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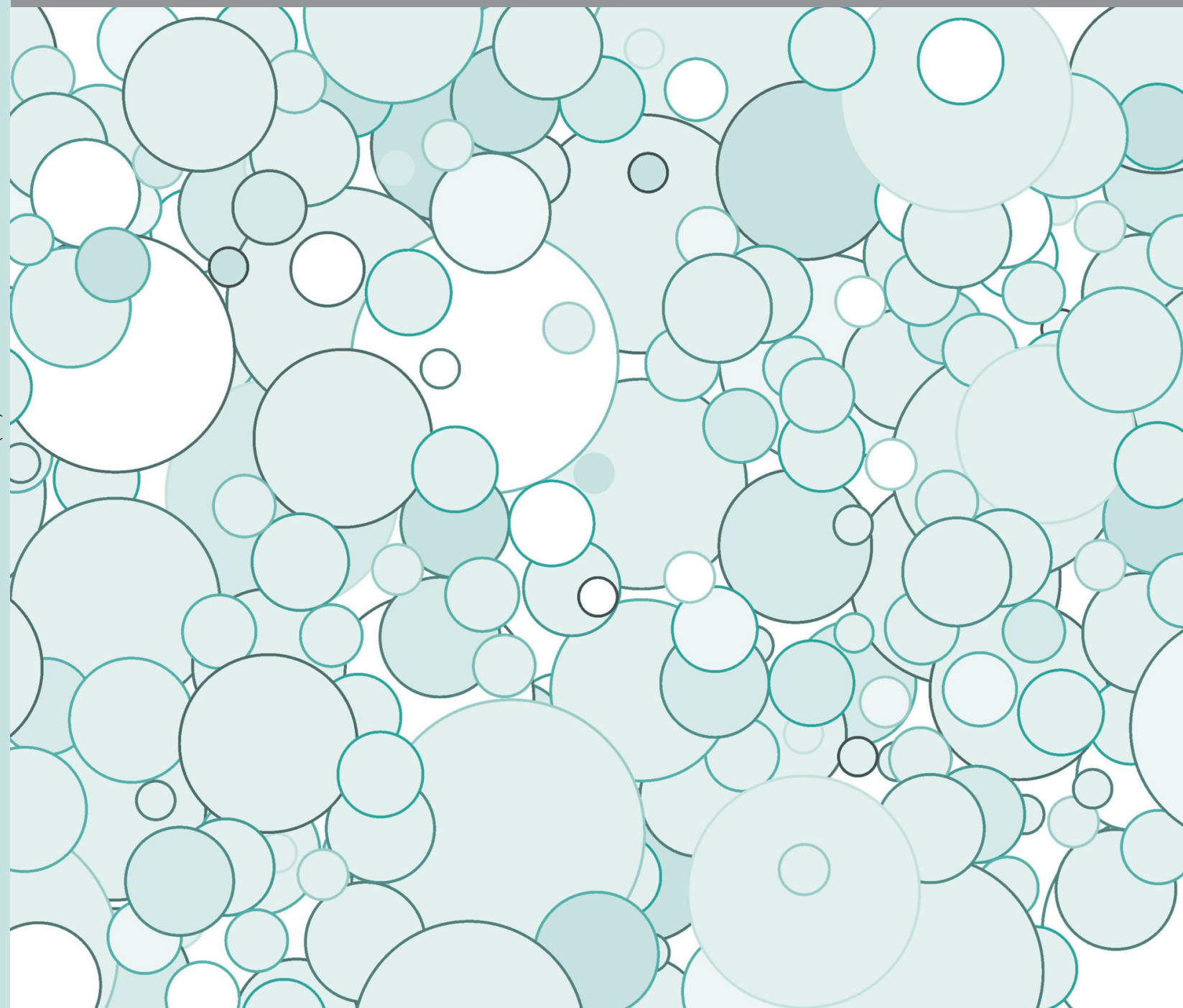
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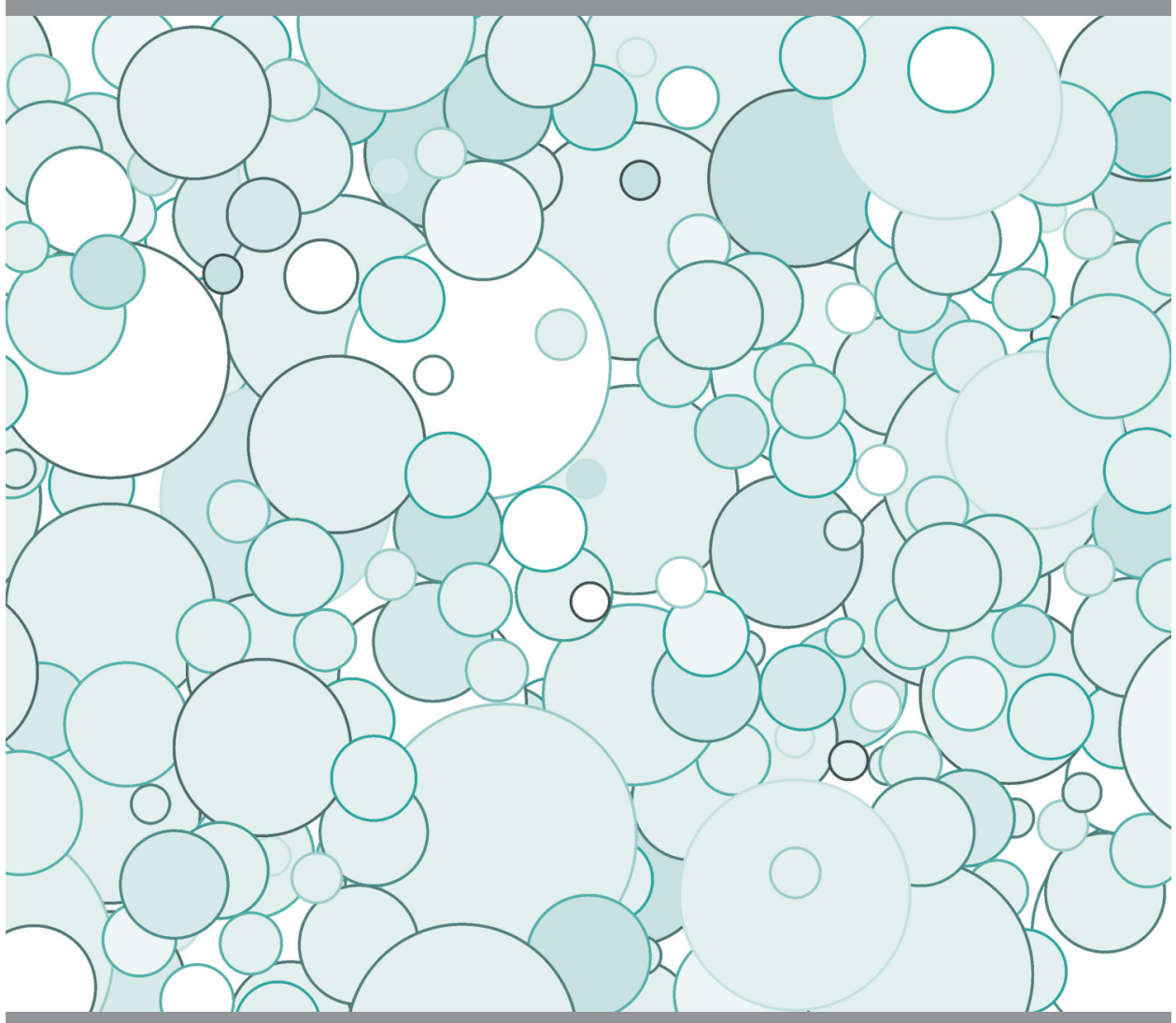
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CONTENTS

1	Antimicrobial potency of <i>Sphenocentrum jollyanum</i> on some human pathogenic bacteria Akinubi OA, Adejuwon AO, Bamkefa BA, Daniels OVC, Ojo VO	1-7
2	Bacteriological and physico-chemical analysis of well water samples in Ibadan South-East Local Government, Ibadan, Nigeria Olubiyi Akinsoji Akintobi, Adekunle Odunayo Adejuwon, Oluwatosin Adetola Arojojoye, Bukola Ayodeji Bamkefa, Adeyanju Suliat Oyenola	8-14
3	Nutritive and microbial analysis of two types of fermented locust bean (<i>Parkia biglobosa</i>) Ladokun, Olusola Abiola and Adejuwon, Adekunle Odunayo	15-17
4	Distance learning tools in education Mostafa Emami and Moslem Veazarati	18-22
5	Toxicity of Two Anticoagulant Rodenticides to Rodent Species under Laboratory Conditions Abd El-Aleem S. S. Desoky and Saudi A.S Baghdadi	23-25
6	World First Spiral Predictive Prime Number Calculus Vinoo Cameron, MD	26-27
7	The Entropy S_b of Black-hole M_b; The Basic Information Unit $I_0 = h/2$ of Hawking Radiation m_{ss}; Researching Some Characters of Entropy With Black-hole Theory Zhang Dongsheng 张洞生	28-36
8	The Status of the Rights of Accused under Different Indian Laws Dr. Ashish Kumar Singhal, Eakramuddin & Abroo Khan	37-46
9	The changing role of the law in interdependent society Dr. Ashish Kumar Singhal, Eakramuddin & Abroo Khan	47-51
10	A survey of e-banking on the customers' trust (case study: Damghan agricultural bank) Golnar Shojaei (PH.D.) , Mohammad reza babakhanian (MA)	52-57
11	Determination of Porosity and Density of rocks in Kwali Area Council, North-Central Nigeria. Abdulsalam N.N.and Ologe O.	58-62
12	The reasons for the existence of fundamentalism in Afghanistan Fatemeh Rajabi	63-67
13	Optimal Design of Wastewater Collection Networks Based on Production Rate of hydrogen Sulfide (H_2S) Mohammad Karami, Ehsan Drikvand	68-72

Antimicrobial potency of *Sphenocentrum jollyanum* on some human pathogenic bacteria

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Abstract: Water, ethanol, petroleum ether and chloroform were used individually to obtain extracts of the root of *Sphenocentrum jollyanum*. Each of the extracts was screened against some human pathogenic bacteria for antimicrobial activity. The human pathogenic bacteria were *Pseudomonas aeruginosa*, *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus mirabilis*, *Streptococcus faecalis*, *Staphylococcus aureus*. The aqueous extract of the plant root showed the least antimicrobial activity. It was effective on gram positive *Staphylococcus aureus* at a diluted concentration of 83mg/ml and *Streptococcus faecalis* at undiluted concentration of 100mg/ml. Solvent extracts of the sample were effectively better than the aqueous, with petroleum ether having the highest potency than ethanol and chloroform. Comparison of inhibitory effect of the root extract against some broad spectrum antibiotics revealed that ciprofloxacin had the highest efficacy against the susceptible gram negative bacteria used. Antimicrobial activity of these extracts on gram positive and gram negative bacteria cannot be overemphasized as potency of these bacteria was as high as the most potent antibiotic tested.

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Key words: *Sphenocentrum jollyanum*; medicinal plants; herbal medicine; antimicrobial; human pathogen; antibiotics disc

Introduction

Nature has been a source of medicinal agent for thousands of years and an impressive number of modern drugs have been isolated from natural sources, many based on their use in traditional medicine. Medicinal plants are of great importance to the health of individuals and communities. In fact, herbal medicines are known to serve the health needs of about 80% of the world's population; especially for millions of people in the vast rural areas of developing countries (WHO, 2001). Plants are rich in a wide variety of secondary metabolites such as tannins, terpenoids, alkaloids and flavonoids which have been found to have *in vitro*, antimicrobial properties (Edeoga *et al.*, 2005). The medicinal value of these plants lies in some chemical substances that provide definite physiological action on the human body. The relatively lower incidence of adverse reactions to plant preparations compared to modern conventional pharmaceuticals, coupled with their reduced cost consequently encouraged both the consuming public and national health care institutions to consider plant medicines as alternatives to synthetic drugs (Nair *et al.*, 2005).

Undoubtedly, medicinal plants are relevant in both developing countries and developed nations of the world as sources of drugs or herbal extracts for various chemotherapeutic purposes (Alanis *et al.*, 2005). The effects of plant extracts on bacteria have been studied by a very large number of researchers in different parts

of the world (Reddy *et al.*, 2001; Adejuwon *et al.*, 2011).

Sphenocentrum jollyanum was first discovered by Dieism England. It is called "obalabi" or "obanabe" in the south western part of Nigeria. Yorubas call it "Ajo" or "Akerejupon". It grows mainly in the rain forest areas usually in damp places under forest cover. The fruit is like mango and it is edible. *Sphenocentrum jollyanum* belongs to Menispermaceae family. In indigenous Yoruba language, it is called "Akerejupon". The roots are commonly used for healing purposes (Dalziel, 1955). This plant is known to be effective in treating chronic wounds, cough, tumours and other inflammatory conditions. It is also known to have antioxidant and anti-angiogenic property and it contains flavonoids, 150 guanine alkaloids such as palmatine, columbamine, diterpenes and some other alkaloids (Nair *et al.*, 2005).

The purpose of study was to determine the antimicrobial effect of the root extract of *Sphenocentrum jollyanum* on different pathogenic microorganisms.

Materials And Methods

Collection of Plant Materials

The extract used for this study was the root of *Sphenocentrum jollyanum*. The already sun-dried roots were purchased from Bode market at Ibadan, Nigeria and identified at the Department of Botany, University of Ibadan, Ibadan, Nigeria. The roots were washed

thoroughly with distilled water, dried before milling into powder for experimental use.

Collection of Test Organisms

The following bacteria were used for this research work: *Streptococcus faecalis*, *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumonia*, *Proteus mirabilis*, *Pseudomonas aeruginosa* and *Proteus rnaribilis*. They were all obtained from the Laboratory Unit, Department of Medical Microbiology, University College Hospital, Ibadan, Nigeria.

Glass Sterilization

The glasswares used were thoroughly washed with liquid detergent, rinsed with distilled water, drained and dried. They were wrapped with aluminium foil and sterilized at 160°C in a hot air oven (Fawole and Osho, 2002).

Validity of Test Organisms

The organisms were maintained in nutrient agar slants and kept in the refrigerator at about 4°C. They were further sub-cultured into petri dishes using streak plate technique. Gram staining procedure, catalase, starch hydrolysis and oxidase tests were carried out on the samples to establish the validity of the test bacteria (Harrigan and McCane, 2001).

Preparation Culture Media

Peptone water

The peptone water used for the culturing of the test organisms was buffered to pH 7.2. This was done by mixing 38ml of 3% monobasic sodium phosphate (Na_2PO_4) with 72ml of 7% dibasic I sodium phosphate ($\text{Na}_2\text{HPO}_4 \cdot 12\text{H}_2\text{O}$). This solution was mixed and later homogenized. The mouth of the flask was then plugged with cotton wool and wrapped with aluminium foil paper. This was then sterilized in an autoclave at a temperature of 121°C for 15 minutes (15lb/sq inch pressure). This peptone water was buffered to allow the medium to maintain its pH value, as microbial metabolite can alter the pH value of the medium with subsequent exhibition of variable gram characteristics (Valya *et al.*, 2011; WHO, 2003).

Nutrient agar

According to the manufacturer's instruction, 8g of Nutrient Agar powder was dissolved into 250 mls of distilled water. The solution was properly mixed and placed in a homogenizer to ensure proper solubility and even distribution. The mouth of the conical flask was then plugged firmly with cotton wool then wrapped with aluminium foil paper. This was then sterilized in an autoclave at a temperature of 121°C for 15 minutes (Fawole and Osho, 2002).

Reactivation of Test organisms

The bacteria isolates were tested for viability by resuscitating the organisms in buffered peptone broth for 72 hours to allow heavy growth. It was then sub-cultured into the nutrient agar using streak plate

techniques and incubated at 37°C for 24hrs (Valya *et al.*, 2010; Nwinyi *et al.*, 2009).

Plant Extract Preparation

Forty grams of milled extract powder (*Sphenocentrum jollyanum*) were weighed and dissolved into 400ml of different solvent for 24 hours. The solvents were aqueous sterile distilled water, chloroform, ethanol and petroleum ether. The supernatant was filtered using muslin cloth first and then Whatman No 1 filter paper. The extract was used immediately and the remaining extract stored in the refrigerator for further study (Olayemi and Opaleye, 1990).

Antimicrobial Activity on Bacteria

Well diffusion technique

The extracts were tested for antimicrobial activity using the well diffusion method. This method depends on the diffusion of extracts from cavity through the solid medium in the petri dish such that growth of the cultured organism is restricted for a zone, thereby forming a circular area around the extract. The observed cleared zone and the diameter of such clearance is directly proportional to the efficacy of the extracts (Dairo and Adanlawo, 2007; Valya *et al.*, 2010; Nwinyi *et al.*, 2009).

Inhibitory tests

The test organism was streaked on the solid nutrient agar until it covered the petri dish using sterile inoculating loop. A sterile cork borer of about 8mm in diameter was used to cut deep uniform wells into the agar gel. Each well was then filled with the extracts prepared in different concentrations. The petri dishes were allowed to stand for 45 minutes at room temperature to allow proper diffusion. The control experiments were then set up using each of the solvents (without extracts). Sterilized distilled water was equally used as aqueous control sample.

Sensitivity Tests Disc (STD) was used side by side to compare the degree of clearance. The culture plates were transferred into the incubator for 24 and 48 hours at 37°C. Zones of clearance around each of the wells and their diameter were measured in millimeter (mm) value. The minimum inhibitory concentration (MIC) was determined by comparing the difference in concentration of the extracts with the control (Satish, 1998; Harrigan and McCane, 2001).

