; trading, 13.6%; farming, 13.1%block making, 15.8% and others, 6.4%. From the data presented, it is clear that auto-repairing constitute the major activity in the Corridor. Observation shows that welding and panel beating activities are co-located with auto-repairing especially along Akure/Ilesha highway, FUTA South Gate area and Agagu Road.

Table 4: Major Activities in the Power-Line Corridor

Activities	Frequency	Percentage (%)
Welding	45	20.4
Auto repairing	68	30.8
Trading	30	13.6
Farming	29	13.1
Block making	35	15.8
Others	14	6.4
Total	221	100

Source: Authors' Fieldwork, 2021

For instance, Figure 11 shows auto-repairing, volcanizing, block making, and residential activities in the study area.

© 2022 London Journals Press

(a). Auto-repairing activity along Agagu Road

(b). Volcanizing activity at FUTA Gate area

(b). Block-making activity along Akure/Ilesha Highway

(d). Residential activity in Awule Community

Figure 11: Various Activities in the Study Area

Source: Authors' Fieldwork, 2021

In addition to the above-listed activities, farming was also a major activity along the corridor. At locations traversed by streams or rivers, farming activity occurs all-year round while in other areas it is seasonal. Figure 12 shows farming activity in the corridor. The major crops planted include vegetables, maize, cassava and soya-beans among others.

© 2022 London Journals Press

Figure 12: Maize Farm directly under the overhead Power-line

Source: Authors' Fieldwork, 2021

VI. CONCLUSION AND RECOMMENDATIONS

This paper revealed that, there are more males (69.7%) than females (30.3%) in the study area; majority of respondents (80%) are below the age of 65years signifying a youthful population; Most of the respondents are married (66.1%) indicating a possible population explosion; about 77.3% of respondents are educated. The major activities in the corridor include: auto-repairing, welding works, trading, farming and block-making. Over 90% of respondents earn less than $100.0 per month which is about 10 times below the UN standard and over 77% of the inhabitants have been living in the study area for over 20 years showing a long period of residents living/working under unhealthy condition.

Going by the high number of buildings encroaching on the corridor, it is imperative for the State Government to urgently strengthen existing laws and promulgate new codes that will prevent encroachments on the power-line with a view to protecting the health of residents and ensuring sustainable urban development in the study area. Also, educating the public on codes, rules and regulations, prohibiting buildings close to high voltage electrical transmission lines and base station rights-of-way must be prioritized. Shanties along the corridor distorts the beauty of the cityscape, hence power-line setbacks should be landscaped for aesthetic purpose.

REFERENCES

1. Abolade, O., and Adeboyejo, A. (2006). Analysis of Spatial Changes in Ogbomosho City:. *Journal of the NITP, Vol XIX no.1, 40th Anniversary Issue,*, 35-47.
2. Agbola T.O. (2001). Readings in Urban and Regional Planning. Macmillan Publisher, London.
3. Akintonwa, A., and Busari et al, A. (2009). The Hazards of Non-Ionizing Radiation of Telecommunication Mast in an Urban Area of Lagos, Nigeria. *African Journal of Biomedical Research*, 31-35.
4. Aliyu, O., and Ali, H. (2011). Analysis of magnetic field pollution due to 330kva and 132kva transmission lines. *Journal of Technology and Educational Research, 4(20)*, 87-93
5. Fahria, M. (2009). *Urban Fringe Management and Role of Good Governance:Integrating Stakeholders in Land Management Process.7th FIG Regional Conference Spatial Data Serving People: Land Governance and the Environment*, 19-22.

© 2022 London Journals Press

6. Marshall, R., and Baster, R. (2002). Strategic Routeing and Environmental Impact Assessment for Overhead Electrical Transmission Lines. *Journal of Environmental Planning and Management, 45(5)*, 747-764. doi:10.1080/0964056022000013101
7. Neuert, and Michael, R. (2012). What Distance is Safe? www.emfinfo.org (2012)
8. Ojambati, V. (2007). Land use succession: the viability of conversion of Agricultural land to Residential use at Akure Urban Fringe. *Federal University of Technology, Akure, Nigeria: An unpublished B.Tech Thesis submitted to Department of Estate Management*.
9. Oketola. (2012). Internet access experts worry over 95% deprived Nigerians. *The punch news paper*, February 11. Pg7.
10. Olamiju, I. O. (2014). *Micromanagement of Infrastructure in Private Residential Layouts in Akure, Nigeria*. Unpublished Ph.D. Thesis, Urban and Regional Planning Department, School of Environmental Technology, School of Environmental Technology, federal University of Technology, Akure, Nigeria.
11. Olamiju, I. O., and Oyinloye, M.A. (2015). Characteristics and Vulnerability of Houses under Overhead High-Tension Powerline in Akure, Nigeria. *World Environment, Vol. 5 No. 3*, pp. 121-133. doi:10.5923/j.env.20150503.04
12. Oloto, E., and Adebayo, A. (2007). The New Lagos –Challenges Facing The Peri-Urban Areas and its Relationship With Its City Center. *Department of Architecture, University of Lagos, Nigeria*. Retrieved from: https//www.researchgate.net/public
13. Olapeju O.O. and Farotimi A.O. (2016*). 'Profile of Buildings on the setback of High Tension Power lines in Agbado, Ogun State*. Research Gate, Conference paper, (January, 2016).
14. Ramunas and Robertas (2020). Distribution of magnetic field in 400kV double-circuit transmission lines, Faculty of Electrical Electronics Engineering, Kaunas University of Technology, LT-51367, Kaunas, Lithuania. Available online at: https://www.mdpi.com/2076-3417/10/9/3266.
15. Wikipedia. (2021, February 03). *Wikipedia*. Retrieved from Wikipedia: https://en.wikipedia.org›wiki›Overhead_power_line.