Determination of Minimum Inhibitory Concentration (MIC)

The Minimum Inhibitory Concentration (MIC) was determined using the agar streak technique (Nester *et al.*, 2001). The concentration around the agar well that gave the least inhibition zone was regarded as the minimum inhibitory concentration.

The minimum inhibitory concentration of the extracts (*Sphenocentrum jollyanum*) against the human pathogens used was determined by dissolving 40g of

the extracts sample with 400ml (0.4L) solvent. This was then filtered with muslin cloth and with Whatman No 1 filter paper into glass beaker before being concentrated in the water bath at 60°C for about 4 hours. The concentrated extract solution was then diluted serially four folds to give various diluted concentrations in mg/ml.

Determination of Minimum Potency Concentration (MPC)

The minimum potency concentrations for the extract were evaluated. According to Satish (1998), an inhibitory clear zone of 6mm diameter or less was considered non-potent on isolate.

Results

Aqueous, petroleum ether, ethanoic and chloroform extracts of *Sphenocentrum jollyanum* at concentrations of 72, 77, 83, 91 and 100 mg/ml were used in the present study. In Table 1, we report the clearance and zones of inhibition by extracts of *Sphenocentrum jollyanum* within 24hr incubation. In

Table 2, we have zones of inhibition within 48hr. Isolates tested were *Streptococcus faecalis*, *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, *Escherichia coli* and *Proteus mirabilis*.

In Table 3 we have sensitivity to commercially available standard antibiotics discs. *Escherichia coli* and *Proteus mirabilis* were sensitive to ciprofloxacin (CIP) and Gentamycin (GN). *Proteus mirabilis*, *Staphylococcus aureus* and *Streptococcus faecalis* were sensitive to Augmentin (AG). Other antibiotics tests disc used were non-reactive to the test organisms. These were Amoxillin (AX), Erythromycin (E), Norfloxacin (NB), Nitrofurantoin (N), Tetracycline (T), Chloramphenicol (C), Ampicillin (AM), Nalidixic Acid (NA), Cefuroxime (CF), Drovid (D), Cephalexin (CX), Clindamycin (CD), Seprin (SXT) and Ampiclox (AC). The isolates were resistant to these.

Table 1: Inhibition of isolates by extracts of *Sphenocentrum jollyanum* at 24hr incubation

	Microbial Isolate	Extract	Conc. 100mg/ml	Conc. 91mg/ml	Conc. 83mg/ml	Conc. 77mg/ml	Conc. 72mg/ml	Control
A	<i>Streptococcus faecalis</i>	Water	10	-	-	-	-	-
		Petroleum	50	40	38	34	30	18
		Ether						
		Ethanol	24	20	-	-	-	-
		Chloroform	26	18	-	-	-	-
B	<i>Staphylococcus aureus</i>	Water	30	30	18	-	-	-
		Petroleum	48	32	29	24	24	20
		Ether						
		Ethanol	33	24	-	-	-	6
		Chloroform	20	15	13	-	-	8
C	<i>Klebsiella pneumonia</i>	Water	-	-	-	-	-	-
		Petroleum	60	55	50	45	40	38
		Ether						
		Ethanol	36	21	18	-	-	5
		Chloroform	48	42	35	30	-	22
E	<i>Escherichia coli</i>	Water	-	-	-	-	-	-
		Petroleum	34	28	25	16	-	12
		Ether						
		Ethanol	20	20	-	-	-	-
		Chloroform	14	-	-	-	-	-
	<i>Proteus mirabilis</i>	Water	-	-	-	-	-	-
		Petroleum	23	18	12	12	-	5
		Ether						
		Ethanol	22	15	13	-	-	8
		Chloroform	13	5	-	-	-	-

Table 2: Inhibition of isolates by extracts of *Sphenocentrum jollyanum* at 48hr incubation

			100mg/ml	91mg/ml	83mg/ml	77mg/ml	72mg/ml
	Microbial Isolate	Extract					
A	<i>Streptococcus faecalis</i>	Water	10	-	-	-	-
		Petroleum Ether	32	22	20	16	12
		Ethanol	24	20	-	--	-
		Chloroform	26	18	-	-	-
B	<i>Staphylococcus aureus</i>	Water	30	30	18	-	-
		Petroleum Ether	28	12	9	4	4
		Ethanol	27	18	-	-	-
		Chloroform	12	7	5	-	-
C	<i>Klebsiella pneumonia</i>	Water	-	-	-	-	-
		Petroleum Ether	22	17	12	7	2
		Ethanol	31	16	13	-	-
		Chloroform	26	20	13	8	-
D	<i>Pseudomonas aeruginosa</i>	Water	-	-	-	-	-
		Petroleum Ether	21	12	9	-	-
		Ethanol	24	14	14	9	-
		Chloroform	21	14	6	-	-
E	<i>Escherichia Coli</i>	Water	-	-	-	-	-
		Petroleum Ether	22	16	13	4	-
		Ethanol	20	20	-	-	-
		Chloroform	14	-	-	-	-
F	<i>Proteus mirabilis</i>	Water	-	-	-	-	-
		Petroleum Ether	18	13	7	7	-
		Ethanol	14	7	5	-	-
		Chloroform	13	5	-	-	-

Table 3: Reaction of pathogenic bacteria to antibiotics Reactive antibiotics:

Trade code	Commercial name	Diameter of inhibition	Microorganism
CIP	Ciprofloxacin	18mm	<i>Proteus mirabilis</i>
CIP	Ciprofloxacin	12mm	<i>Escherichia coli</i>
GN	Gentamyci	15mm	<i>Proteus mirabilis</i>
GN	Gentamycin	5mm	<i>Escherichia coli</i>
AG	Augumentin	9mm	<i>Staphylococcus aureus</i>
AG	Augmentin	14mm	<i>Proteus mirabilis</i>
AG	Augmentin	8mm	<i>Streptococcus faecalis</i>

Non Reactive antibiotics:

Amoxillin (AX), Erythromycin (E), Norfloxacin (NB), Nitrofurantoin (N), Tetracycline (T), Chloramphenicol (C), Ampicillin (AM), Nalidixic Acid (NA), Cefuroxime (CF), Drovid (D), Cephalexin (CX), Clindamycin (CD), Septrin (SXT) and Ampiclox (AC).

Discussion

The antimicrobial activity of the solvent extracts of *Sphenocentrum jollyanum* root against the human pathogenic bacteria indicates the assessment of the potency of the root extracts as observed in the inhibition zones that occurred on the plates. The results obtained showed that two of the root extracts

(petroleum ether and ethanol) had significant antimicrobial activity against the pathogenic bacteria tested (*Pseudomonas aeruginosa*, *Proteus mirabilis* and *Streptococcus faecalis*).

Petroleum ether was found to be the most active against the tested bacterial strains followed by ethanol among all extracts used. This is similar to the findings of Giriya *et al.* (2011), who reported alcohol as a good organic solvent for the extraction of most plant bioactive constituents of medicinal importance. Nester *et al.* (2001) reported that genetic properties of tested organisms play a major role in the resistance effects of microorganisms on extracts.

Klebsiella pneumonia was found to be the most susceptible to petroleum ether extract with an inhibition zone diameter ranging between 60mm and 55mm at concentration between 100 mg/ml and 91 mg/ml followed by *Streptococcus faecalis* with an inhibition zone diameter ranging between 40mm and 50mm at concentrations between 100 mg/ml and 91 mg/ml. *Staphylococcus aureus* had an inhibition zone diameter of 48mm at 100 mg/ml. The remaining three bacteria strains were resistant to the ethanol extract.

Petroleum ether extract showed maximum antimicrobial activity against *Streptococcus faecalis* at concentration between 91 mg/ml and 100 mg/ml with inhibition zone diameter ranging between 22mm and 32mm. *Escherichia coli* had an inhibition zone diameter between 16mm and 22mm at concentrations ranging between 91 mg/ml and 100 mg/ml. *Proteus mirabilis* showed least susceptibility with inhibition zone diameter ranging between 13mm and 18mm. From these results, it can be inferred that the activity of the extract is concentration dependent. This is in agreement to an earlier report that an increase in the concentration of an antimicrobial agent might result in an increase in its effectiveness (Aspen, 2000).

The alcohol extracts showed greater antimicrobial activity than the corresponding aqueous and petroleum ether extracts. This finding is interesting in that the African traditional method of treating a bacterial infection is by administering a decoction of the plant parts or whole plant in water whereas, from these results, preparing an extract with an organic solvent seem to provide a better antimicrobial activity which is in accordance with the results obtained by Nair *et al.* (2005). African traditional healers in history, used aqueous solutions to extract biologically active compounds because of ease of availability (Shale *et al.*, 1999), however, the findings of these experiments show that alcoholic extracts seem to have greater antimicrobial activity.

The mechanism of action of the bioactive constituents of *Sphenocentrum jollyanum* may be difficult to speculate, though many antibacterial agents may exhibit their action through inhibition of nucleic

acids, proteins and membrane phospholipids biosynthesis (Franklin *et al.*, 1987). The strong extracting capacity of the organic solvent has produced greater number of bioactive constituents responsible for antimicrobial activity (Okigbo and Omodamiro, 2005). The bioactive components contained in a plant are connected with its antimicrobial properties (Adegoke *et al.*, 2009).

Plants are rich reservoir of antimicrobials. It is observed that a single plant is known to contain several bioactive principles of biological significance (Cowan, 1999). The antimicrobial properties of *Sphenocentrum jollyanum* probably connote its traditional use for treating bacterial disease. Akinpelu and Obuotor (2000) indicated that different solvent extracts of some plants may exhibit different pharmacological properties. The observed variation in susceptibility pattern of the test bacteria used in this research may be related to the genetic properties of test organisms which plays major role in their resistance to the effects of the extract. Also, the susceptibility of the pathogenic bacteria to the alcohol extracts or their resistance to the extract at varying concentrations might be ascribed to the differences in the morphology of the cell structure and chemical composition within these organisms as well as variation in permeability and osmotic potential (Hailu *et al.*, 2005).

From the results of this experiment, gram negative bacteria used are more susceptible to the plant extract than gram positive bacteria which contradicts previous reports that plant extracts are more active against gram positive bacteria than gram negative bacteria (Tulukey *et al.*, 2009; Delmare *et al.*, 2007; Tepe and Daferera, 2005).

It is a general belief that gram positive bacteria are more susceptible than gram negative bacteria to antimicrobials due to differences in the cell wall structure. Gram negative organisms are considered to be more resistant to antimicrobials because of their outer membrane acting as a barrier to many environmental conditions including antibiotics (Tortora *et al.*, 2001). Of all the microorganisms used, *Streptococcus faecalis* had the highest susceptibility with Petroleum ether extracts. This is an indication that the extract could be a good first line basis for drug production with high potency against infection caused by this bacterium.

Proteus mirabilis is frequently associated with urinary tract infection, bacteraemia, pneumonia and focal lesions in debilitated patients or those receiving intravenous infusions (Brooks *et al.*, 2007). According to Nester *et al.* (2001), *Proteus mirabilis* seem to be more resistant to many of the commonly used antibiotics and may be liable to cause super-infection during antibiotic therapy. We observed that Norfloxacin and Ciproflaxin had significant

antimicrobial activity against our strain of *Klebsiella pneumonia* when compared with the organic solvent extract and aqueous extract of the herb. The aqueous extract of the herb had no observable antimicrobial activity on this isolate. We observed no noticeable antimicrobial activity of both the aqueous and organic solvent extracts on our strain of *Escherichia coli*. A similar result was for the broad spectrum antibiotics. Our observations on *Staphylococcus aureus* and *Escherichia coli* were similar.

Conclusion

Antibiotics provide the main basis for the therapy of bacterial infections. However, the genetic variability of bacteria enables them to rapidly evade the action of antibiotics by developing antibiotic resistance. In recent years, development of multidrug resistance in pathogenic bacteria and parasites has created major clinical problems in the treatment of infectious diseases. Multidrug resistance and other problems such as toxicity of certain antimicrobial drugs in the host tissue have triggered interest in search of new antimicrobial substances/drugs of plant origin, considering, perhaps the rich diversity of *Sphenocentrum jollyanum* in bioactive constituents. Screening of various natural organic compounds and their identification to reveal the active principle by isolation and characterization of their antimicrobial constituents must be considered as a fruitful approach in the search of new herbal drugs for folkloric usage.

Antimicrobial activity can be advanced if active components of plants are purified with the determination of adequate dosage for proper administration. This may go a long way in preventing the administration of inappropriate concentrations which is a common practice among many folklore medicine practitioners. Finally, the results obtained from *in vitro* antimicrobial assay should confirm the therapeutic potency of *Sphenocentrum jollyanum* used in folklore medicine. The antibacterial properties of this herb makes it of interest in the development of new drugs in pharmaceuticals.

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Bacteriological and physico-chemical analysis of well water samples in Ibadan South-East Local Government, Ibadan, Nigeria

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Abstract: Provision of safe drinking water is one of the main purposes for community development and improvement. Having a healthy community is related to the safety of drinking water in that community. This study was conducted to assess the levels of physico-chemical and bacteriological water quality in ten different wells in Ibadan South East Local Government. The results show that most of the physical and chemical values of sampled water were within the acceptable guide-line limits of the World Health Organization (WHO) for potable water. The well water were colourless with pH range of between 6.3-7.0; hardness ranged between 12- 32mg/l; and temperature was 30°C for all water samples analyzed. Nickel, cobalt, cadmium, lead and chromium were not detected in all the water samples, however, the bacteriological quality of the samples was poor rendering them unsafe for human consumption unless treated. Total coliform ranged between 2-6 cfu/ml and total viable bacterial counts ranged between 1.7-5.73 cfu/ml. Such microbial contamination pose a threat to well water quality and could lead to an increase in risk level of outbreak of water borne diseases in Ibadan South East Local Government area.

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Key words: safe drinking water; Ibadan South East Local government; total coliform; total viable bacterial count

1. Introduction

Water is vital to our existence in life. It exists in gaseous, liquid or solid state. It is the most abundant compound on earth's surface, covering about 70% of the planet's surface (Nester *et al.*, 2004). According to Taylor (2005), diseases contacted through drinking water accounts for approximately five million pediatric deaths annually. Potable drinking water should be colourless, tasteless, free of smell, without organic matter or suspended particles, of neutral pH, soft and not hard (WHO, 2005).

2. Materials and Methods

2.1 Materials

Reagents: Kovac's reagent, Gram stain reagents, Phenolphthalein, Hydrosulphuric acid, Sodium thiosulphate, Methyl purple, Buffer 10 solution, Solochrome indicator, EDTA, DPD Rapid No 1 tablet, ethanol (95%), glasswares: beaker (100ml, 250ml, 500ml), Conical flask (250ml, 500ml, 1000ml), Durham tubes, media: Nutrient Agar (Britania Laboratories), MacConkey Agar, Salmonella-Shigella Agar, Peptone water by and Starch Agar all by Lab M Limited, Simmon's citrate Agar (Biomark Laboratories), Eosine Methylene Blue and Nitrate peptone water (Lab M Limited).

Apparatus and Equipment: Atomic

Absorption Spectrophotometer model A-Analyst 200, Microscope (binocular) (Olympus), Autoclave (YMSO), Radiometer acid base analyzer (Model-MK-2), Incubator (Gallenkamp), Weighing balance (Mettler-Toledo), Spectrophotometer (Jenway 6320D) and Mercury bulb.

2.2 Study Area

This research work was carried out in Ibadan South East Local Government area. Water samples were obtained from ten different wells from different locations under the Local Government.

2.3 Study Sample

From each well, water samples were collected into sterile bottles and brought to the Laboratory for testing within 12 hours of collection. Precautions were taken to prevent accidental contamination of the water during collection and transportation to the Laboratory. Water samples were transported to the laboratory in ice packs in a bucket. Some physical parameters were determined at the point of collection.

2.4 Description of Water Samples

The physical appearance of the water samples was noted. These include colour, odour and

turbidity. The water in the sterile containers were allowed to settle for a period of time and the sedimentation rate of the particles were noted.

2.5 Determination of Physico-chemical Parameters

2.5.1 Temperature

Temperature was determined using a mercury bulb thermometer. Before use, the Thermometer was cleaned with cotton wool soaked in ethanol. It was dipped to about 15cm below the surface of water for 3 minutes and the temperature was read.

2.5.2 Hydrogen ion concentration

The pH meter used was calibrated with standard buffer of pH 7.0. The pH of samples was measured by placing the glass electrode in the samples and then the results were read on the pH scale.

2.5.3 Alkalinity test

100ml of water sample was measured into a conical flask, 2-3 drops of phenolphthalein were added. Colour change was observed and titrated against 0.02N Sulphuric acid (H_2SO_4). The colour change was noted which is the P value (Partial alkalinity), 2 drops of sodium thiosulphate ("T" indicator solution) were added to neutralize any excess acid in the water. 2-3 drops of methyl purple ("M" indicator solution) was added and titration continued until the colour finally changed from blue to pink to give the final alkalinity (N value). Total alkalinity was calculated with the formula $2P - N$. Where P is partial alkalinity; N is final alkalinity and Standard value = 2-7 mg/l.

2.5.4 Miscellaneous tests

Other tests carried out were water hardness, chlorine test and test for heavy metals.

2.6 Culture Media

The culture media used include Nutrient agar, Eosin methylene blue agar, MacConkey agar, Salmonella-Shigella agar. Each of them was prepared according to the manufacturers' specifications.