© 2022 London Journals Press

Scan to know paper details and
author's profile

Impact of Chemical Constituents in Hair Dressing Salon Effluent on Soil and Soil Bacterial

Ugueri Udochukwu & Amupitan Paul

Salem University Lokoja

ABSTRACT

This research studied the Impact of Chemical Constituents in Hair Dressing Salon Effluent on Soil and Soil Bacterial. The soil sample was collected from Ganaja village, Lokoja, Kogi State.

A 25 liter Jerri can with a height of about 30cm was filled with soil and polluted with the hair dressing salon effluent for 30 days. After 30 days of pollution, the top soil was collected from the height of 0-5cm, middle soil 12-17cm and the sub soil 25-30cm. The total heterotrophic bacterial count was determined, the acute and chronic toxicity of the effluent on bacterial was determined and the soil was analyzed for the presence of polyaromatic hydrocarbon using gas chromatography with mass spectrometry.

Keywords: soil, bacteria, polyaromatic hydrocarbon, toxicity, hair dressing salon effluent.

Classification: DDC Code: 628.5 LCC Code: TD172

Language: English

London Journals Press

LJP Copyright ID: 925646
Print ISSN: 2631-8490
Online ISSN: 2631-8504

London Journal of Research in Science: Natural and Formal

Volume 22 | Issue 2 | Compilation 1.0

© 2022. Ugueri Udochukwu & Amupitan Paul. This is a research/review paper, distributed under the terms of the Creative Commons Attribution- Noncom-mercial 4.0 Unported License http://creativecommons.org/licenses/by-nc/4.0/), permitting all noncommercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

Impact of Chemical Constituents in Hair Dressing Salon Effluent on Soil and Soil Bacterial

Ugueri Udochukwu[α] & Amupitan Paul[σ]

ABSTRACT

This research studied the Impact of Chemical Constituents in Hair Dressing Salon Effluent on Soil and Soil Bacterial. The soil sample was collected from Ganaja village, Lokoja, Kogi State.

A 25 liter Jerri can with a height of about 30cm was filled with soil and polluted with the hair dressing salon effluent for 30 days. After 30 days of pollution, the top soil was collected from the height of 0-5cm, middle soil 12-17cm and the sub soil 25-30cm. The total heterotrophic bacterial count was determined, the acute and chronic toxicity of the effluent on bacterial was determined and the soil was analyzed for the presence of polyaromatic hydrocarbon using gas chromatography with mass spectrometry. The polyaromaic hydrocarbon (PAHs) detected in the test soil sample were 45.02ng/g biphenyl, 28.23ng/g Benzo[a] pyrene, 12.05ng/g Anthracene, 23.00ng/g and 5.07ng/g Phenanthrene. Only 2.01ng/g of biphenyl was detected in the control garden soil, while counts from the contaminated soil ranged from 1.0 x10² ± 1.10 to 4.0 x 10² ± 0.11. The counts from the control soil sample ranges from 2.0 x10³ ± 0.20 to 8.2 x10³ ± 0.20. The control soil sample had higher value compared to the test soil samples.

The following isolate were identified. Serretia sp., Klebsiella sp., Escherichia coli, Pseudomonas sp., Staphylococcus sp. Pseudomonas sp. and Staphylococcus sp had the highest percentage occurrence. The acute and chronic toxicity test showed a decline in bacterial count which could have occurred as a result of the presence of PAHs from Salon effluent. The findings from this research indicate that there is a constant release of PAHs into the soil which poses serious threat to the survival of soil bacteria and other soil biological sentinels.

Keywords: soil, bacteria, polyaromatic hydrocarbon, toxicity, hair dressing salon effluent.