2.6.1 Nutrient agar

31 grams of nutrient agar was dissolved in a conical flask in a litre of distilled water and mixed well. It was then heated with frequent stirring by boiling until it homogenized completely. The whole flask was wrapped with aluminium foil then sterilized by autoclaving at $121^\circ C$ for 15 minutes at 15lb/sq inch. The medium was allowed to cool to $50^\circ C$ before dispensing into petri dishes where it solidified. The medium was used for bacterial characterization, cultural and colonial appearance and determination of

the total viable bacteria.

2.7 Isolation of Microorganisms

1ml of each well water sample was serially diluted: 1ml from dilution 10^{-1} , 10^{-3} and 10^{-5} was inoculated on sterile Nutrient agar and Salmonella-Shigella agar respectively. The plates were incubated at $37^\circ C$ for 24hr, after which visible colonies were counted and results were expressed in colony forming unit per millilitre (cfu/ml) (Hans, 2002). MacConkey agar and Eosine Methylene blue agar respectively were used for coliform test using membrane filters. Membrane filter technique was carried out using 100ml of each of the water samples which was passed through membrane filters. The filter with its trapped bacteria was transferred to the surface of solid medium and incubated at $37^\circ C$ for 24hours (Hans, 2002).

2.8 Characterization and Identification of Isolates

Procedures were carried out according to standard techniques. Bacteria isolation was carried out using streak and pour-plate technique. Isolation of pure culture was completed by streaking on Nutrient agar media plates. Morphological identification was carried out using the Gram staining procedure and examined under X 100 objective of a light microscope. Sub culturing on solid agar was done to maintain viability. Characterization of isolates and identification of the isolate were carried out on the basis of their cultural characteristics on agar plates (Hans, 2002).

2.8.1 Cultural characterization

Sterile wire loop was used to aseptically pick from each bacteria colony and streaked on nutrient agar plates. The plates were incubated at $37^\circ C$ for 24hr. The cultural characteristics of each isolate were determined by visually observing the elevation, size of colony, surface opacity, colour, edge, pigmentation and consistency of colony.

2.8.2 Morphological characterization

A heat fixed smear of each isolate was prepared on a clean plain slide. Observation was made under oil immersion objective (X 100) of a light microscope. Observed shapes and structures were recorded.

2.8.3 Biochemical characterization

Gram's staining of the isolates was carried out under appropriate conditions to view the nature of bacteria cell wall and classify the isolates.

3. Results

A total of ten different well samples were

analyzed and named A-J respectively. Water samples were collected from wells that were used everyday. Table 1 shows the results of the physiochemical tests that is odour, colour, appearance, pH, alkalinity, hardness, chlorine and temperature of samples.

All samples collected were odourless and tasteless and their temperature was 30°C. Metals such as Nickel, Cobalt, Cadmium, Lead and Chromium were not detected in all the water samples analyzed. Sample A, C, F, G, H and J contained few particles while sample B and I contained suspended solid.

Sample D also contained suspected solid and appeared cloudy while sample D contained cloudy particles.

The pH values of all the water samples was between 6.3 and 7.0 which meets the standard for drinking potable water according to the World Health Organization.

Values of total alkalinity of samples A, B, C, D, E, F, G and H were in the normal range. Samples I and J had lower values of 1.8 and 1.0 respectively which is lesser than normal value for total alkalinity (Table 1).

Table 1: Physico-chemical values and composition of the well water samples analysed

Values and constituent	Samples									
	A	B	C	D	E	F	G	H	I	J
Colour	Colourless	Colourless	turbid	Turbid	turbid	Colourless	turbid	colourless	Turbid	colourless
Appearance	Few particles	Suspended solid	Few particles	Cloudy with suspended solid	Cloudy particles	Few particles	Few particle	Few particles	Suspended solid	Few particles
Odour	Odourless	Odourless	Odourless	Odourless	odourless	odourless	odourless	odourless	Odourless	odourless
Taste	tasteless	tasteless	tasteless	Tasteless	tasteless	tasteless	tasteless	tasteless	Tasteless	tasteless
Ph	6.6	6.3	6.0	7.0	6.5	6.5	6.7	6.5	6.4	6.4
Temperature	30	30	30	30	30	30	30	30	30	30
Total alkalinity	2	3	3	2.5	2.5	2	2	2.3	1.8	1.0
Total hardness (mg/l)	30	32	14	20	16	16	16	12	18	14
Total chloride (mg/l)	0.5	0.6	NIL	0.5	NIL	NIL	NIL	NIL	NIL	0.2
Nickel (mg/l)	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
Cobalt(mg/l)	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
Cadmium (mg/l)	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
Lead	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL
Chromium (mg/l)	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL	NIL

Table 2 shows the result of bacteria load of well water samples analyzed. A total of 3.33×10^6 cfu/ml were isolated from sample A; 2.9×10^6 cfu/ml from sample B; 5.73×10^6 cfu/ml from sample C; 2.0×10^6 cfu/ml from sample D; 1.93×10^6 cfu/ml from sample E; 3.2×10^6 cfu/ml from sample F; 2.63×10^6 cfu/ml from sample G; 2.6×10^6 cfu/ml from sample H; 1.7×10^6 cfu/ml from sample I; and 3.5×10^6 cfu/ml from sample J (Table 2). Sample B has the highest bacteria load while sample I had the lowest bacteria load count.

The isolate were initially differentiated on the basis of their cultural and morphological studies after which they were subjected to various biochemical tests.

Table 2: Bacteria load of well water samples

S/N	Sample Name	Cultural Appearance and Colonial Description	Bacterial Load (cfu/ml)
1	A	Creamy circular, golden yellow circular, white circular with lobate edge	3.3×10^6
2	B	Creamy circular (swarm), golden yellow circular, pink circular, creamy circular with dentate edge, creamy rhizoid, irregular creamy shape.	2.9×10^6
3	C	Creamy circular, whitish rhizoid, yellow circular, pink circular, creamy circular with dentate edge, creamy rhizoid, irregular creamy shape.	5.73×10^6
4	D	Whitish circular, orange circular, irregular creamy shape, creamy circular (swarm), brownish rhizoid, creamy with lobate edge, creamy circular with undulated edge, creamy fimbriate yellow circular	2.0×10^6
5	E	Yellow circular, creamy rhizoid, creamy circular (swarm), green circular, irregular creamy shape, irregular yellow shape.	1.93×10^6
6	F	Yellow circular, orange circular, creamy circular, whitish circular, irregular creamy shape, pink circular, creamy rhizoid.	3.2×10^6
7	G	Creamy circular with undulated edge, light yellow circular, orange circular, irregular creamy shape, creamy rhizoid, creamy circular, whitish circular, creamy fimbriate.	2.63×10^6
8	H	Irregular whitish shape, golden yellow circular, creamy circular, creamy rhizoid, irregular creamy shape, light yellow circular, whitish circular, white fimbriate	2.6×10^6
9	I	Creamy circular with lobate edge, golden yellow circular, orange circular, irregular creamy shape, creamy circular, creamy rhizoid	1.7×10^6
10	J	Light yellow circular shape, creamy rhizoid, creamy circular shape, irregular creamy shape, creamy fimbriate, orange circular	3.5×10^6

Table 3 shows the result of the coliform of water samples. Sample A, B, C, E, I and J had no coliform count because they tested negative for the coliform test. Sample D had coliform count of 4×10^6 cfu/ml; Sample F had a coliform count of 6×10^6 cfu/ml; Sample G had a coliform count of 2×10^6 cfu/ml; and sample H a coliform count of 2.7×10^6 cfu/ml (Table 3).

Table 3: Coliform count of well water samples

S/N	Samples Name	Coliform Count (cfu/ml)
1	A	NIL
2	B	NIL
3	C	NIL
4	D	4×10^6
5	E	NIL
6	F	6×10^6
7	G	2×10^6
8	H	2×10^6
9	I	NIL
10	J	NIL

The probable organisms, from biochemical characterization, were *Microoccus luteus*, *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Bacillus subtilis*, *Klebsiella aerogenes*, *Mycobacteria* and *Enterobacter aerogenes* (Table 4). Table 5 represents the microorganisms in each well water sample.

Table 4: Biochemical characteristics of isolates

Glucose Reaction	Lactose	Glucose	Sucrose	Manitol	Maltose	Starch Hydrolysis	Indole	Catalase	Citrate Utilization	Nitrate Reduction	Probable Bacteria
+	-	-	-	-	-	+	-	+	+	-	<i>Micrococcus luteus</i>
-	+	+	+	+	+	+	+	-	-	+	<i>Escherichia coli</i>
-	-	+	+	-	-	-	-	+	+	+	<i>Pseudomonas aeruginosa</i>
+	+	+	+	+	+	+	+	+	+	+	<i>Staphylococcus aureus</i>
+	+	+	+	+	+	+	+	+	+	+	<i>Bacillus subtilis</i>
-	+	+	+	+	+	+	-	-	+	+	<i>Klebsiella aerogenes</i>
+	+	+	-	+	+	+	+	+	+	+	<i>Mycobacteria</i>
-	+	+	+	+	-	+	-	+	+		<i>Enterobacter aerogenes</i>

Key:

+ = Positive

- = Negative

Table 5: Occurrence of bacterial isolates in the analyzed well water sample

S/N	Sample names	<i>Micrococcus luteus</i>	<i>Escherichia coli</i>	<i>Pseudomonas aeruginosa</i>	<i>Staphylococcus aureus</i>	<i>Bacillus subtilis</i>	<i>Klebsiella aerogenes</i>	<i>mycobacteria</i>	<i>Enterobacter aerogenes</i>
1	A	+	-	-	+	+	-	+	-
2	B	+	-	+	+	+	-	+	-
3	C	+	+	+	+	+	-	+	-
4	D	+	-	+	+	+	+	+	+
5	E	+	+	+	+	+	+	+	-
6	F	+	+	+	+	+	+	+	+
7	G	+	+	+	+	+	+	+	+
8	H	+	+	+	+	+	+	+	+
9	I	+	-	+	+	+	+	+	-
10	J	+	-	+	+	+	+	-	-

Key:

+ = Positive

- = Negative

4. Discussion

In our study, the pH values of water samples under investigation were within the acceptable range (6.3-7.0). This conforms with the pH range reported by Okonko *et al.* (2008). According to Edema *et al.*, (2001), the pH of the most natural waters range from 6.3-8.3. The pH of water is extremely important physicochemical factor. The fluctuations in optimum pH range may lead to an increase or decrease in the toxicity of chemicals in water bodies (Ali, 1991; Okonko *et al.*, 2008).

The temperature 30°C reported in this study is comparable to the temperature reported by other researchers in similar studies. For instance Alabaster and Lloyd (1980) reported a temperature range of 26 to 30°C in their study. A temperature of 30°C of water samples as observed in this research is believed to have been influenced by the intensity of the sun (Mulusky, 1974; Okonko *et al.*, 2008).

The total bacteria count for some of the water samples were generally high, exceeding the recommended standard limit for water (FAO, 1997). Several factors are responsible for the presence of bacteria in well water. The presence of septic tanks as well as refuse dumps in close proximity with wells is sometimes responsible for coliform load in such well water (Adejuwon *et al.*, 2010). Some of the wells were uncovered. The isolated bacteria species were identified to be same with those commonly encountered in water and aquatic environments (Nester *et al.*, 2001). These identified isolates include *Bacillus subtilis*, *Staphylococcus aureus*, *Enterobacter aerogenes*, *Pseudomonas aeruginosa*, *Micrococcus luteus*, *Escherichia coli*, *Mycobacteria*, *Klebsiella aerogenes*.

The presence of enteric bacteria including *Escherichia coli*, *Klebsiella aerogenes* and *Enterobacter aerogenes* as reported in this study are indicators of faecal contamination as a result of unhygienic handling of the well water and unhygienic environment. The greatest hygiene danger associated with water used for drinking purposes, food processing and human consumption is contamination by human excrement (Edema *et al.*, 2001; Okonko *et al.*, 2008). Underground water generally should not contain faecal organisms or pathogenic microorganism of any kind. Result obtained confirms the presence of bacteria in the well water sample because of the location of the well which might be close to septic tanks or soak away which created room for seepage of microorganisms into the well and poor drainage system. The need for microbial assessment of water for domestic purpose should always be emphasized to reduce possible infection due to contamination. The presence of *Micrococcus luteus* and *Enterobacter aerogenes* reported in this study has

also been earlier reported by Umeh *et al.*, (2005) in their study conducted on the bacteriological quantity and safety of water in Akwa, Nigeria using membrane filtration method.

Bacterial growth in water may be unnoticed even in transparent packaged water and the presence of some of these microorganisms may pose a potential risk to consumers. Most of the organisms found in these water samples are those commonly found in soil and water (Nester *et al.*, 2001). *Staphylococcus aureus*, a nosocomial pathogen of public health concern and significance may contaminate water samples through improper handlers and fetchers of such wells (Nester *et al.*, 2001).

4.1 Conclusion

Outbreak of disease as well as epidemics could occur in a population through consumption of water contaminated with faecal organisms. The prevention of communicable disease requires that the cycle of disease transmission is interrupted. Depending on the prevailing transmission pathways, different interventions in water supply and sanitation are required. Bacterial diarrhoea and epidemics of typhoid fever and shigellosis are often transmitted through water. These current findings on these unsafe water are grim reminders of the need to address the probable sources of contamination.

4.2 Recommendations

As recommendations:

- i.) Government should help members of the public in sinking boreholes in these areas so that the consumption of contaminated well water is reduced and the risk of contacting disease through such wells is minimized;
- ii.) Well water can be treated before consumption with chlorine, but under strict guidance to reduce the risk of developing cancer;
- iii.) Boiling would kill most organisms and almost all pathogenic bacteria since most of them are mesophiles and would not withstand high temperature;
- iv.) Awareness is also an important component of health education on water borne infections in a society. People should be educated on personal hygiene. Consumers of well water should be enlightened on the risk of consumption.

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4/29/2013

Nutritive and microbial analysis of two types of fermented locust bean (*Parkia biglobosa*)

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Abstract: Locust bean (*Parkia biglobosa*) is fermented and sold locally in Nigeria as mashed and unmashed locust bean. In this study, two forms of fermented beans were purchased from a local market in Ibadan, Nigeria. Their proximate composition and microbiological quality were determined using standard analytical methods. Our mashed locust bean was observed to contain $9.62 \pm 0.33\%$ moisture, $3.29 \pm 0.35\%$ ash, $13.30 \pm 0.32\%$ crude fibre, $39.84 \pm 0.29\%$ protein and $49.93 \pm 0.36\%$ fat while the unmashed contained $5.3 \pm 0.20\%$ moisture, $3.24 \pm 0.32\%$ ash, $17.68 \pm 0.40\%$ crude fibre, $39.14 \pm 0.31\%$ protein and $22.80 \pm 0.20\%$ fat. *Aspergillus niger*, *Pseudomonas maltophilia* and *Streptococcus faecalis* were isolated from mashed samples. *Aspergillus flavus* and *Pseudomonas maltophilia* were isolated from the unmashed samples. As observed, these bacterial and fungal isolates are evidences of unhygienic procedures of processing in that environment.

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Key words: Locust bean (*Parkia biglobosa*); fermented; microbial; nutritive

1. Introduction

Locust bean, *Parkia biglobosa* or Néré is a tree of the genus *Parkia* in the family Fabaceae. In West Africa, its fruits are fermented to a condiment called "sombala" or "dawa-dawa" (Bonkougou, 1987). The striking red spherical inflorescences, which appear in the dry season, are often used by children for games (Burkill, 1995). The yellowish powder inside the seed pods is sweet and can be eaten without preparation and can also be made into drinks. The pods are boiled to make a black liquid used for sealing floors (Hall *et al.*, 1996). It is a perennial deciduous tree with a height ranging from 7 to 20 m, although it can reach 30 m under exceptional conditions (Hopkins *et al.*, 1984). Its seeds are fermented to make dawadawa, a black, strong-smelling, tasty food high in protein (Steinkraus, 1996).

In the tropics, especially in Nigeria, locust bean is processed locally into consumable delish and is a part of traditional dishes in most parts of the country. It is sold in the Nigerian consumables markets in two forms, the mashed and the unmashed locust bean. During the Nigerian processing of locust bean, salt is usually added to prevent microbial contamination and growth. However, inspite of procedures engaged, locust bean could still harbor loads of microorganisms especially while handling. We here present reports on the microbiological analysis and proximate composition of the mashed and unmashed locust bean sold within Ibadan, Nigeria metropolis because of its high demand.

2. Materials and Methods

2.1 Sample Collection

Two types of processed locust beans were purchased at Oja Oba market, Ibadan, Nigeria. One is locally called òru Woroö (whole beans) and the other òru peteö (mashed beans). They were identified at the Department of Botany, University of Ibadan, Ibadan, Nigeria.

2.2 Microbiological and proximate analysis

The microbial analysis was carried out at the Department of Microbiology, University College Hospital, Ibadan, Nigeria, while the proximate analysis was carried out at the National Institute of Science Laboratory Technology (NIST), Samonda, Ibadan.

Standard methods of the Association of Official Analytical Chemists (AOAC, 1995) were used to determine the moisture, crude protein, crude fat, total ash and crude fibre contents of each sample.

Quantitative and qualitative microbial analysis of the locust beans were carried out using standard methods (Olutiola *et al.*, 1991; APH, 1992; Adejuwon *et al.*, 2010). Bacteria were isolated and characterized based on the gram reaction, colonial morphology and biochemical characteristics. Fungi were identified using the colors on potato dextrose agar, staining and reproductive structures using lactophenol cotton blue (Hanlin, 1990).