Author α σ: Department of Biosciences, Salem University Lokoja, Nigeria. e-mail: rev.dr.ud@gmail.com.

I. INTRODUCTION

Kogi state lokoja precisely battles with waste management, its efficient treatment as well as discharge. This is a major problem as Nigeria is counted among the developing countries which do not channel much attention towards efficient waste water management. Wastewater refers to any water that has been adversely affected in quality by anthropogenic influence. It comprises liquid waste discharged by domestic residences, commercial properties, small scale industries and aquifer treatment institutions. In general, waste water is characterized based on its bulk or organic contents, physical characteristics and specific contaminants (Damelle, 1995; Griffiths and Philippot, 2012). Efforts have been made towards curbing the menace of pollution around the world, particularly by the United Nations Environmental Programme. There have been many international conferences to this effect, such as the Rio de Janeiro conference of 1992 (Oyesola, 1998; OECD, 2004; Odokuma and Olewi, 2003). In many parts of the world, human activities still have negative impact on the environment. Some of the consequences of manmade pollution are transmission of disease by water-borne pathogens, eutrophication of natural water bodies, accumulation of topic or recalcitrant chemicals in the soil, destabilization of the ecological balance and negative effect on human health (Chikere and Okpokwasili, 2004).

The continuous trend toward the formulation of new beauty tips and manufacture of novel hair

© 2022 London Journals Press

products to satisfy the demands of the growing populace could lead to some pollution problems.

Today's salons offer a wide range of services from hair styling and skin treatments to tanning, manicure and make up application. In providing these services, waste is generated. In most cases, this waste goes into the sanitary sewer system, where it can have a negative impact on the environment (Bowers *et al.,* 2002). A typical example of what happens, is logging of contaminated water in the soil. In this situation, oxygen becomes less available as electron acceptor, results in the reduction of available nitrate into gaseous nitrogen which has negative effects. Leaching into ground water is a major concern, because of the recalcitrant nature of some contaminants (Lapygina *et al.*, 2002; Toetora *et al.*, 1997). Different methods of waste treatment have been developed for reasons of public health and conservation which results in the destruction of pathogens and the mineralization of the organic components of sewage prior to discharge. Anaerobic wastewater treatment using granular sludge reactor is one of such methods (Lin, 2001). However, in Nigeria like in many developing countries, the discharge of untreated waste into the environment is still a problem, despite the establishment of Federal Environment Protection Agency (FEPA) since 1998. Other considerations for treatment can be the removal of toxic organic pollutants and heavy metal altering the physical conditions of the water (e.g. pH, electrical conductivity, etc), removing sediment loads or biochemical oxygen demand (BOD).

The aim of this study is to examine the extent of contamination in untreated wastewater of five different hair salons in lokoja, Kogi State, Nigeria and the impact on soil and soil biological sentinels. Soil pollution causes decrease in soil fertility, alteration of soil structure, disturbance of the balance between flora and fauna residing in the soil, contamination of the crops, and contamination of groundwater, constituting a threat for living organisms (Udochukwu *et al.* 2014)

II. MATERIALS AND METHODS

The study area for this research was victory road, Ganaja Village, Lokoja, Kogi State. The soil sample was collected from Ganaja village, Lokoja, Kogi State. A 25 liter Jerri can with a height of about 30cm was filled with soil. The Jerri can was cut open at the top and bottom. The salon effluent was collected in with another Jerri can from different salons in Ganaja village everyday for 30days and poured into the Jerri can containing the soil. After 30 days of pollution, the top soil was collected from the height of 0-5cm, middle soil (12-17cm) and the sub soil (25-30cm). A non polluted garden soil sample was collected which served as the control soil sample was collected.

The four soil samples were taken to the labouratory to air dry for two and were sieved. The soil samples (1gram) each were weighed on the analytically weighing balance in the laboratory. A total viable heterotrophic bacterial count was determined using pour plate technique. The bacterial isolates were identified using the various biochemical test (Burkhard *et al.*, 2001).

2.1 Preparation of Hair Dressing Saloon Effluent Concentration for Toxicity Test

For the determination of the median lethal concentration (LC_{50}), hair dressing saloon effluent concentrations of 100, 200, 300, 400 and 500 ml/l will be formulated by adding (100, 200, 300, 400 and 500 g) in 1000 ml of Winograsky medium respectively (Ibiene and Okpokwasili, 2011). For the median effective concentration, the following hair dressing saloon effluent concentrations (20, 40, 60, 80 and 100 ml/l.) will be formulated by adding (20, 40, 60, 80 and 100 g) in 1000 ml of Winograsky medium respectively.

A control experiment consisting of Winograsky medium only will be set up (Ibiene and Okpokwasili, 2011).

2.2 Soil Bacteria Acute and chronic Toxicity Test

The acute toxicity test will be carried out by determining the median effective concentration (EC_{50}) with these effluent concentrations (20, 40, 60, 80 and 100 ml/l). Also, the chronic toxicity

© 2022 London Journals Press

will be carried out by determining the median lethal concentration (LC_{50}) with these effluent concentrations (100, 200, 300, 400 and 500 ml/l). The winograsky medium which will be fortified by several milliliters of hair dressing saloon effluent (100, 200, 300, 400 and 500 ml/l) and (20, 40, 60, 80 and 100 ml/l) respectively.

They will be inoculated with ten milliliters of bacteria standard inoculum. They will be allowed to stand for an hour for growth. 1 ml of the suspension thereafter will be plated from mineral salt media composted with different volumes of hair dressing saloon effluent on a non-hair dressing saloon effluent composted winograsky agar plates. This will be carried out for the all concentrations and repeated for 2, 3 and 4 h interval (Okpokwasili and Odokuma, 1996). The colony forming units for each plate will be calculated and used to determination acute toxicity (EC_{50}) of the various hair dressing saloon effluent composted mineral salt media. The chronic toxicity of the effluents on soil bacteria will be determined by calculating the lethal concentration (LC_{50}) using probit analysis. All results will be subjected to the analysis of variance (ANOVA) (Ferrara *et al.,* 2006).

2.3 Instrumentation and Conditions

Hewlett Packard HP 5890 series II Gas chromatograph equipped with an Agilent 7683B injector (Agilent Technologies Santa Clara, CA, USA), A 30 m, 0.25 mm i.d. HP-5MS capillary column (Hewlett – Packard, Palo Alto, CA, USA) coated with 5% phenyl-methylsiloxane (film thickness 0.25 m) and an Agilent 5975 mass selective detector (MSD) will be used to separate and quantify the BPA compounds. The samples will be injected in the split less mode at an injection temperature of 300°C. The transfer line and ion source temperature will be 280°C and 200°C. The column temperature will be initially held at 40°C for 1min, raised to 120°C at the rate of 25°C/min, then to 160°C at the rate of 10°C/min and finally to 300°C at 5°C/min, held at final temperature for 15 min. Detector temperature will be kept at 280°C. Helium will be used as a carries gas at a constant flow rate of ml/min. Mass spectrometry will be acquired using the electron ionization (EI) and selective ion monitoring (SIM) mode. A PerkinElmer Gas Chromatograph model Autosystem XL, with Flame Ionization Detector will be used for identification of BPA, phthalate, organotin, alkyl phenol and other cosmetic chemicals by comparison between the retention times of the BPA sample peak and the standard compound.

The quantification carried out done by the internal normalization method. An Elite-5 fused silica capillary column (30 m x 0.25 mm i.d. crossbond 5% diphenyl – 95% dimethyl polysiloxane, 0.25 µm film thickness) will be used for the GC separation using the following oven temperature program: 150°C (5 min hold) heating to 250°C at 3°C/min and heating to 300°C at 10°C/min (5 min hold). The injector temperature will be 250°C. The injection volume will be 1.0 µL (n=3) in the split mode (1:50) (Burkhard *et al.*, 2001).

© 2022 London Journals Press

III. RESULTS

Fig. 1: Top Soil Sample

Fig. 2: Mid Soil Sample

© 2022 London Journals Press

Fig. 3: Sub Soil Sample

Table 3.1: Heterotrophic bacteria count for the effluent-enriched composting soil and the control garden soil. The garden soil sample had higher counts compared to the test salon effluent-enriched composting soil which was as result of the inhibition of bacteria by the PAHs present in the test soil sample

S/N	Bacterial Isolates	Frequency (%)
1	*Pseudomonas* spp.	27.27
2	*Staphylococcus* spp.	27.27
3	*Escherichia coli*	18.18
4	*Serretia* spp.	18.18
5	*Klebsiella* spp.	9.09

Table 3.2: Frequency of Bacterial Isolates

Time (Days)	Garden soil sample	Effluent composted soil
1-3	$7.8 \times 10^3 \pm 0.10$	$4.0 \times 10^2 \pm 0.11$
4	$7.5 \times 10^3 \pm 0.11$	$3.0 \times 10^2 \pm 2.10$
5	$8.2 \times 10^3 \pm 0.20$	$1.0 \times 10^2 \pm 1.10$
6	$6.8 \times 10^3 \pm 0.40$	No growth
7	$2.0 \times 10^3 \pm 0.20$	No growth

© 2022 London Journals Press

Table 3.3: Individual PAHs Detected in the Soil Samples and Their Concentration, Biphenyl, Benzo[a]pyrene, Anthracene and Phenanthrene Were Detected in the Plastic-Enriched Composting Soil While Only Biphenyl Was Detected in the Garden Soil Sample