3. Results

Table 1 represents proximate composition of unmashed *Parkia biglobosa* while Table 2 that of mashed *Parkia biglobosa*. The ash, protein, fat and

moisture contents of the mashed locust bean was higher than that of the unmashed. The crude fibre seem higher in the unmashed.

Table 1: Proximate composition of unmashed fermented locust beans (*Parkia biglobosa*) (Iru woro)

Moisture (%)	Ash (%)	Crude fibre (%)	Protein (%)	Fat (%)
5.3 ± 0.20	3.24 ± 0.32	17.68 ± 0.40	39.14 ± 0.31	22.80 ± 0.20

Values were expressed as mean ± standard deviation of triplicate determinations

Table 2: Proximate composition of mashed fermented locust bean (*Parkia biglobosa*) (Iru pete)

Moisture (%)	Ash (%)	Crude fibre (%)	Protein (%)	Fat (%)
9.62 ± 0.33	3.29 ± 0.35	13.30 ± 0.32	39.84 ± 0.29	49.93 ± 0.36

Values were expressed as mean ± standard deviation of triplicate determinations

Aspergillus niger, *Pseudomonas maltophila* and *Streptococcus faecalis* were isolated from samples of mashed *P. biglobosa*. *Aspergillus flavus* and *Pseudomonas maltophila* were isolated from the unmashed samples (Table 3).

Table 3: Identified isolates on locust bean samples

Sample (S/N)	Bacteria observed	Fungi observed
1 (Mashed)	<i>Pseudomonas maltophila</i> ; <i>Streptococcus faecalis</i>	<i>Aspergillus niger</i>
2 (Mashed)	<i>Pseudomonas maltophila</i> ; <i>Streptococcus faecalis</i>	<i>Aspergillus niger</i>
3 (Mashed)	<i>Pseudomonas maltophila</i> ; <i>Streptococcus faecalis</i>	<i>Aspergillus niger</i>
4 (Unmashed)	<i>Pseudomonas maltophila</i>	<i>Aspergillus flavus</i>
5 (Unmashed)	<i>Pseudomonas maltophila</i>	
6 (Unmashed)	<i>Pseudomonas maltophila</i>	<i>Aspergillus flavus</i>

4. Discussion

Moisture, ash, fibre, protein and fat in *Parkia biglobosa* infer the nutritional value of locust bean. Previous reports reveal that dawadawa is rich in protein, lipids and vitamin B2 (Hopkins, 1983) and that fermented beans are rich in lysine (Hopkins, 1983; Steinkraus, 1996). According to Hong *et al.* (1996), *Parkia biglobosa* seeds are used as coffee substitute and they are embedded in a mealy pulp sometimes called dozim, that is high in energy value. They contains up to 29% crude protein and up to 60% saccharose, rich in vitamin C and high in oil content.

Aspergillus niger and *Aspergillus flavus* in fermented *Parkia biglobosa* infer fungal infection which could have been acquired during cultivation and harvestation or during the fermentation processes by handlers. The presence of *Streptococcus faecalis* is an evidence of faecal contamination which must definitely have been acquired during handling and processing. The presence of *Pseudomonas maltophila* is an evidence of poor unhygienic handling.

4.1 Conclusion

This study confirmed the nutritional benefits of locust bean produced by traditional method. However, the different methods of production could affect the overall nutritional components and benefits.

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Distance learning tools in education

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Abstract: While there is still prejudice surrounding some distance learning, it is increasingly being accepted as an alternative to traditional classroom learning. Courses can be offered via the Internet, where students are able to interact with instructors and other students without physically being in the same room. Getting a college education can be difficult for people with inflammatory bowel disease (IBD). Frequent trips to the restroom, exhaustion, doctor visits, and medication side effects are all barriers to the traditional college experience. What if you could get the degree without ever setting foot on a campus? You can do just that through distance or virtual learning. Distance learning has been around for a long time (we've all seen the commercials on TV).

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Keywords: adult education, distance learning

Introduction:

The folk high school bandwagon that developed intensively between the two World Wars, withered away after 1949 for political reasons. At the same time, the "educational" subsector of adult education in organised forms under state supervision, Only the negative consequences are obvious: getting more education often means leaving one's family and community for jobs and opportunities for advancement somewhere else. The future of Kentucky depends on uplifting the quality of life and economy of all of Kentucky. The social and economic costs of neglect of large parts of the state will drag down the rest of the state and seriously hinder its capacity to compete in the global economy.

Much like strategies to curb epidemic, strategies to reduce illiteracy and raise the educational attainment of Kentucky's population must include both short-term efforts to face the immediate crises as well as long-term strategies to get at the underlying causes. Short-term crises include the imperative to keep helping welfare clients make the transition from welfare to work within the constraints of federal and state mandates and the need to train workers for immediate employer demands. Long-term prevention must address the underlying, persistent problems of the state's economic structure as well as the low awareness--if not appreciation--among segments of the population of the vital connection among education, employment, and improved standards of living.

The everyday approach towards the expression of *adult education* is general and covers everything in connection with formal teaching, educating, training of adults.

In parallel with this concept, there is another interpretation of what is rather an education policy or

an education administration nature, namely that adult education covers programmes with well-determined purposes and functions that have results visible in real life, particularly in the labour market.. By this concept adult education and adult training are differentiated, *adult education* means formal learning in institutions where general programmes dominate, and *adult training* covers everything that is oriented to give a mainly specialized and professional knowledge, or is not a systemic part of formal education.

The Adult Education Act (Act 101 /CI/, 2001), which came into force in 2001 uses the general interpretation of the concept as a starting point, which on one hand regulates only a part of it, training outside formal education, and on the other hand it extends it with services that are in connection with adult education. This act defines the training user target group (adults) as persons or individuals who have fulfilled their compulsory school attendance, which means people over 18 according to Hungarian regulations still in force. (At the same time, students in tertiary education with student status are not included). adult education in the local agricultural education program is an essential component of the "total" program. Offering adult education programs helps to keep farmers and agribusiness employees better informed of current trends and provides them with opportunities to learn new skills and improve existing ones. Teaching adults can be very challenging, but also very rewarding. Most teachers would agree that the benefits derived from a successful adult education program in agriculture far outweigh the costs. In addition to the direct benefits to adult participants, the teacher, the school, the community, and the secondary program also benefit from a quality adult education program in agriculture.

The role of the agriculture teacher should be as a facilitator of the learning process. Most adults reject the traditional teacher-student relationship, which is necessary to maintain in secondary programs. Teachers should be encouraged to view themselves as partners with adult participants in the learning process. The democratic philosophy of shared responsibility for planning, conducting, and evaluating adult education programs distinguishes adult education from secondary education.

A local plan for adult education in agriculture should consist of two major components. Namely, a broad statement of philosophy, goals, and objectives of the local adult education program, and an annual calendar of program activities.

Distance Learning Program

Distance learning is one of the fastest-growing components of higher education. Almost 3.5 million students were enrolled in at least one distance learning course in the fall of 2006 and online enrollments are increasing every year. The convenience of taking classes at any time from any location appeals to today's adult learner, especially those who work, have families or live in rural areas. Below are several important factors to consider in choosing a distance learning program.

1. **Accreditation.** Accreditation is a means of ensuring the quality and effectiveness of higher education institutions and programs in the United States. Eight regional accrediting agencies accredit most of the colleges and universities in the United States. A host of national and professional accrediting organizations also exist, including the Distance Education and Training Council (DETC), an organization that identifies and accredits distance learning programs. These twelve questions outlined by the Council for Higher Education Accreditation are helpful in examining a distance learning program's claims of accreditation.

In evaluating distance learning paralegal programs, determine if the school is accredited by one of the regional accrediting bodies and by the American Bar Association (ABA). ABA-approval signifies that the school has met certain standards in terms of academics, facilities and instruction. Graduating from an ABA-approved school may give you an advantage in the legal job market.

2. **Reputation.** The reputation of the distance learning program you attend may hinder or enhance your post-graduate employment prospects. In evaluating the reputation of a distance learning program, you should not solely rely on the school's website or marketing

materials. Other ways to investigate the reputation of a distance learning program include:

- Visiting the school.
- Talking to alumni (contact the career services department for alumni names and contact information).
- Researching the distance learning program's record with the Better Business Bureau.
- Talking to paralegals, attorneys and legal employers about the reputation of the school you are considering.
- Researching the school in print publications, news articles and on the Internet.

Academic Offerings. When evaluating distance learning programs, it is also important to consider the program's academic offerings. A quality distance learning program offers a comprehensive curriculum with a variety of options, electives and advanced coursework. Talk to professors or an academic dean regarding the content and delivery of courses. The American Association for Paralegal Education (AAfPE) recommends that paralegal instructional content include courses in legal research and writing, litigation, ethics, contracts, business organizations and torts. In addition, courses should develop students' critical thinking, communication, computational, computer and organizational skills, and competency to handle ethical issues, according to the AAfPE.

Legal programs should also offer an experiential learning component such as an internship, practicum, pro bono work or clinical experience. These are great resume-building opportunities and allow you to learn practical skills and gain real-world experience.

Instructional Technologies. Distance learning courses can be delivered in a variety of ways through a growing array of technological tools including audio tapes, CD or DVD ROM's, e-mail, telephone conferences and web-based delivery systems. Questions to ask include whether the program employs a mix of instructional technology? Is hands-on training and support provided? Can students preview courses online and try out the technologies before enrolling?

Teaching Staff. The faculty is the backbone of any distance learning program. Are the courses taught by professors or are the courses pre-taped correspondence instruction? If the courses are taught by instructors, what is the background and qualifications of the teaching staff? Are classes taught by paralegals, attorneys or a mix of both?

Career Services. Another important consideration in any distance learning program is the extent and quality of its career services

program. Research indicates that the greater the resources offered by the career services department, the greater the program's job placement success. You might inquire as to what percentage of graduates find related employment following graduation and whether the career center offers personalized career counseling, job placement assistance, job search seminars, online job boards or resume assistance.

Conclusion:

Additional material for the next stage of learning often means to be expected when developing your learning skills. Learners to increase awareness and enjoyment of reading and studying to operate.

To improve the quality of life, learning materials should reinforce the skills they acquired previously. This material should have access to information and provide new technology. should also have to make learning more fun. Additional materials should provide opportunities for literacy skills to read and to strengthen their cognitive awareness.

Track materials (continued) which increased literacy skills and knowledge gained is also effective in enriching learning environment for learners are important. Participatory materials to ensure the participation of learners in the learning process and codification are included out of class activities, dialogue, role playing, etc.

In traditional programs that the principles of psychology and curriculum planning, less attention is the form of content presentation ie codification and providing books, original format and have the dominant form, while for adult content that could have valuable experience in addition to writing, other ways also be provided. Affect the selection of pictures and images related to the concepts and content produced by including them.

Learning activities such as activities outside the classroom, dialogue, role playing and... Another type of content is presented. Duties are placed on the learner, a resource for developing knowledge, skills and insights he considered.

Curriculum content only from the training provided to learners or not, but put together their learning through activities that can inform or does, skills and attitude to achieve. In this case, apart from learning that the essays taught learners directly to sustainable and effective learning occurs in his.

Another way of providing content that is educational activities outside the learning environment possible for learning more and better enables adult learners. For example, hits, field trip experiences for learners or transfer is provided, develop knowledge, insight and skills they will.

To ensure that science curriculum and educational aspects, according to community needs and audiences, application form is provided or not, the content selection criteria should be considered. These criteria is being include knowledge, effectiveness, flexibility, diversity, relevance and practical learning

The geographical distribution indicates that large areas have been left or abandoned without any provision. In a county with several hundred thousand inhabitants and where the rate of people with unfinished basic education is over the national average, there is just one institute. This occurred despite the fact that these schools have a demonstrable function to provide a second chance for underachievers who score below literacy level, to improve their literacy skills.

There are two main reasons which have led to the reduction in number of institutes and their vanishing role, firstly the need for them has dropped (the rate of people with unfinished basic education has decreased within the population), and secondly because the supporting system has changed and the responsibilities (maintaining schools and their specializations) is now the task of local authorities, and the state budget gives significantly less support compared with the refunds for initial education.

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Toxicity of Two Anticoagulant Rodenticides to Rodent Species under Laboratory Conditions

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Abstract: A laboratory evaluated of 2 anticoagulant rodenticides, Kelerat super (Brodifacoum 0.005%) and Caid (Chlorophacinone 0.005%) against three rodent species, *Rattus rattus frugivorus*, *Rattus rattus alexandrinus* and Nile grass rat, *A. niloticus* fed on poison bait for 3 days, 4 days and 5 days. Results indicated that Kelerat was the most effective ones followed by Caid. The dead period for Caid was longer than in the case of Kelerat. It was found that there was a significant difference in the animal consumption of the tested rodenticide baits for rodent species. Also, significant difference in rodenticides consumed by males and females. [Abd El-Aleem S. S. Desoky and Saudi A.S Baghdadi. **Toxicity of Two Anticoagulant Rodenticides to Rodent Species under Laboratory Conditions.** *Academia Arena* 2013;5(5):23-25] (ISSN 1553-992X). <http://www.sciencepub.net/academia>. 5

Keywords: Brodifacoum, Chlorophacinone, *Rattus r. frugivorus*, *Rattus r. alexandrinus*, *A. niloticus*

1. Introduction

Since the early 1950s, anticoagulant rodenticides have been used to control commensal rodents worldwide. They are also used in field treatments against crop pests, these pesticides, with a relatively slow mode of action; interfere with vitamin K-mediated synthesis of liver blood clotting factors (Buckle and Smith, 1994). Animals die from haemorrhages hastened by minor trauma. Second-generation anticoagulant rodenticides generally present significant physiological persistence and are defined as single-feeding rodenticides (Kolf-Clauw et al., 1995). In any case, exposed animals will not die for 5–10 days and may continue feeding on bait. The consumption of exposed prey by predators can cause secondary poisoning with important effects on the mortality of non target species. (For instance, risks to predators and scavengers appear to be especially high for owls and diurnal raptors when brodifacoum is used (Eason et al., 2002; Joermann, 1998; Stone et al., 2003).) Bromadiolone, the focus of the current study, was patented in 1968 and introduced to the market as a rodenticide in 1976. Its risk to non target species is only considered as moderate (birds) to high (mammals), but there is a definite lack of field or laboratory data to support these assumptions (USEPA, 1998, 2002). The present work was initiated to evaluate of two rodenticides under laboratory conditions for used in a large scale in Egypt.

2. Materials and Methods

Rodents were trapped and picked up to the laboratory. Healthy mature males and females of *R. r. frugivorus* (120-160gm), *R. r. alexandrinus* (110-150gm) and *A. niloticus* (120-140gm) were chosen for this experiment. Animals were singly caged and kept under ventilated laboratory

conditions (temperature 25-35, R.H 60-70%) for two weeks and provided with enough bruised maize bait and water. Thirty males and 30 females were selected and divided into three groups according to the exposure period to Kelerat 0.005% carried on crushed maize and Caid 0.005% carried on crushed maize as follows: group (1) fed on poison bait for 3 days, group (2) fed for 4 days and group (3) fed for 5 days. The daily poisoned bait consumption per animal was recorded in three groups. After exposure period assigned for each group of animals, the poisoned bait was replaced by unpoisoned free bait in new cages. Moreover, unpoisoned 5 males and 5 females of each species were observed under the same condition as control. The day of death of each animal were recorded. Baghdadi (2006).

Data were analyzed using analyses of variance (MSTAT-C 1988) and means were separated using the least significant differences method (LSD) at 5% probability level (Steel and Torrie, 1984), only when a significant "F" test was obtained.

Rodenticides :

The common names, chemical group and chemical structures of the rodenticides used in the toxicological and control studies are:

1. Kelerat 0.005% (trade name)

Common name (Brodifacoum 0.005%)

Chemical group: hydroxyl Coumarin

Used method: Bait (Crushed maize)

2. Caid 0.005% (trade name)

Common name (Chlorophacinone 0.005%)

Chemical group: Indandione

Used method: Bait (Crushed maize)

3. Results and Discussion

Data in Table (1) illustrated the food consumption of rodent (*R. r. frugivorus*) when used two rodenticide baits (Kelerat 0.005% and Caid

0.005%) under laboratory conditions for 3, 4 and 5 days. According to the mean consumption during 3 days, in males, the consumption was scarce in Kelerat bait (11.80 gm) as compared with Caid (15 gm), but in females 10.40gm, 13.20gm) were counted for the two rodenticide baits. The dead period for Caid was longer than in the case of Kelerat. It was found that there was a significant difference in the animal consumption of the tested rodenticide baits for *R.r. frugivorus*. Also, insignificant difference in rodenticides consumed by males and females the results are as similar as **Abdel-Gawad et al. (2001)**.

Data in table (2) According to the mean consumption during 3 days in *R.r. alexandrines* male, the consumption was scarce in Kelerat bait (13 gm) as compared with Caid (15.40 gm), but in females (11.60gm, 14.80gm) were observed. The dead period for Caid was longer than in Kelerat. It was found that there was a significant difference in the animal consumption of the tested rodenticide baits for *R.r. alexandrines*. Also, no significant difference was observed between males and

females, the results are as similar as **Abazaid (1990), Littin et al. (2000) and Shooba, (2003)**.