PAHs	Effluent composted soil	Garden soil sample
Biphenyl	45.02	2.01
benzo[a]pyrene	12.05	NR
Anthracene	28.23	NR
phenanthrene	5.07	NR
Naphthalene	<LOD	NR
Flourene	<LOD	NR
Coronene	NR	NR
Total (ng/g)	90.37	2.01

Table 3.4: Bacterial Toxicity Analysis Showing the Values for the Median Effective Concentration (EC50) and the Median Lethal Concentration (LC50) Which Was Carried Out With the Salon-Enriched Composting Soil Sample at Different Time Intervals

Incubation time	EC_{50} for acute toxicity	LC_{50} for chronic toxicity
1h	123.13	13.39
2h	111.31	15.94
3h	81.72	23.93
4h	52.00	25.04

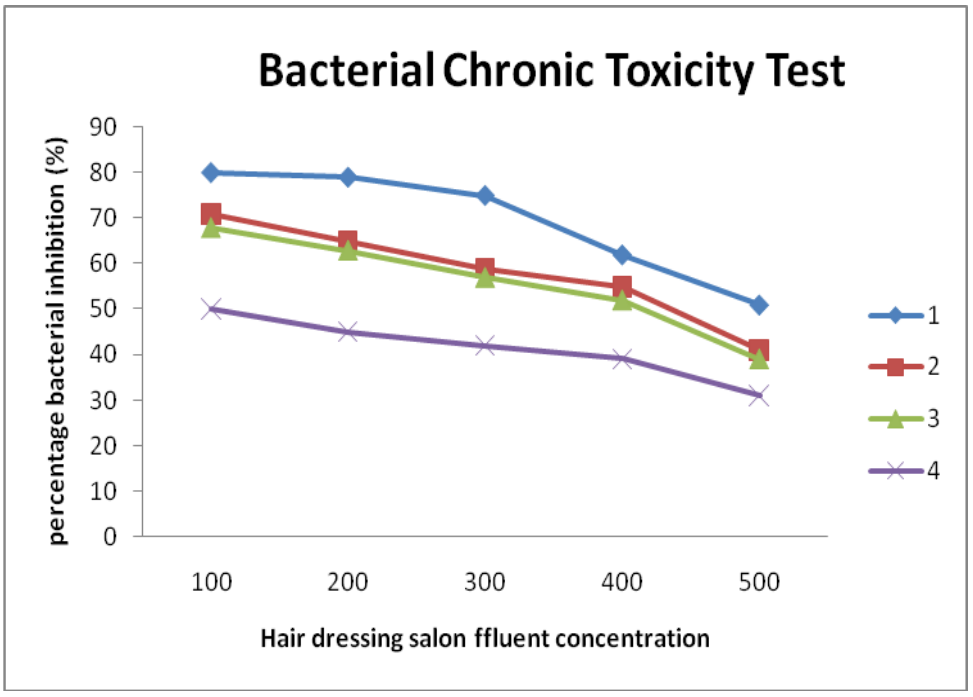


Fig. 3.3: A Growth Curve Showing Bacterial Inhibition at High Salon Effluent Concentration From 1 to 4 Hours

© 2022 London Journals Press

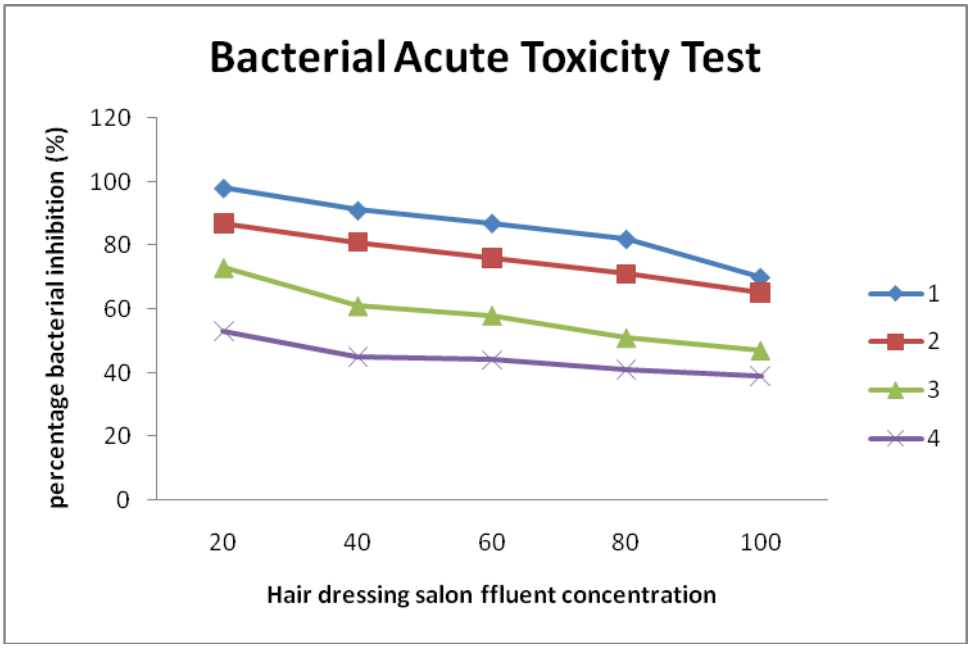


Fig. 3.4: Percentage Bacterial Inhibition at Low Salon Effluent Concentration From 1 to 4 Hours

IV. DISCUSSION

The results from this study showed that at the end of the pollution, there was a change in the colour of the soil sample from the top soil, mid soil to the sub soil which was as a result of the chemicals present in the salon effluent (Plate 1, 2 and 3).

This study revealed some of the degradation by-products of different PAHs the soil. Most of these compounds are in the degradation pathway of lots of PAHs like Biphenyl. The gas chromatography revealed the presence of PAHs in the Salon effluent composting soil. The concentration of the PAHs present in the soil were 45.02ng/g biphenyl, 28.23ng/g Benzo[a]pyrene, 12.05ng/g Anthracene, 23.00ng/g and 5.07ng/g Phenanthrene. Naphthalene and Flourene were below the limits of detection. Coronene was not recovered in the Salon effluent composting soil sample. Only 2.01ng/g of biphenyl was detected in the control garden soil, other PAHs were not recovered (Table 3.3). The total concentration of PAHs in the Salon effluent composted soil was 90.5ng/g and 2.01ng/g for the control garden soil sample. The presence of polyaromatic hydrocarbon, if not properly controlled, can affect the soil fertility and soil fauna which is has been established by (Lokke and Rasmussen, 1983).

These PAHs elicit toxic effects on the soil and soil biological sentinels. Atuanya *et al.* (2016) had earlier revealed that autotrophic transformation by nitrifying bacteria which enhances soil fertility may be hindered in an ecosystem polluted with high concentration of PAHs as nitrification processes will be altered.

PAHs have been shown to have acute effects on heterotrophic bacteria. The results showed that the bacterial counts from the control garden soil sample were higher than the test Salon effluent soil where bacterial growth was inhibited. The Salon effluent composted soil had counts ranging from 1.0 x 10^2±1.10 to 4.0 x 10^2±0.11cfu/g while the control soil sample had counts ranging from 2.0 x 10^3±0.20 to 7.8 x10^3±0.10cfu/g (Table 3.1).

This was as a result of the presence of acidic degradation PAHs in the soil which inhibited the growth of bacteria. Dalgaar *et al.* (2003) observed that pollution on soil can affect the growth of microorganisms in the soil. The degradation test was carried out; growth was observed in the mineral salt media which showed that some components of the PAHs were being degraded by bacteria. The result obtained in this study is in line with the previous study of (Wick *et al.*, 2010; Atuanya *et al.*, 2011). *Pseudomonas* sp. and

© 2022 London Journals Press

Staphylococcus sp had the highest percentage occurrence (Table 3:2).

The acute and chronic toxicity effect of the Salon effluent composted soil was conducted since growth is a function of enzyme activity and its measurement has been used as an indicator of pollution (Wilson *et al.,* 2001; Witter *et al.,* 20000). A decline in bacterial count was observed, and which could have occurred as a result of the presence of PAHs from Salon effluent which must have caused a toxic effect on the organism as earlier reported by Okpokwasili and Odokuma. (1997) who assessed the ecotoxicological impact of petroleum refinery oily sludge. The results of toxicity studies showed that the toxicity of Salon effluent composted soil on soil bacteria depended on the contact time and effluent concentration which corroborated Ibiene and Okpokwasili (2011) who assessed the toxicity of different insecticide concentrations on *Nitrobacter* sp. The EC_{50} values increased with increase in exposure time (Table 3.4) while the LC_{50} values decreased with increased exposure time. This shows that at low Salon effluent composted soil concentrations the bacteria were able to adapt and oxidize nitrite which increased with time (Figure 3.4). Also at higher Salon effluent composted soil concentration, the bacterial growth and metabolism were retarded even up to a hundred percent (Figure 3.3) resulting to decreasing LC_{50} values which is as a result of the inhibition of enzyme activities by the PAHs in the Salon effluent composting soil (Dokaniakis *et al.,* 2005; Atuanya *et al.,* 2012).

The comparison of LC_{50} and EC_{50} values of the test system showed that the LC_{50} values were lower than the EC_{50} values which suggest that LC_{50} was the best criterion for assessing response of the bacteria to toxicity. The results obtained from this study further suggest that autotrophic transformation may be hindered in an ecosystem polluted with these PAHs as bacterial growth and other microbial activities will be hindered (Ibiene and Okpokwasili, 2011).