Data in table (3) According to the mean consumption during 3 days In *Arvicanthis niloticus*, it was observed that the consumption of males was scarce in Kelerat bait (10.20 gm) as compared with Caid (3.20 gm), but in females 11.80gm, 12.40gm were recorded. The dead period for Caid was longer than Kelerat. It was found that there was a significant difference in the animal consumption of the rodenticide baits tested for *Arvicanthis niloticus*. Also, a significant difference was found in rodenticides consumed by males and females, in agreement with **Ali (1991), Abazaid (1997), Abd El-Galil (2005), Baghdadi (2006) and Desoky (2011)**. In conclusion, the recommended procedure for rodent control applying Kelerat as rodenticide, seems to be satisfactory being applied within areas holding different culture i.e. farms, buildings, open areas. However, it is rather important to give all possible attention to environmental sanitation. At the same time, type of applied anticoagulant should be changed upon appearance signs of resistance of rodents under control to such product.

Table (1) Means of daily consumption and time to death of two rodenticides on *R.r. frugivorus* under laboratory conditions

Sex species	Males						Females					
	Kelerat 0.005%			Caid 0.005%			Kelerat 0.005%			Caid 0.005%		
Feeding period in (days)	3	4	5	3	4	5	3	4	5	3	4	5
Mean of Consumption (gm) to death	11.80±0.37bc	10.80±0.86cd	9.00±0.71d	15.00±1.30a	13.20±0.37ab	10.60±0.51cd	10.40±0.51c	9.20±0.58cd	8.00±0.45d	13.20±0.86a	12.60±1.08ab	11.00±0.71bc
Time to death (day)	Range	5-11	4-9	4-8	5-12	5-11	4-10	4-10	4-9	5-12	4-10	4-9
	Mean	7	6.8	6.4	7.8	7.2	7	6.6	6.2	6	7.2	6.8

Table (2) Means of daily consumption and time to death of two rodenticides on *R.r. alexandrines* under laboratory conditions

Sex species	Males						Females						
	Kelerat 0.005%			Caid 0.005%			Kelerat 0.005%			Caid 0.005%			
Feeding period in (day)	3	4	5	3	4	5	3	4	5	3	4	5	
Mean of Consumption (gm) to death	13±0.84c	9.40±0.51d	7.60±0.51e	17.20±0.58a	15.40±0.51b	12.60±0.87c	11.60±0.81b	10±0.71bc	8.80±0.58c	14.80±0.66a	11.60±0.75b	10±0.55bc	
Time to death (day)	Range	5-10	4-8	4-7	5-11	5-9	4-9	4-10	4-8	4-7	5-10	5-8	4-8
	Mean	6.2	5.8	5.4	6.8	6.4	6.2	5.8	5.4	5	6.2	6	5.8

Table (3) Means of daily consumption and time to death of two rodenticides on *A. niloticus* under laboratory conditions

Sex species		Males						Females					
Anticoagulants		Kelerat 0.005%			Caid 0.005%			Kelerat 0.005%			Caid 0.005%		
Feeding period in (day)		3	4	5	3	4	5	3	4	5	3	4	5
Mean of Consumption (gm) to death		10.20 ±0.37 b	9.80± 0.66b	7.6 0±0 .51 c	13.20 ±0.66 a	12.8 0±0 .37a	10.80± 0.73b	11.80 ± 0.86a	9.60 ± 0.93 bc	8.40± 0.51c	12.4 0 ±0.5 1a	11.4 0 ±0.5 1ab	10.6 0±0. 40ab
Time to death (day)	Range	4-9	4-8	3-9	5-10	4-9	4-9	4-8	4-8	4-7	4-10	4-8	4-8
	Mean	6	5.8	5.2	6.6	6.4	6.2	5.6	5.2	5	6.4	6.2	5.8

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World First Spiral Predictive Prime Number Calculus

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Abstract: This is for the spiral at 18 from the half-line, and is predictive. Example of spiral $18(6*3)$ from midline= $(29*19) + (29*18) = (29*37)$.

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Keywords: world; spiral; prime number; calculus

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This is for the spiral at 18 from the half-line, and is predictive. Example of spiral $18(6*3)$ from midline= $(29*19) + (29*18) = (29*37)$.

NOTE: all you smart Alec's, the values are symmetrical in all dimensions --- $263-19=244$, $181-37=244$. The spiral at 18 is the prime numbers in bold:

19	29	37
23	31	41
41	47	59
43	53	61
53	61	71
61	71	79
71	79	89
89	101	107
149	157	167
163	173	181
179	191	197
181	193	199
263	271	281

292 International Journal of Applied Mathematical Research

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**The Entropy S_b of Black-hole M_b ; The Basic Information Unit $I_0 = h/2$ of Hawking Radiation m_{ss} ;
Researching Some Characters of Entropy With Black-hole Theory**
黑洞的霍金辐射 m_{ss} 及其信息量 I_0 , I_m 和熵 S_{bm} 及 S_b ; 黑洞的熵和物质粒子团的熵

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【Abstract】: Entropy and information are first united in the black-hole theory in this article by arthor. It is proved that, entropy is nothing but information, i.e, $S_b = \pi I_m/H$. Author's purposes in this article are to want: 1*; to find out that any black hole of mass M_b emitting every Hawking quantum radiation m_{ss} would bring away a fixed and basic information unit $I_0 = h/2\pi =$ Planck constant. I_0 has nothing to do with mass of M_b and m_{ss} . 2*; to prove that the entropy S_{bm} of minimum black hole M_{bm} , $S_{bm} = \pi$. 3*; to prove that the total information amount I_m of a black hole M_b are $I_m = 4GM_b^2/C$, and the total entropy amount S_b of M_b are $S_b = \pi 4GM_b^2/CI_m = A/4L_p^2$. 4*; to research the characters of entropy with the black hole theory.

[Dongsheng Zhang. **The Entropy S_b of Black-hole M_b ; The Basic Information Unit $I_0 = h/2$ of Hawking Radiation m_{ss} ; Researching Some Characters of Entropy With Black-hole Theory.** *Academia Arena* 2013;5(5):28-36] (ISSN 1553-992X). <http://www.sciencepub.net/academia>. 7

【Key words】: the total information amount I_m of black hole M_b ; the total entropy amount S_b of black hole M_b ; the fixed and basic information unit I_0 of any Hawking radiation m_{ss} , $I_0 = h/2$ minimum black hole M_{bm} ; Planck constant;

黑洞的霍金辐射 m_{ss} 及其信息量 I_0 , I_m 和熵 S_{bm} 及 S_b ; 黑洞的熵和物质粒子团的熵

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【内容摘要】作者在本文中首次将黑洞的熵 S_b 与信息量 I_m 二者完全统一在黑洞理论中了, 证明信息量 I_m 和熵 $S_b = I_m/H$ 有确定的关系, 信息量就是熵。本文的主要任务在于用经典理论和公式证明: 1*。无论任何大小质量的黑洞 M_b , 它每次所发射的任何一个霍金辐射量子 m_{ss} , 其所拥有的信息量 I_0 刚好等于宇宙中最小的、不可再分割的、最基本的信息量 $I_0 = h/2 H$, 即普朗克常数, 而与黑洞的 M_b 和 m_{ss} 的质-能的量无关。其次, 证明最小黑洞 $M_{bm} =$ 普朗克粒子 m_p 的熵 $S_{bm} =$; 其信息量即是 $I_0 = h/2$ 。3*。证明黑洞 M_b 的总信息量 $I_m = 4GM_b^2/C$; 而其总熵 $S_b = 4GM_b^2/CI_0 = A/4L_p^2$; $S_b = I_m/I_0 = I_m/H$; 4*。对熵的特性作一些探讨。

【关键词】。黑洞的霍金辐射 m_{ss} ; 霍金辐射的信息量 I_0 ; 黑洞的信息总量 I_m ; 最小黑洞的熵 S_{bm} ; 黑洞的熵 S_b ; 最小黑洞 M_{bm} ; 我们的宇宙大黑洞 M_u ; 测不准原理; 普朗克常数;

【前言】。史瓦西黑洞 M_b (球对称, 无旋转, 无电荷) 在其视界半径 R_b 上的守恒公式, 这几个公式是对黑洞普遍适用的基本公式。

下面(1) 式是霍金根据热力学和量子力学等得出的著名的黑洞在其视界半径 R_b 上的温度 T_b 公式,

$$T_b M_b = (C^3/4G) \times (h/2\pi\kappa) \approx 10^{27} gk \quad (1)$$

M_b —黑洞的总能量-质量; R_b —黑洞的视界半径, T_b —黑洞视界半径 R_b 上的温度, m_{ss} —黑洞在视界半径 R_b 上的霍金辐射的相当质量, λ_{ss} 和 ν_{ss} 分别表示 m_{ss} 在 R_b 上的波长和频率, κ —波尔兹曼常数 = $1.38 \times 10^{-16} g \cdot cm^2/s^2 \cdot k$, C —光速 = $3 \times 10^{10} cm/s$, h —普朗克常数 = $6.63 \times 10^{-27} g \cdot cm^2/s$, G —万有引力常数率 = $6.67 \times 10^{-8} cm^3/s^2 \cdot g$,

下面是霍金黑洞的温度公式, $T_b M_b = (C^3/4G) \times (h/2\pi\kappa) \approx 10^{27} gk$ [1] (1a) M_b —黑洞的总质能量; R_b —黑洞的视界半径, T_b —黑洞的视界半径 R_b 上的温度, m_{ss} —黑洞在视界半径 R_b 上的霍金辐射的相当质量, m_{ss} 既然是量子辐射, 在视界半径 R_b 上的 m_{ss} , 按引

m_{ss} 既然是 在视界半径 R_b 上的霍金量子辐射 m_{ss} , 按质能转换为辐射能的熵温等价公式应该为,

$$C^2 m_{ss} = \kappa T_b \quad [2][4] = Ch/2\pi\lambda_{ss} = \nu_{ss} h/2\pi \quad (2)$$

根据史瓦西对广义相对论方程的特殊解,

$$GM_b/R_b = C^2/2 \quad [2][4] \quad (3)$$

(3)式是黑洞存在的充要条件。作者用 (1) 和 (2), 很容易推导出下面黑洞的新公式 (4),

$$\underline{m_{ss} M_b = hC/8\pi G = 1.187 \times 10^{-10} \text{g}^2} \quad (4)$$

在极限情况下，得出最小黑洞 M_{bm} 为， $M_{bm} = m_{ss} = (hC/8\pi G)^{1/2}$ ，这正好等于普朗克粒子 m_p ，所以有，

$$\underline{M_{bm} = m_p = m_{ss} = (hC/8\pi G)^{1/2} \text{g} = 1.09 \times 10^{-5} \text{g}} \quad (5)$$

在参考文献[4]中，作者曾精确地证明了，黑洞与本文有关的一些基本性质：第一；上面的 5 个公式的参数 M_b ， m_{ss} ， T_b ， R_b 都是在 R_b 上，而与黑洞 M_b 内部的结构、运动状态、变化无关。第二；任何黑洞，它只能是因吞噬外界能量-物质或与其它黑洞合并而膨胀，也只能是因吞噬完外界能量-物质后，发射霍金辐射 m_{ss} 而收缩，但无论它是膨胀还是收缩，在它最后收缩成为最小黑洞 $M_{bm} = m_p = 1.09 \times 10^{-5} \text{g}$ 而消失在普朗克领域前，它会永远是一个黑洞。这是黑洞的最本质的属性。第三； M_b ， m_{ss} ， T_b ， R_b 的 4 个参数，只要其中 1 个的数值确定了，其它的 3 个也就跟着按照上面的公式被单值地确定了，而且 4 个参数中的每一个都只为 4 个自然常数 h ， C ， κ ， G 的不同关系式所决定。第四；**我们的宇宙是一个真正的巨无霸宇宙黑洞**。它来源于宇宙诞生时大量的最小黑洞 $M_{bm} = m_p = m_{ss} = (hC/8\pi G)^{1/2} \text{g} = 1.09 \times 10^{-5} \text{g}$ 的合并。^[4] 把握住这几项，是理解本文中求出黑洞熵 S_b 和信息量 I_m 问题的关键。宇宙中不可能存在比 $M_{bm} = m_p$ 更小的黑洞。^[2]

【1】。Bekenstein-Hawking 的史瓦西黑洞熵 S_b 的公式。（本文只研究球对称、无电荷、无角动量的史瓦西引力黑洞）。类比最小信息量 $I_0 = h/2\pi$ 与测不准原理。

在热力学中，可以证明，对于一个转动物体有下式，

$$\delta M = T\delta S + \Omega\delta J^{[2]} \quad (1a)$$

按照黑洞物理中的热力学类比，爱因斯坦引力理论中的黑洞熵 S_b 可写为，

$$S_b = A/4L_p^2^{[2]} = 2\pi^2 R_b^2 C^3/hG^{[2]} \quad (1b)$$

上式中， A 为黑洞面积， $A = 4\pi R_b^2$ 。 L_p 为普朗克长度，即

$$L_p = (HG/C^3)^{1/2}^{[2][3]} \quad (1c)$$

(1b) 式即有名的 Bekenstein-Hawking 黑洞熵公式。再从史瓦西公式(3)， $GM_b/R_b = C^2/2$ ，于是得，

$S_b = A/4L_p^2 = 4\pi R_b^2/(4GH/C^3) = 2\pi^2 R_b^2 \times C^3/Gh = \pi R_b R_b C^3/GH = \pi \times Ct_s \times 2GM_b C^3/GHC^2 = \pi 2t_s \times M_b C^2/H$ ， t_s 为光穿过黑洞的史瓦西半径 R_b 的时间。于是有黑洞熵 S_b 的下式，

$$S_b = \pi(2t_s \times M_b C^2)/H, \quad (1d)$$

$$\text{或者 } S_b = \pi(2\pi/h) \times (2t_s \times M_b C^2) \quad (1d)$$

$$\text{现令 } I_0 = H = (h/2\pi) \quad (1e)$$

海森伯测不准原理说，互补的两个物理量，比如时间和能量，位置和动量，角度和角动量，无法同时测准。它们测不准量的乘积等于某个常数，那个常数就是普朗克常数 h ，即 $h = 6.63 \times 10^{-34}$ 焦耳/秒 = $6.63 \times 10^{-27} \text{g} \cdot \text{cm}^2/\text{s}$ 。由于最小黑洞 $M_{bm} = m_p = m_{ss}$ ，用类比法取 $I_0 = h/2\pi$ 为最小黑洞黑洞的信息量=最小信息量，即令，

$$m_{ss} C^2 \times 2t_s = h/2\pi = I_0 \quad (1f)$$

$$\underline{\Delta E \times \Delta t \approx h/2\pi = I_0} \quad (1g)$$

对比 (1f) 和 (1g)， (1g) 式即是测不准原理的数学公式，可见， $2t_s$ 对应于 Δt 时间测不准量， $m_{ss} C^2$ 对应于 ΔE — 能量测不准量。**这初步说明黑洞发射霍金辐射的整个过程就是将其能量-物质量子化为辐射能的过程。**

【2】。求证最小黑洞的霍金辐射 m_{ss} 的信息量 $I_0 = h/2\pi$ =最小信息量。最小黑洞的熵 $S_{bm} = \pi$ =最小熵值。

下面根据(5)式中普朗克粒子 m_p 的数据对 (1f) 和 (1g) 式进行验算。在参考文献[4]中，作者证明了**宇宙中的最小黑洞 $M_{bm} = m_{ss} = m_p = (hC/8\pi G)^{1/2} = 1.09 \times 10^{-5} \text{g}$** ，其视界半径 $R_b = L_p = (Gh/2\pi C^3)^{1/2} = 1.61 \times 10^{-33} \text{cm}$ ，其史瓦西时间 $t_{sbm} = R_{bm}/C = 0.537 \times 10^{-43} \text{s}$ 。所以，**对最小黑洞信息量 I_0 的计算是：**

$$I_0 = 2t_{sbm} \times M_{bm} C^2 = 2t_{sbm} \times m_{ss} C^2 = 2 \times 0.537 \times 10^{-43} \text{s} \times 1.09 \times 10^{-5} \text{g} \times 9 \times 10^{20} = 1.054 \times 10^{-27} \text{g} \cdot \text{cm}^2/\text{s}. \quad (2a)$$

$$I_0 = h/2\pi = 6.63 \times 10^{-27}/2\pi = 1.06 \times 10^{-27} \text{g} \cdot \text{cm}^2/\text{s}. \quad (2b)$$

由上2式的计算结果几乎完全相等，即说明，

$$\underline{2t_{sbm} \times M_{bm} C^2 = h/2\pi = H = I_0} \quad (2c)$$

再用公式验证：先按(4)式后按(3)式验证(2c)，

$$2t_{sbm} \times m_{ss} C^2 = (2R_{bm}/C) \times (hC^3/8\pi GM_{bm}) = h/2\pi = H = I_0$$

上式说明 H 值不多不少 = 宇宙中最小黑洞即普朗克粒子的信息量 I_0 。可见，**最小黑洞 M_{bm} = 普朗克粒子 $m_p = m_{ss}$ ，它已经量子化为拥有宇宙中一个最小的信息单位 = I_0 。**所以它无法分解为更多和更小的信息量，因为 m_p 的寿命太短了，**已经达到宇宙粒子寿命的最短极限 10^{-44}s 。**但是它的质能不是最小，可以分割。因 $m_p = 1.09 \times 10^{-5} / 1.67 \times 10^{-24} = 10^{19}$ 个质子，它只会在普朗克领域分解成更小的高能 γ -射线而具有更长波长的低能射线，其寿命都会变得 longer，总信息量却能极大地增加。所以 m_p 只能在普朗克领域解体消失。^[2]