Table 3: Shows the cultural, morphological and biochemical characteristics of bacteria isolate. The following isolate were identified. *Serretia* sp., *Klebsiella* sp., *Escherichia coli, Pseudomonas* sp., *Staphylococcus* sp. A total of 5 bacteria were isolated from the soil samples. *Pseudomonas* sp. and *Serretia* spp. had the highest percentage occurrence followed by *Klebsiella* sp. and *Escherichia coli*, this study agrees with the study of (Baath, 1989; Udochukwu *et al*., 2018; 2021).

The low occurrence of the Klebsiella can be attributed to the high Chlorine content of salon waste water as Chlorine is bactericidal to enteric bacteria (Ajuzie and Osaghae 2011; Auanya *et al*., 2016a).

The physiochemical parameters of waste water sample; the physiochemical analysis shows the pH to be 6.82. The result indicates that the pH value varies from weakly acidic. This could be attributed to the presence of chemicals like sodium hydroxide in hair relaxers and dyes used in hair conditioners (Donohue *et al.,* 2013). The pH value is however within the World Health Organization (WHO) and Federal Environmental Protection Agency (FEPA) acceptable limits of 6.0 – 9.0 for drinking water and waste water discharge into the surrounding (Ferna´ndez, *et al.,* 2006; Fierer and Lennon, 2011; Fred, 2002; WHO, 2004; Auanya *et al.,* 2016b).

V. CONCLUSION

From the analysis of the impact of discharge from salon waste water on soil, it was discovered that salon waste water seeps into the top soil, the mid soil and the sub soil. This could affect the normal flora of the soil, and from the study, there was low occurrence of *Klebsiella,* and this could be attributed to high Chlorine content of salon waste water as Chlorine is bactericidal to enteric bacteria. Other industrial activities in the study area could have contributed and influenced the low occurrence of the organisms present in the soil. From the result of the test, it reveals that there was significant relationship between salon waste water parameters and soil microbes.

REFERENCES

1. Ajuzie, C. U. & Osaghae, B. A. (2011). The bacterial and physico-chemical properties of hair salon wastewater and contaminated soil

© 2022 London Journals Press

in Benin metropolis. *African Journal of Biotechnology*, **10**(11): 2066-2069.
2. Atuanya, E.I., Aborisade, W.T. and Nwogu, N.A. (2012). Impact of Plastic Enriched Composting on Soil Structure, Fertility and Growth of Maize Plants. *European Journal of Applied Sciences*. **4 (3)**: 105-109.
3. Atuanya, E.I., Nwogu, N.A. and Akpaje, E. O. (2011). Biodegradation of Polyethylene Film by White-Rot Fungus *Pleurotus tuberrgium*. *Nigerian Journal of Aapplied Science*. **29**: 19-25.
4. Atuanya, E.I., Udochukwu, U., and Dave-Omoregie, A.O. (2016a). Bioavailability and toxicity of plastic contaminants to soil and soil bacteria. *British Microbiology Research Journal*. **13(6):**1-8.
5. Atuanya, E. I., O. M. Adeghe and U. Udochukwu (2016b): Bioavailability of Plastic Contaminants and Their Effects on Plastic Bottled and Sachet Drinking Water Supplies. *British Microbiology Research Journal*. 14(4): 1-10.
6. Baath E., (1989) Effects of heavy metals in soil on microbial processes and populations. Water and Soil Pollutyion Impact factor Journal. Research gate review Background, Metals and Inorganics, Pesticides and PCBs. EPA 440/4-79-029a.
7. Bowers, F., Cole, K., Hoffman J. (2002). *Characterizing Beauty Salon Wastewater for the Purpose of Regulating Onsite Disposal Systems*. New Jersey Department of Environmental Protection Division of Water Quality, Trenton.
8. Burkhard, S., Bernd, M.R., and Enrico, M., (2001). The Arabidopsis thaliana ABC transporter AtMRP5 controls root development and stomata movement. *Envronmental microbiology Journal*. **20**: 1875–1887.
9. Chikere G., C. Okpokwasili and O. Ichiakor (2009) Characterization of hydrocarbon utilizing bacteria in tropical marine sediments. *African Journal of Biotechnology*, **8** (11).
10. Damelle H. (1995) Chose appropriate water treatment technologies in Chemical Engineering.
11. Derraik, J.G.B. (2002). Fate and biological treatment. *Environmental Microbiology,* **76**:3936.
12. Dokaniakis, S.N, Kornaros, M, and Lyberatos C. (2005). On the effect of enobiotic bacterial nitrite oxidation. Proceedings of the 9th International Conference on Environmental Sciences and Technology Rhodes Island, Greece.
13. Donohue, K. M., Miller, R. L., Perzanowski, M. S., Just, A. C., Hoepner, L. A., Arunajadai, S., Canfield, S., Resnick, D., Calafat, A. M., Perera, F. P., and Whyatt, R. M. (2013). Prenatal and postnatal bisphenol A exposure and asthma development among inner-city children. *Journal of Allergy and Clinical Immunoogy,*. **131**: 736-741.
14. Engelhardt, G., and Wallno¨ fer, P.R., (1978). Metabolism of di- and mono-nbutyl phthalate by soil bacteria. *Applied Environmental Microbiology*. **35**: 243–246.
15. Engelmann, P., Molnar, L., Palinkas, L., Cooper, E.L. and Nemeth, P. (2004). Earthworm leukocyte populations specifically harbor lysosomal enzymes that may respond to bacterial challenge. *Cell and Tissue Research*, **316:** 391–401.
16. Environment Canada. (2001). The state of municipal wastewater effluent in Canada. Minister of Public Works and Government Services Canada.
17. FDA, US Department of Health Education and Welfare, Food and Drug Administration, (1982). Notice, Food Chemistry News, **24**, 32.
18. Ferna´ndez, M.-D., Vega, M.M., and Tarazona, J.V., (2006). Risk-based ecological soil quality criteria for the characterization of contaminated soils. Combination of chemical and biological tools. *Science Total Environment,* **366**: 466–484.
19. Ferrara, G., Loffredo, E., and Senesi, N., (2006). Effects of bisphenol A on the microtubule arrays in root meristematic cells of Pisum sativum *Plant letters,* **223**: 910–916.
20. Fierer, N and Lennon, J.T (2011). Metabolism of di- and mono-nbutyl phthalate by soil bacteria. *American Journal of Biotechnology,* **98**:1-5.