下面计算最小黑洞 $M_{bm} = m_p$ 的熵 S_{bm} ，按照 (1b) 式，

$$S_{bm} = A/4L_p^2 = 2\pi^2 R_{bm}^2 C^3/hG = \pi 2t_{sbm} \times M_{bm} C^2 / (h/2\pi) = \pi(h/2\pi)/(h/2\pi) = \pi \quad (2d)$$

$$\therefore S_{bm} = \pi, I_0 = 2t_{sbm} \times M_{bm} C^2 = h/2\pi \quad (2e)$$

为什么量子化的常数，普朗克常数，会不多不少刚好正是我们知道的这个数值？这个常数的具体数值到底有什么意义？这说明普朗克常数 $I_0 = h/2\pi$ 就是宇宙中最小黑洞 $M_{bm} =$ 普朗克粒子 m_p 的信息量，这也是宇宙中不可分割的最小信息量，比 $h/2\pi$ 更少的信息量在宇宙中不可能存在。而 $S_{bm} = \pi$ 就应是宇宙中熵的最小单位。

著名的业余物理学家方舟的女解释说：^[1] ‘这个是什么意思呢？哲学上说，存在即是被感知，感知也就是信息的获得和传递，一样不携带信息的东西，是无法被感知的，所以信息也就是存在。所以，

信息 = 存在 = 能量 × 时间。

普朗克常数 = 能量测不准量 × 时间测不准量

那么为什么存在 = 能量 × 时间呢？这个反映了存在的两个要素，存在的东西必须要有能量，没有能量，那也就是处于能量基态的真空，是不存在的。存在的东西也必须持续存在一定的时间，如果一样东西只存在零秒钟，那便是不存在。^[1]

她对信息的上述解释是可以被理解接受的，是否满意是另外的问题。因为人们对量子世界还处在瞎子摸象的阶段。本文验证的结果还是认可其解释的。

【3】。任何黑洞 M_b 每次发射的任何一个霍金辐射 m_{ss} 都只是最小的信息量 $I_0 = h/2\pi$ ，而与黑洞的 M_b 和 m_{ss} 的数值大小无关。任何一个黑洞 M_b 的总信息量 $I_m = 4GM_b^2/C$ 。黑洞 M_b 的总熵 S_b 与其信息量 I_m 的关系是 $S_b = \pi n_i = \pi I_m/I_0 = \pi I_m/H = \pi(2t_s \times M_b C^2)/H$ 。

1*。现在来求任何黑洞的一个霍金辐射粒子 m_{ss} 信息量 I_0 的普遍公式，根据(4)和(3)式，

$$m_{ss} M_b = hC/8\pi G = 1.187 \times 10^{-10} g^2 \quad (4)$$

注意：由(4)式可见，黑洞 M_b 发射其霍金辐射 m_{ss} 是间断地一次发射一个，由于 M_b 发射一个 m_{ss} 后就减小了，所有下一个 m_{ss} 就比上一个增大了些。因此，每个 m_{ss} 的量是不一样的，是在逐渐地增大，直到最后变成最小黑洞 $M_{bm} = m_{ss} = m_p$ 而消失在普朗克领域为止。

$$I_0 = m_{ss} C^2 \times 2t_s = C^2 hC / (8\pi G M_b) \times 2R_b / C = C^2 hC / (8\pi G M_b) \times 2 \times 2GM_b / C^3 = h/2\pi$$

$$\therefore I_0 = m_{ss} C^2 \times 2t_s = h/2\pi \quad (3a)$$

(3a)证明任一黑洞的任何一个 m_{ss} ，无论其质能大小，其信息量都是 I_0 ，而与 M_b 和 m_{ss} 的量的大小无关。

2*。再求任何一个黑洞 M_b 的总熵 S_b 。

根据(1b)式，黑洞的熵 S_b 只与其表面积 $4\pi R_b^2$ 成正比，而 S_{bm} 是最小黑洞 $M_{bm} = m_p$ 的熵，所以，

$$\therefore S_b = S_{bm} (R_b/R_{bm})^2 = \pi (R_b/R_{bm})^2 \quad (3b)$$

$$\text{令 } n_i = M_b/m_{ss} \quad (3c)$$

用(3b)(3c)式，再根据(3)式， $S_b = \pi (R_b/R_{bm})^2 = \pi M_b R_b / M_{bm} R_{bm} = \pi M_b C^2 \times 2t_s / M_{bm} C^2 \times 2t_{bm} = \pi n_i (m_{ss} C^2 \times 2t_s) / (M_{bm} C^2 \times 2t_{sbm})$ 。根据(3a)式，于是得，

$$S_b = n_i \pi = n_i S_{bm} = \pi M_b / m_{ss} \quad (3d)$$

3*。求任何一个黑洞 M_b 的总信息量 $I_m = 4GM_b^2/C$ ；黑洞 M_b 的熵 S_b 与其信息量 I_m 的关系 $S_b = \pi n_i = \pi I_m / I_0$ 。

$$\text{按照(1d)和(2d)式， } S_b = \pi(2t_s \times M_b C^2) / H, S_{bm} = \pi$$

$$S_b / S_{bm} = (2t_s \times M_b C^2) / (2t_{sbm} \times M_{bm} C^2) = n_i \quad (3e)$$

而在(3e)中， $2t_{sbm} \times M_{bm} C^2 = I_0$ ，显然，对于任一黑洞 M_b 的信息量 I_m 就应该是 $(2t_s \times M_b C^2)$ ，于是，

$$S_b / S_{bm} = n_i = I_m / I_0 \quad (3f)$$

$$S_b = \pi n_i = \pi I_m / I_0 = \pi I_m / H = \pi M_b / m_{ss} \quad (3g)$$

$$\therefore I_m = n_i I_0 \quad (3h)$$

$$\therefore I_m = n_i I_0 = I_0 M_b / m_{ss} = 4GM_b^2 / C \quad (3i)$$

综合(1b)，(1d)，(3g)，(3i)等式，得，

$$S_b = \pi n_i = \pi I_m / I_0 = (\pi / I_0) \times (4GM_b^2 / C) = 2\pi^2 R_b^2 C^3 / hG \quad (3j)$$

$$\therefore S_b = A/4L_p^2 = (\pi / I_0) \times (4GM_b^2 / C) = \pi I_m / I_0 = \pi n_i = 2\pi^2 R_b^2 C^3 / hG = \pi (2\pi/h) \times (2t_s \times M_b C^2) = \pi (2t_s \times M_b C^2) / H \quad (3k)$$

(3j)，(3k)式与(1b)式完全相等。

4*。用另一种方法求黑洞 M_b 的信息量 I_m

由(2a)和(3)式 $GM_b/R_b = C^2/2$ ，对于最小黑洞 M_{bm} ，

$$I_0 = 2t_{sbm} \times M_{bm} C^2 = 2R_{bm} \times M_{bm} C = 4GM_{bm}^2 / C \quad (3l)$$

相应地对比(3l)式，可得黑洞 M_b 的信息量 I_m ；

$$\therefore I_m = 4GM_b^2 / C \quad (3m)$$

可见，(3m) = (3i)

$$\therefore I_m / I_0 = M_b^2 / M_{bm}^2 = R_b^2 / R_{bm}^2 = n_i = S_b / S_{bm} \quad (3n)$$

而 $n_i = M_b / m_{ss}$ ，对于2黑洞 M_{b1} 和 M_{b2} 而言，有

$$I_{m1} / I_{m2} = M_{b1}^2 / M_{b2}^2 = R_{b1}^2 / R_{b2}^2 = n_{i1} / n_{i2} \quad (3o)$$

5*。从(2)式 $m_{ss} C^2 = (h/2\pi) \times C / \lambda_{ss}$ 中可得出，

黑洞的任何霍金辐射 m_{ss} 的波长 λ_{ss} 等于黑洞 M_b 的直径 D_b 。

$$I_0 = h/2\pi = m_{ss} C^2 \times 2t_c = m_{ss} C^2 \times D_b / C = m_{ss} C^2 \times \lambda_{ss} / C$$

$$\therefore \lambda_{ss} = 2t_c C = 2R_b = D_b \quad (3p)$$

6*。结论：由(3n)式可以推导出(3g)式和(1b)式。表明以上所有证明都是正确和自洽的。就是说，只要知道了前言中黑洞的5个普遍公式，就可推导出最小黑洞 M_{bm} 的 I_0 和 S_{bm} ；进而推导出黑洞 M_b 的 S_b 和 I_m 。

【4】。作为实例，算算我们宇宙黑洞的熵 S_{bu} 和信息量 I_{mu} 。

作者在参考文献[4]中，已经完全证明我们宇宙就是一个巨无霸宇宙黑洞。我们宇宙现在的总能量-质

量约为 $M_{bu} = 10^{56} g^{[4]}$, $M_{bu}/M_{bm} = 10^{56}/10^{-5} = 10^{61}$, 同样, 其视界半径之比 $= R_{bu}/R_{bm} = 10^{28}/10^{-33} = 10^{61}$, 另外 $t_u/t_{sbm} = 10^{61}$. 按最新精密的天文观测, 宇宙(黑洞)年龄为 $t_u = 137$ 亿年 $= 4.32 \times 10^{17} s$.

1*. 我们宇宙黑洞总熵 S_{bu} 可按(1d)或(3j)式计算, $S_b = \pi(2\pi/h) \times 2t_s \times M_b C^2$,

$$S_{bu} = \pi(2\pi/h) \times 2 \times 4.32 \times 10^{17} s \times 10^{56} g \times C^2 \approx 0.736 \times 10^{122} \pi \quad (4a)$$

$$\text{再从(3b), } S_{bu} = \pi(R_b/R_{bm})^2 \approx 10^{122} \pi \quad (4b)$$

(4a) 和 (4b) 来源不同, 结果一样. 证明上面 2 式的正确性.

结论: 由于黑洞的熵与其表面积 A 成正比, 也可按照(3o)式, 所以, 任意 2 个黑洞熵之比,

$$S_{b1}/S_{b2} \propto (R_{b1}/R_{b2})^2 \propto (t_{s1}/t_{s2})^2 \quad (4c)$$

2*. 我们宇宙黑洞总信息量 I_{mu} .

我们宇宙的总信息量 I_{mu} 可用(3h)式, $I_{mu} = 10^{56}/10^{-66} I_0 = 10^{122} I_0 = 10^{122} \times 1.06 \times 10^{-27} = 10^{95} g \cdot cm^2/s$; 再用(3i)式 $I_{mu} = 4GM_b^2/C = 4 \times 6.67 \times 10^{-8} \times (10^{56})^2/3 \times 10^{10} = 0.89 \times 10^{95}$. 2 种计算方法计算的结果是相等的, 佐证了所用公式正确.

3*. 由后面的(7b)式求宇宙现在的实际密度 ρ_{bu} , $M_{bu}^2/M_{bm}^2 = \rho_{bm}/\rho_{bu}$
 $\therefore \rho_{bu} = \rho_{bm} M_{bm}^2/M_{bu}^2 = 10^{93} (10^{-61})^2 = 10^{-29} g/cm^3$
 $\rho_{bu} = 10^{-29} g/cm^3$ 与当今对宇宙的实际的观测数据相吻合, 说明我们宇宙是一个真正的宇宙黑洞, 而宇宙的平直性 $\Omega = 1$ 是黑洞的本性. 可见, 由广义相对论方程得出的弗里德曼模型是一个不切实际的假命题, 折腾了科学家们近百年还搞不清楚 Ω 是否 $= 1$.

【5】. 关于黑洞熵和信息量的几点重要的分析和结论:

1*. 任何黑洞不论 M_b 的大小, 每次发射的任何一个霍金辐射 m_{ss} 都只含有或曰带走一个最小的信息量 $I_0 = h/2\pi = 1$ 个基本单元信息量, 也是一个最小单元的熵 $S_{bm} = \pi$. I_0 与 m_{ss} 和 M_b 的值无关. 因此, 霍金辐射 m_{ss} 就是黑洞内的质-能转变为辐射能通过视界半径发送到外界的. 霍金辐射 m_{ss} 就是带着熵和信息能量子和波.

2*. 任一黑洞 M_b 的总信息量 $I_m = 4GM_b^2/C$, 而按照(3g)式, 其熵 $S_b = (\pi/I_0)I_m = (\pi/I_0) \times 4GM_b^2/C$,

$$\therefore S_{b1}/S_{b2} = I_{m1}/I_{m2} = M_{b1}^2/M_{b2}^2 = (R_{b1}/R_{b2})^2 \quad (5a)$$

由(3g)式可见, 信息量就是熵. 黑洞的 M_b 愈大, 其面积愈大, 其熵 S_b 愈大, 信息量 I_m 也愈大.

3*. 设任一黑洞 M_{b1} 吞噬外界能量-物质或与其它黑洞 M_{b2} 合并的膨胀过程中, 其总信息量 I_m 和总熵 S_b 是不守恒的, 是增加的.

比如, 当 $M_b = M_{b1} + M_{b2}$ 的 2 个黑洞合并时, 其合并后的总信息量 I_m , 合并前的总信息量 $I_{m1} + I_{m2}$.

所以, $I_m = 4GM_b^2/C = 4G(M_{b1} + M_{b2})^2/C$, 而 $I_{m1} = 4GM_{b1}^2/C$, $I_{m2} = 4GM_{b2}^2/C$. 所以,

$$I_m \neq I_{m1} + I_{m2} > I_{m1} + I_{m2} \quad (5b)$$

$$\text{同样, } S_b \neq S_{b1} + S_{b2} > S_{b1} + S_{b2} \quad (5c)$$

由上面公式可见, 由于 $I_m \propto (M_{b1} + M_{b2})^2$, 而合并前 $I_{m1} \propto M_{b1}^2$, $I_{m2} \propto M_{b2}^2$, 合并后之 $I_m > I_{m1} + I_{m2}$. 所以黑洞合并后总信息量 I_m 是增加的、不守恒的. 同理, 当黑洞 M_b 发射霍金辐射 m_{ss} 而缩小时, 起初 $I_m \propto M_b^2$, 当 M_b 发射 m_{ss} 到 $0.5 M_b$ 之后, 剩余的 $0.5 M_b$ 的信息量只有 $0.25 I_m$, 而发射出去的 $0.5 M_b$ 却带走了 $0.75 I_m$. 当然, I_m 的总量还是一样的. 这是因为每个 m_{ss} 的信息量 $I_0 = h/2\pi$. 而在黑洞 M_b 大时, m_{ss} 小, 其波长 λ_{ss} 较长, 所以一个 I_0 所需的 m_{ss} 就小, 同等黑洞的质能可产生多个 m_{ss} , 带走了更多的信息量. 熵的情况与信息量一样的.

4*. 黑洞熵 S_b 和信息量 I_m 的波粒二重性. 由(3a)和(3p),

$$I_0 = m_{ss} C^2 \times 2t_s = h/2\pi = m_{ss} C \times \lambda_{ss} = \kappa T_b \times \lambda_{ss}/C \quad (5d)$$

如上所述, 所有黑洞的熵 S_b 和信息量 I_m 都来源于其霍金辐射 m_{ss} 的最小信息量 I_0 , m_{ss} 不是物质粒子, 而是能量子, 所以霍金辐射是发射能量子, I_0 是受 $m_{ss} \times \lambda_{ss}$ 乘积的双重影响. I_0 在行进时表现为波而有 λ_{ss} , 碰撞或被阻挡停止时, 表现为粒子 m_{ss} . 在强引力场附件行进时, 轨道会受引力场影响而弯曲, 表现为波粒二重性.

但是由于黑洞发射的每个 m_{ss} 的相当质量都不相等, 所以它的温度 T_b 和波长 λ_{ss} 都是不相同的.

5*. 所有前述公式所描述的都是黑洞发射霍金辐射 m_{ss} 的理想过程. 因此, I_0 , I_m , S_{bm} , S_b 等公式都是描述理想过程的.

【6】. 黑洞霍金辐射的熵和物质粒子团的热力学熵, 对它们的性质和作用的一些探讨.

熵到现在还是科学没有弄明白的概念. 熵是一个极其重要的物理量, 但却又以其难懂而闻名于世. 克劳修斯于 1865 年首先引入它, 用来定量地阐明热力学第二定律. 后来, 玻尔兹曼赋予了熵的统计解释. 到了 1929 年, 西拉德又将熵与信息联系起来, 给出了熵的新含义. 熵由什么决定的等微观机制还没有弄明白, 只给出了宏观统计解释, 认为概率法制是制约熵的本质. 其实热力学和统计物理学是在宏观框架下完成的, 它并没有深入微光世界的实质, 是宏观统计的表现.^[5]

其实越是简单的基本的东西越难使人们搞清楚明白. 现代科学对热和温度是什么, 力是什么, 万有引力说什么, 熵是什么, 空间是什么, 质量是什么, 量

子力学是什么等基本问题都搞不明白。但能运用其基本定理定律搞清较复杂问题。比如，人们可以熟练地运用万有引力定律，但并不了解引力是什么。有谁能说清楚测不准原理的本质？但他被广泛地运用着。在理论科学上，有许多时候，是知难行易的。

6-1*。黑洞发射霍金量子辐射 m_{ss} 的熵、信息量的特性

黑洞 M_b 在其视界半径 R_b 上一个一个的发射霍金辐射 m_{ss} 是量子辐射，按照(2)式是微观状态的理想过程，所以 m_{ss} 本身应该既无能量的损失，也无熵 S_{bm} 和信息量 I_0 的损失，因为 S_{bm} 和 I_0 都是宇宙中的最小量。 m_{ss} 的总数、即黑洞的熵 S_b 和信息量 I_m 是由黑洞的总能量-质量 M_b 按照公式(2)完全转变为发射霍金辐射 m_{ss} 后发射到外界的，它们只与黑洞 M_b 的能量-物质的总量有关，而与 M_b 是什么性质的能量-物质、结构和状态都无关系。至于黑洞复杂的内部和发送到外部 m_{ss} 的熵和信息量如何变化，与黑洞在其 R_b 上发射霍金辐射 m_{ss} 无关。黑洞 M_b 在其视界半径 R_b 上发射霍金辐射 m_{ss} 只服从【前言】中的 5 个公式。

黑洞是一个非稳定的非封闭系统。但是，如果将黑洞所有发射出去的霍金辐射与残存的还在发射霍金辐射的黑洞作为一个系统来看，当然，这是一个非理想过程、熵增加的过程，因为在黑洞外的辐射能有不同的温度，温度的平均化就是熵增加的过程。

由(1b)式 $S_b = A/4L_p^2$ 和 (1c)式 $L_p = (HG/C^3)^{1/2}$ 可知，当黑洞收缩到最后为最小黑洞 $M_{bm} = m_p = 10^{-5}g$ 时，

$$S_{bm} = A/4L_p^2 = 4\pi R_{bm}^2/4R_{bm}^2 = \pi \quad (6a)$$

由此可见，霍金在定义黑洞熵的最小值 S_{bm} 时，是以宇宙中最小黑洞 $M_{bm} = m_p$ 普朗克粒子的面积 $A_{bm} = 4\pi R_{bm}^2$ 与其视界半径 R_{bm}^2 之比为基准的。因而使黑洞每次发射一个霍金辐射 m_{ss} 时，就带走一个单位信息量 $I_0 = h/2\pi$ ，也会同时带走一分最小的熵 $S_{bm} = \pi$ 。1929 年，西拉德又将熵与信息联系起来，是科学的预见。这说明只有运用黑洞发射霍金辐射 m_{ss} 的理论才能将辐射能的熵和信息量二者完全对应地联系起来。

在黑洞理论里，熵是一个无量纲数，而黑洞所发射的 m_{ss} 是辐射能量，是量子，有波长 λ_{ss} 。从(3a)式可见，

$$I_0 = m_{ss} C^2 \times 2t_c = \frac{h}{2\pi} = m_{ss} C \times \lambda_{ss}, \quad (6b)$$

黑洞 M_b 自身是一个非稳定的非孤立系统。当它因吞噬外界质能或与其它黑洞合并时，黑洞因吸食外界的质能，使系统的体积增大，能量密度降低，温度降低，黑洞熵 S_b 和信息量 I_m 的增加表现

为辐射能 m_{ss} 的减少和波长 λ_{ss} 的同时增长。因为 $I_0 = m_{ss} C^2 \times 2t_c = \frac{h}{2\pi} = m_{ss} C \times \lambda_{ss}$ 是一定的。而黑洞熵的增加由(3g)式和(3i)式所决定。所以熵和信息量的增加不是与 M_b 的增加成正比，而是与 M_b^2 成正比。

类似地，黑洞 M_b 因发射霍金辐射 m_{ss} 后而使熵 S_b 和信息量 I_m 减少的量也与残存的 M_b^2 成正比。

也可以另作解释说，黑洞熵 S_b 和信息量 I_m 的增减量之所以与 M_b^2 成正比，因为黑洞是非孤立系统，熵的增减一是因为 M_b 的增减，一是因波长增减的原因。

黑洞发射霍金辐射也是从高温流向低温源，是从热力学第二定律的反映。^[6]

6-2*：物质粒子团在理想和非理想过程的孤立系统中，因膨胀和温度降低而熵增加的情况。从热力学中，熵 S 的定义为每开温度 T 中所拥有的热量 Q (能量)。

$$dS = dQ/T \quad (6c)$$

(6f)

在热力学中，熵 S 作为热力学熵，是有量纲的，即每度(开)焦耳 J/k ，是一种热能量的量度。按照热力学，在一个绝热系统，熵的增加有 2 方面的影响造成：一是理想过程的熵增加表现为膨胀时的温度降低(相反，熵减少表现为收缩时的温度增高)。而非理想过程的熵增加除了上述膨胀降温使熵增加外，还表现为粒子摩擦撞击等所产生的动能转变为额外的热量增加，只要有热量从系统内的高温物体流向低温物体，系统的熵就会增加。所以热力学第二定律是有关过程进行方向的规律，这是对熵的宏观描述。它指出一切与热现象有关的实际宏观过程都是非理想、不可逆的。粒子系统体积越大，物质粒子微观态数就越多，系统就越混乱无序。

因此，热力学中熵表示的是“系统混乱状态”。1877 年，玻尔兹曼发现单一系统中的熵跟构成热力学性质的微观状态数量相关。设一个容器内的理想气体的微观状态为：(i)所有粒子的位置皆在容器的体积范围内；(ii)所有原子的动能总和等于该气体的总能量值。玻尔兹曼由此假设：

$$S = \kappa \ln N \quad (6ca)$$

公式中的 κ 是玻尔兹曼常数。 N 则为该宏观状态中所包含之微观状态数量。根据玻尔兹曼的定义，

熵是一則關於狀態的函數。我們可以看出 N 是一個系統混亂程度的度量。玻爾茲曼原理指出系統中的微觀特性 N 與其熱力學特性 (S) 的關係。這個被稱為玻爾茲曼原理的假定是統計力學的基礎。統計力學則以構成部分的統計行為來描述熱力學系統。

有人也直接將 N 定義為系統 S 內的事件 p_i 的總數，則熵 S 可以表述為，

$$S \leq \log_2 N, \quad (6c)$$

當且僅當 $p_1 = p_2 = \dots = p_n$ 時，等號成立，此時系統 S 的熵最大。

熵增的熱力學理論與幾率學理論結合，表明事物的混亂程度越高，則其幾率越大。(6ca) 和 (6cb) 只是提出了一個新的物理概念，但是實際上因為 N 的數目太大，無法用於微觀的計算物質粒子團熵，只可用於宏觀的概率統計。

6—3*；再分析推論一下黑洞發射霍金輻射熵和物質粒子團熵的情況

第一：黑洞發射霍金輻射 m_{ss} 輻射能與太陽發射的光和一般的热辐射完全是同样的辐射能^[6]，因此，从黑洞發射霍金輻射 m_{ss} 可以看出就是任何輻射能 m_{ss} 與熵和信息量之間的關係，所以研究霍金輻射就可用以研究其它輻射能的熵 S_b 和信息量 I_m 。由此可以推論任何一种波长的辐射能，比如一定波长的可见光，其信息量也极可能是 I_0 ，其熵也是 $S_{bm} = \pi$ 。

黑洞吞噬外界能量-物質和黑洞的的合并所造成的巨大膨胀和温度巨降，使黑洞所拥有的熵 S_b 和信息量 I_m 的迅速增加，表现为与 M_b^2 成正比。在黑洞吞噬完外界的能量-物質后，就会不停地、一个一个地發射霍金輻射 m_{ss} 而收缩，^{[2][6]} 此过程是个理想过程。但是，在黑洞内部和黑洞發射霍金輻射 m_{ss} 后的外部，必定存在非理想过程，在这些过程中，粒子和輻射能的熵和信息量是如何额外地增加，如何量化其增量，如何从微觀上予以解釋，是人们现在难以了解的。同时必須注意，普通的粒子團增加其质量的公式，是按照球體公式，其半径 R 的增加是很小的。而当黑洞 M_b 增加其质量-能量时，其视界半径 R_b 是按公式 (3) 正比例增长的。

第二：孤立系统的物質粒子團中因膨胀和温度降低而热力学熵增加的情况。(6c) 式分为理想过程和非理想过程。热力学中，用宏觀的效率来表示非理想过程中熵增加而造成的一些能量损失。

第三，由于輻射能的(6a)與物質粒子團的(6c)式对熵的定义不同，量纲也不同。(6c)式的熵是粒子團的宏观状态，而黑洞(3g)式將熵 S_b 与信息量 I_m 完全联系在一起，是由微觀直接推導到宏觀的精确公式，所以没有必要对黑洞熵再提出和采用几率的概念和公式。

第四：对于非黑洞熵的一般輻射能團，因为它们不是粒子，是能量量子，有波粒二重性，其相当质量极小，至少比质子小很多很多，很难用微觀的事件几率的對數來定义輻射能的熵，可能仍然得用宏觀的(6c)式，与物質粒子團一樣。

6—4*；無論是輻射能量系統，還是物質粒子系統，當系統增加容積和密度溫度降低時，都是釋放能量的過程，這是個不可逆過程，如果想要再將系統回復原樣，就需要比原來放出去的能量更多的能量才能復原。而對於絕大多數系統和事物來說，都是非理想過程，更是無法也沒有條件能夠復原的。因此，熵的增加代表著時間的方向，是宇宙不停地朝膨脹方向進程的反映，表示宇宙中事物的‘破鏡不能重圓，覆水無法回收，死灰不可復燃’是不可違背的熱力學第二定律，這反映了宇宙所有事物都有生長衰亡的普遍規律。

因此，對宇宙中的任何事物或者一個系統來說，都必須不違反能量-質量守恆定律、電荷守恆定律和熵增加定律。而能量的總和 = 有效能量 + 無效能量。所以熵的增加就是表示有效能量的一部分轉變為無效能量了。

6—6*；結論：在上面列舉的 2 種不同的熵增加的情況中；A；(6c)式是先從宏觀上描述物質粒子團的熵增加情況，其非理想過程的熵增加靠實驗數據來解決。B；本文是運用黑洞發射霍金輻射的理論，直接由微觀到宏觀求出理想過程中黑洞的熵 S_b 和信息量 I_m 與黑洞總質能量 M_b 之間的準確公式。至於輻射能在非理想過程中熵是如何增加的，人們無論從宏觀上和微觀上都了解不多。

【7】。宇宙中在什麼區間存在理想過程，什麼區間存在非理想過程？

要了解熵的性質和作用是什麼？首先要了解理想過程和非理想過程，特別是要知道宇宙中在什麼區間存在理想過程，什麼區間存在非理想過程，這些只有從黑洞理論中才能了解到。在當今現實的物理世界，全是非理想過程，不可能存在理想過程。

7—1*；從黑洞 M_b 不停地發射霍金輻射 m_{ss} 而最後收縮為普朗克粒子 m_p = 最小黑洞 M_{bm} ，而消亡在普朗

克领域来看，^[4]宇宙中的理想过程会出现在什么状态和区域？

黑洞 M_b 因吞噬外界能量-物质增大其 M_b 后的密度 ρ_b 与熵 S_b 的增大情况。

从公式 (3) $M_b = R_b C^2 / 2G$ ，将黑洞作为一个球体，

$$M_b = 4\pi\rho_b R_b^3 / 3,$$

从以上 2 式，可得出黑洞的下式，

$$\rho_b R_b^2 = 3C^2 / 8\pi G \quad (7a)$$

将(7a)与(5a)相比较，可得出，(6a)

$$S_{B1}/S_{B2} = I_{m1}/I_{m2} = (R_{b1}/R_{b2})^2 = M_{b1}^2/M_{b2}^2 = \rho_{b2}/\rho_{b1} \quad (7b)$$

由(7b)式可见，前面已经证明，如果 2 个孤立的黑洞 M_{b1} 和 M_{b2} 系统合并后成为大黑洞 $M_b = M_{b1} + M_{b2}$ ，其过程中的方向就是熵和信息量增加的方向。在霍金黑洞熵公式看来，熵的增加是合并后表现为黑洞面积的增加，而实质上是黑洞合并后，是其内部密度 ρ_b 成反比的降低。

假设 M_{b2} 黑洞吞噬其外界能量-物质而增大到黑洞 M_{b1} ，而且 $M_{b1} = 2M_{b2}$ ，再由(7b)式，可见其熵 $S_{b1} = 4S_{b2}$ ， $I_{m1} = 4I_{m2}$ ，而 $\rho_{b2} = 4\rho_{b1}$ 。这就是黑洞因吞噬外界质能长大后，在理想过程中熵和信息量大大增加的情况表现为黑洞密度相应的降低。

7—2*；如果黑洞 M_b 在吞噬完外界能量-物质后，只能发射霍金辐射而不停地收缩，使 M_b 减小而密度 ρ_b 增加。^{[4]2*}。黑洞熵与其理想状态

由【前言】中可知，任何黑洞 M_b 在吞食完所有外界能量-物质后，就只能向外不停地发射霍金辐射 m_{ss} ，不停地减小 M_b 、 R_b 和增大 ρ_b 、 m_{ss} 直到最终收缩成为 $M_b = m_{ss} = m_p = 10^{-5}g$ ，而最后消亡在普朗克领域。^{[2][4]}

现在的问题是当黑洞 M_b 不停地因发射 m_{ss} 而收缩时，由于其密度的快速增大，会发生什么情况呢？请看下面(7c)式。按照霍金的恒星塌缩成黑洞的熵公式，任何一个恒星在塌缩过程中，熵总是增加的。假设 S_{bc} —恒星塌缩前的熵， S_{af} —塌缩后的熵， M_0 —太阳质量= $2 \times 10^{33}g$ 。

$$S_{af}/S_{bc} \approx 10^{18} M_b / M_0^{[2]} \quad (7c) \quad (6c) \quad (7a) \quad (7a)$$

7-2*。按照霍金的黑洞理论和熵公式，任何一个恒星在塌缩过程中，熵总是增加而信息量总是减少的。假设 S_b —恒星塌缩前的熵， S_a —塌缩后的熵， M_0 —太阳质量= $2 \times 10^{33}g$ 。

$$S_a/S_b = 10^{18} M_b / M_0^{[2]} \quad (7a) \quad (8a)$$

Jacob Bekenstein 只简单地指出，在理想条件下， $S_{af} = S_{bc}$ ，就是说，会出现熵在恒星塌缩的前后不变。

这样，就从(7c)式得出一个小黑洞 $M_{bo} = 10^{15}g$ 。这个黑洞被称之为宇宙的原初小黑洞 = M_{bo} ^[2] 按照【前言】中的公式，可计算出其几个参数是：其密度 $\rho_{bo} = 0.7 \times 10^{53}g/cm^3$ ；视界半径 $R_{bo} = 1.5 \times 10^{-13}cm$ ； $m_{sso} \approx 10^{-25}g \approx 6p_m$ —质子质量；

作者认为，应理解恒星在塌缩前后过程中(7c)式的重要的物理含义。

A；(7c) 表明我们宇宙中的物质粒子团只有在密度 $< 10^{53}g/cm^3$ 的收缩和膨胀过程中才都是不等熵的非理想过程。这表示质子(或超子)作为粒子在此过程中能够保持质子的结构没有被破坏或分解，所以质子才有热运动、摩擦和熵的改变，辐射能的粒子或波之间也有交互作用。在现实的宇宙中，最高密度的物质实体是中子星和约 $3M_0$ 个太阳质量小黑洞的密度 $\approx 10^{16}g/cm^3$ 。可见，在现实宇宙中，所有过程都是非理想过程，因为 $10^{16}g/cm^3 \ll 10^{53}g/cm^3$ 。

B；宇宙中出现的理想过程：既然小黑洞 M_{bo} 的密度到最后的最小黑洞 M_{bm} 密度的改变过程中，不管是膨胀还是收缩，熵是不会改变，说明它就是理想过程。因此，质子在此过程中必须解体而不能再作为粒子，只能分解成为夸克。所以夸克就应该是没有热运动和摩擦可在密度 $10^{53}g/cm^3 \sim 10^{93}g/cm^3$ 之间作理想过程的转变的，因此就不会因为收缩或者膨胀产生额外的热量使熵产生不必要的（非理想的）额外的增加量。

宇宙中另外一个理想过程可能出现在某些原子或分子在极低的温度下达到超导状态。这是人为的过程。

【8】。对黑洞发射霍金辐射与熵 S_b 和信息量 I_m 之间关系的一些看法和疑问。

8—1*。从(3g)式 $S_b = \pi n_i = \pi I_m / I_0 = \pi I_m / H = \pi M_b / m_{ss}$ 证明了，信息就是熵。Bekenstein-Hawking 所定义的黑洞熵公式(1b)与作者由黑洞发射霍金辐射所拥有的熵 S_b 和信息量 I_m 的(3g)式是从不同的观点出发，将二者完全天衣无缝地统一在黑洞理论中了。(3g)式可写为 $S_b/\pi = n_i = I_m/I_0 = I_m/H = M_b/m_{ss}$ ， S_b/π 和 I_m/H 可以说类似于(6ca)和 (6cb)式，而 M_b/m_{ss} 类似于 2 式中事件或状态的总数 N ，黑洞发射霍金辐射就像上帝在抛掷铜币或骰子似的。这有助于人们对辐射能（量子）的熵和信息量的理解。

对于小黑洞 $M_{bo} = 10^{15}g$ ，其 $M_{bo}/m_{sso} = 10^{15}/10^{-25} = 10^{40}$ ，

这就是狄拉克大数，类似于该黑洞的状态总数 N 。就是说，该黑洞内有约 10^{40} 个质量的质子，或有许多相当于质子质量的辐射能粒子。

当该黑洞继续发射霍金辐射而收缩时，黑洞的密度会增大到 $> \rho_{b0} = 0.7 \times 10^{53} \text{g/cm}^3$ ，于是质子会分解为夸克，成为熵减少的理想过程的收缩，熵由于没有质子之间的摩擦而产生附加的额外增加而有所减少。

8—2*。现在，我们的宇宙 M_u 在其视界半径 R_u 外尚有能量-物质可被吞噬，因此宇宙的 R_u 仍在照常膨胀， M_u 仍在增加，哈勃常数的正常存在就是明证。^[4] 这是一个非理想过程。因为我们宇宙处在膨胀状态，温度密度都在降低。从 (7b) 可见，宇宙的熵和信息量就会一直在增加，所以宇宙熵的增加反映了宇宙的膨胀和时间的方向，也是宇宙膨胀到结果。