© 2022 London Journals Press

21. Fred B. (2002) Characterizing Beauty Salon Wastewater for the Purpose of Regulating Onsite Disposal System, New Jersey Department of Environment Protection, Division of Water Quality.
22. Griffiths, B.S and Philippot, L. (2012). Insights to resistance and resilience of the soil microbial community. *Microbiology Review*. **30**:60–79.
23. Ibiene, A.A, and Okpokwasili,. G.S.C. (2011). Comparative toxicities of three agro-insecticide formulations on nitrifying bacteria. *Report and Opinion*. **3(12):**14-17.
24. Lin, P. H. (2001). Study on the estrogenic active substances in the environment. Study report (EPA-90-E3S5-02-01) submitted to the Taiwan Environmental Protection Administration, Taipei, Taiwan.
25. Odokuma LO, and Oliwe SI. (2003). Toxicity of substituted benzene derivatives to four chemolithotrophic bacteria isolated from the New Calabar River. Global *ournal of Pure and Applied Science*. **26**:1-5.
26. OECD. (2004). Guideline for testing of chemicals: *earthworms reproduction test*. No. 222, Paris, France.
27. Oyesola D, (1998) Protection and Control of the Environment Polities and International Environmental Regulations. Daily Graphic Publications.
28. Udochukwu, U, O.C. Udinyiwe, O.M. Adeghe and F.I.Omeje (2014): Comparative effects of mashed mushroom and N.P.K Fertilizer on the bioremediation of crude oil polluted soil, *International journal of current microbiology and applied sciences*. 3(10): pp.65-70.
29. Udochukwu, U., Dave-Omoregie, A.O and Akaluzia, H.C (2018). Effects of Pesticide Application on the Growth of Soil Nitrifying Bacteria. *J. Appl. Sci. Environ. Manage*. 22 (3): 304-307.
30. Udochukwu, U., Emmanuel, S.E., Ehinmitan, E.O., Bodunde, R.S. and Isheke, J.O. (2021) Effects of Plastic Pollution of Soil on the Growth and Survival of Bacteria and Fungi. *J. Appl. Sci. Environ. Manage*. 25 (7): 1190-2021.
31. Wick, P, Malek, A, Manser, P, Meili, D, Maeder-Althaus, X, Diener, L, Diener, P.A, Zisch, A, Krug, HF, and von Mandach, U. (2010) *Environmental Health Perspective*. **118**:432-437.
32. Wilson, N. K., Chuang, J. C., and Lyu, C. (2001). Levels of persistent organic pollutants in several child day care centers. *Journal Exposition Analysis and Environmental Epidemiology,* **11:** 449-458.
33. Witter E., Giller K.E., McGrath S.P. (2000): Toxicity of heavy metals to microorganisms and microbial processes in agricultural soils: a review. Soil Biology and Biochemistry, 30: 45-56.
34. World Health Organisation, (1990). Tributyltin Compounds 116, WHO, Geneva, 273 pp.

© 2022 London Journals Press