如果上述小黑洞 M_{b0} 附近外有大量能量-物质被吞噬进黑洞内，其质量增大为 $3M_0 = 6 \times 10^{33} \text{g}$ ，其霍金辐射 $m_{ss} \approx 10^{-44} \text{g}$ ， $3M_0/m_{ss} \approx 10^{77}$ 个，而该黑洞内可能存在许许多多的大于 m_{ss} 的粒子或能量，如是，该黑洞内部实际的熵总量可能比黑洞所要发射出去的熵总量要少得多。

结论：黑洞 M_b 的 S_b 和 I_m 是代表黑洞将会发射出去的熵总量，而不是该黑洞内部实际存在的熵总量。

8—3*。我们宇宙最后总会有因外界无能量-物质而停止膨胀的一天（至于我们宇宙之外的外宇宙，我们是不得而知的）。那时我们宇宙黑洞会开始向外发射霍金辐射。如果将所发射出去的霍金辐射也算在我们宇宙系统里，宇宙的总熵还是增加的。如果发出的霍金辐射不算在我们残存的宇宙系统里，我们宇宙的熵应该是因收缩导致温度密度增加而逐渐地减少。经过极其漫长的时间发射霍金辐射后，宇宙最终会收缩成为普朗克粒子 m_p 而消亡在普朗克领域，^[4] 宇宙经过一个轮回后，就变成全是大小不同的霍金辐射的极其广大寂静的能量场。

8—4*。在我们宇宙黑洞从诞生到现在的膨胀演变过程中，只有在其能量-物质的密度 $\rho_{bu} < \rho_{b0} = 0.7 \times 10^{53} \text{g/cm}^3$ 时、出现稳定的物质粒子--质子时，宇宙才进入非理想的不可逆过程中，熵的额外的增加表示粒子无序性的增加，即热力学熵的增加。这在粒子团的收缩和膨胀运动中很容易理解。但是对黑洞的发射出去在黑洞外的霍金辐射（辐射能）团的降温和升温的非理想过程中，熵的额外的增加是表示辐射波的什么样的互相影响和作用呢？互相缠绕、撞击、交叉、改变路径？信息量的耗损和熵的关系如何表现，过程是如何进行的？黑洞的熵和信息量之间究竟是什么关系，如何互相作用？它们是一种永远不变的等比关系吗？黑洞之外的一般的宇宙空间，熵和辐射能又是什么样的关系呢？

么关系，如何互相作用？它们是一种永远不变的等比关系吗？黑洞之外的一般的宇宙空间，熵和辐射能又是什么样的关系呢？

8—5*。仅从 (6b) 式来看，黑洞和宇宙所发射出去的霍金辐射 m_{ss} 完全是辐射能，人们尚不知道那些有序地辐射能是如何变为无序的辐射能而使熵和信息量增加的。作者认为，这还可能与如何定义黑洞的总能量-质量 M_b 也有一些关系，因为现在人们对黑洞的总能量-质量 M_b 的定义只包含引力能和辐射能，但是对物质粒子拥有的热能动能似乎无法计算到辐射能中去。

8—6* (3g) 式 $S_b = \pi I_m / I_0$ 只是因黑洞发射霍金辐射对熵和信息量及其关系的量化，也只能通过黑洞在其视界半径上发射霍金辐射的理想过程而表现和计算出来。但是 A；至于黑洞内和发送到黑洞外的霍金辐射的熵是多少、它们在非理想过程的熵增加是无法反映出来的。虽然如此，它们既不会影响也不能阻止黑洞发射霍金辐射的量以及其带走的熵和信息量。B；在所有其它的非黑洞的辐射能互相作用过程中， $S_b = \pi I_m / I_0$ 公式还有效吗？

8—7*。前面所有章节和公式假定黑洞 M_b 发射霍金辐射 m_{ss} 都是理想过程，能量的转换完全服从于公式 (2)，这是简化了的分析和论证。然而在实际的发射过程中，真是理想过程吗？就是说，每个 m_{ss} 在通过视界半径 R_b 被发射到外界后，其能量是否有所损耗，比如说，其温度有所降低和波长有所增长呢？现在宇宙中实际存在的最小黑洞是 $3M_0$ 恒星级黑洞，其 m_{ss} 的波长是 $\lambda_{ss} \approx 10^6 \text{cm}$ ，是引力波， m_{ss} 的相当质量比质子要小约 10^{20} 倍，今后短时期内尚无法有新观测仪器能够测量到其 λ_{ss} 。就是说，即使霍金辐射能有损耗使熵有所增加，现代技术也测量不出来。

8—8*。大量的辐射能团的波或粒子之间，由于有不同的温度波长和方向，他们的碰撞和交互作用肯定是熵增加的非理想过程，目前无论从宏观和微观上对其熵的增加都很难量化，因为对其间交互作用的机理还所知甚少。

8—9*。虽然本文中从黑洞发射霍金辐射而对熵和信息量做了许多论证和计算，也不一定能够增加人们对熵的理解。总之，现代科学对熵的性质和作用的了解仍然是很不够的，特别是熵、信息量、辐射能、物质粒子 4 者之间在非理想过程中的关系了解的很不够。

====全文完====

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The Status of the Rights of Accused under Different Indian Laws

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Abstract: An accused is a person against whom an accusation has been made for alleged commission of crime or for his alleged involvement in the commission of crime, which invites Punishment under penal laws of the country the accused also have got certain rights privileges and protections, which are laid down in criminal procedure code, 1973, Indian Evidence Act, 1872, and in the constitution of India 1950. A person accused of an offence is put under the peril of his life and liberty. Therefore it becomes necessary that certain safeguards should be provided to him. These protections are almost common to all civilized legal system of the world including that of India. Many procedural rights and privileges are laid down under the Indian evidence 1872, criminal procedure code, 1973, which are available to the accused. Some of them have been guaranteed and made available by The Indian Constitution too. These rights have been inherited in India from common law. Basically It is seen in every morning through the newspaper that in police custody. There is a violation of the rights of accused by the Police personals although there are various provisions in different laws (i.e. The criminal procedure Code 1973, The Indian Evidence Act 1872, etc) But still there is violation of their rights. The judiciary has given the guidelines in regard to the accused that how they will be treated but it is seen in day to day life that how the accused are treated for example we can see the recent incident of Ch. Charan Singh District Jail Meerut that how the police behaved with inmate prisoners. Cognizable offence without going to magistrate, so Court should be vigilant to see that these powers are not abused for lightly used for personal benefits. No arrest can be made on mere suspicion or information. Even private person cannot follow and arrest a person on the statement of another person, however impeachable it is. Though the Code of Criminal procedure, 1973 is mainly procedural, yet it deals with three distinct but closely related subjects, the Constitution and powers of Courts, the conduct of criminal proceedings and the prevention of crimes by interference beforehand.

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Key Words: Penal laws, Offence, Accused, Court, Constitution of India, Human Right

1. Introduction:

It is evident on record (i.e in Veda, Upanishad, Shrutis etc) that the concept of equal rights of men and women, impartial treatment of Human being in society and humanitarian consideration of accused etc. were age old concepts in India which are prevailing since "vedic age" the developments of human rights starting from Magna Carta- 1215 AD to universal declaration of Human Rights 1948 have further enriched the concept. "Today in India Human Rights Like fundamental Rights are paramount sacrosanct, eternal and transcendental in nature and ought to be treated as inalienable and inviolable for preserving. The dignity of the people. In India courts are regarded as custodian of Human Rights and Common men always looks upon the trial court as his protector.¹

In the modern times, every matured legal system of the world accords certain basic protections to accused person- who may be deprived of their personal liberty by way of legal confinement for the commission of an offence and a right to be presumed innocent is a cardinal principle of human rights jurisprudence. Every person who is alleged formally to commit an offence-commonly known as 'accused' has a 'right to be presumed innocent' until the charges leveled against him are finally proved and he is convicted by a competent court in accordance with the prescribed procedure of law. This right arises as soon as the formal accusation is levied upon an accused and continues throughout the continuance of the criminal proceeding until the court declares him

¹ Tripathy Dr. Prabateh, "Realistic approach to Human Rights with Special Reference to Rights of

Accused v. Victim – An Analysis". 2003 Cri L.J. Journal/s III

to be guilty and punishes him.² The duty of the police when they arrest without warrant is, no doubt, to be quick to see the possibility of crime, but equally they ought to be anxious to avoid mistaking the innocent for the guilty.

2. Rights of the Accused Under Different Laws in India

In this chapter we are concerned with those provisions of the Code which entitle an accused of certain rights during the course of any investigation, enquiry or trial of an offence with which he is charged. For convenience we have categorised those rights under certain heads, which are as under:

(i) Protection against arbitrary or illegal arrest: The provisions in this regard are discussed as follows:

(a) When police may arrest without warrant: Under section 41 very wide powers are conferred on the police in order that they may act swiftly for the prevention or detection of cognizable offences without the formality and delay of having to go to a Magistrate for order of arrest. Courts should, therefore, be particularly vigilant to see that the powers are not in any way abused or lightly used for the satisfaction of private feelings or of designing complainants. Therefore, the arrest and detention of persons without warrant are not matters of caprice but are governed by rules and principles clearly laid down by law.³ To arrest persons without justification is one of the most serious encroachments upon the liberty of a subject.⁴ Where there is no danger of the person who has *ex-hypothesis* aroused their suspicion, that he probably is an "offender" attempting to escape. They should make all presently possible enquiries from persons present or immediately accessible who are likely to be able to answer their enquiries forthwith. The police should act on the assumption that their *prima facie* suspicion may be ill founded.⁵ When a constable has taken into custody a person reasonably suspected of committing a crime, it is his duty to act reasonably. Whether he acted reasonably is a question to be decided

judiciously.⁶ There can be no legal arrest if there is no information or reasonable suspicion that the person had been involved in a cognizable offence.⁷ No definition is possible of what is reasonable complaint or reasonable suspicion as it depends so much on the special fact of each case,⁸ but it must at least be founded on some definite facts tending to throw suspicion on the person arrested and not on mere vague surmise or information. Still less have the police any power to arrest persons, as they sometimes appear to do merely on the chance of something being hereafter proved against them.⁹ This case has been approved in several decisions.¹⁰ Reasonable means a *bona fide* belief that an offence had been committed or is about to be committed.¹¹ Mere suspicion is not enough.¹² The burden is on the police officer to satisfy the court before which the arrest is challenged that he had reasonable grounds of suspicion.¹³

(b) Arrest on refusal to give name and residence: Under section 42, arrest of a person - (1) who commits a non cognizable offence in the presence of a police officer, or (2) is accused before him of having committed such an offence is permissible only, if he refuses to give name and address¹⁴ and as soon as they are ascertained he is to be released on execution of a bond for appearance. If name and residence cannot be ascertained he must not be kept under arrest beyond 24 hours, but should be taken to a Magistrate. If his name and address were previously known to the police officer, he cannot be arrested or detained.¹⁵

(c) Arrest by private person and procedure on such arrest: Section 43 is based on the principle that every citizen has the duty 'to help, keep the peace and so has the right to make over or cause to be made over to the authorities any offender who breaks the law. It empowers a private person to arrest or cause

² Jaiswal Dr. Jaishree "Presumption of Innocence- A cardinal principle of human right law of an accused, 'Indian Bar Review, Volume XXXVi. (1 to 4) 2009. P.15.

³ Avinash Madhukar Mukhedkar v. State of Maharashtra, 1983 Cr. L.J. 1833 (Bom)

⁴ Rampriti, AIR 1926 Punj 560.

⁵ Dumbnell v. Roberts, 1944 (1) All ER 326 CA.

⁶ Dallison v. Caffery, 1964(2) All ER 610.

⁷ Raju Mia, 44 CWN 502.

⁸ Behary, 71 WR Cr 3.

⁹ Markby. J in Behary, 71 WR Cr.3.

¹⁰ Charu Ch, 20 CWN 1233; Bhawoo, 12 B 377(388); Saindino, A 1934 S 197; Tribhuwan, AIR 1949 Ori 74; Roshan, AIR 1950 MB 83.

¹¹ Muhammed, AIR 1943 Mad 218.

¹² State v. Maheshwar, AIR 1955 NUC (Or) 439.

¹³ Emperor v. Vimlabai Deshpande, AIR 1946 PC 123; 73 Ind App 144: Cr LJ 831 (Shearer v. Shields, 1914 AC 808 (Scot) (relied on).

¹⁴ Goalab, 5 Bom LR 597.

¹⁵ Gopal (1922) 46 Mad 605 (FB).

to be arrested - (1) a proclaimed offender, or (2) any person who in his presence commits a non bailable and cognizable offence, but not after the completion of such offence. After the offence has already been committed, it is a matter for the police and a private person should then inform them. After arrest, he must without unnecessary delay either take the person or cause him to be taken to the nearest police station. Akin to the right in section 43 is the right of private defence (sections 96 & 97, IPC which every citizen has of protecting the body or property of himself or any other person extending to causing death for saving life or property in proper cases.

The rule of English Common law that a private person may arrest any person reasonably apprehended to commit a breach of the peace does not apply in this country. Sections 96, 97, 102 and 105 of IPC define the limits within which restraint can be placed on another citizen.¹⁶

No arrest can be made on mere suspicion or information.³ Private citizen cannot follow and arrest a person on the statement of another person, however unimpeachable, that the former committed a non-bailable and cognizable offence.¹⁷

(d) Arrest how made: Section 46 envisages three modes of arrest (a) submission to custody, (b) touching the body physically, or (c) confining the body. Arrest is restraint on personal liberty. Unless there is submission to custody, by words or by conduct, arrest must be made by actual contact.¹⁸ Under this provision in making an arrest the police officer or other person making the same shall actually touch or confine the body of the person to be arrested, unless there be a submission to the custody by word or action.¹⁹ If such person forcibly resists the endeavour to arrest him, or attempt to evade the arrest, such police officer or other person may use all means necessary to effect the arrest.²⁰ But if force is required, no force should be employed in effecting arrest than is justly necessary. Whether violence is justifiable depends on whether the means employed were such as an ordinarily prudent man could make use of, who had no intention of doing any serious injury.²¹ All means necessarily includes help from other persons and it also applies to arrest by private

citizens²². However, this section does not give a right to cause the death of a person, who is not accused of an offence punishable with death or with imprisonment for life.²³ Accordingly, police officer in attempting to re-arrest escaped thief has no right to shoot.²⁴

(e) Search of place entered by person sought to be arrested: Section 47 provides that if any person acting under a warrant of arrest, or any police officer having authority to arrest, has reason to believe that the person to be arrested has entered into, or is within, any place, any person residing in, or being in charge of, such place shall, on demand of such person acting as aforesaid or such police officer, allow him free ingress thereto, and afford all reasonable facilities for a search therein.²⁵ The provision is not intended to restrict the powers of police to enter the place to be searched, on the contrary it is a provision for compelling house holders to; afford the police facilities in carrying out their duties. It further provides that if difficulties are placed, force may be used to obtain ingress.²⁶ The force means in order to effect entrance into such place the police officer may break open any outer or inner door or window of any house or place, whether that of the person to be arrested or of any other person, if after notification of his authority and purpose, and demand of admittance duly made, he cannot otherwise obtain admittance.²⁷ But if such place is an apartment in the actual occupancy of a *female* (not being the persons to be arrested) who, according to custom, does not appear in public, such person or police officer shall, before entering such apartment, give notice to such *female* that she is at liberty to withdraw, and shall afford her every reasonable facility for withdrawing, and may then break open the apartment and enter it.²⁸ Therefore, entry of police into *Muth* for arrest and search by breaking open back-doors though the main gate remained open and without demanding the head of *Muth* to allow them to enter, is illegal.²⁹

¹⁶ *Gokul*, 26 Cr LJ 1462.

¹⁷ *Kartar*, AIR 1956 Punj 122.

¹⁸ *Thaneil Victor v. State*, 1991 Cr LJ 2416 (Mad).

¹⁹ Section 46(1).

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²¹ *Protab*, 1 WR 9.

²² *Sheo Balak Dusadh v. Emperor*, AIR 1948 All 103; *Nazir*, AIR 1951 All 3 FB; *Kalavennu.*, AIR 1956 AP 156; *Gouri*, 56 C615: AIR 1925 Lah 684.

²³ Section 46(3)

²⁴ *Dakti*, AIR 1955 All 379.

²⁵ Section 47(1)

²⁶ *Ramesh*, 41 C 350 (376).

²⁷ Section 46(2).

²⁸ Proviso to section 46(2).

²⁹ *Pagla Babu v. State*, AIR 1957 Ori 130.

(f) No unnecessary restraint: According to section 49, there should be no more restraint than is justly necessary to prevent escape, *i.e.*, reasonable force may be used for the purpose, if necessary; but before keeping a person under any form of restraint there must be an arrest. Restraint or detention without arrest is illegal.

(g) Person arrested to be informed of grounds of arrest and of the right to bail: Section 50 provides that any person arrested without warrant shall immediately be informed of the grounds of his arrest, and if the arrest is made in a bailable case the person shall be informed of his right to be released on bail. A similar provision in case of arrest with warrant is provided in section 75. Arrest without compliance of this provision will be illegal and will make the officer or person making such illegal arrest liable to all such remedies as are available in case of an illegal arrest. Section 50 is mandatory. If particulars of offence are not communicated to an arrested person, his arrest and detention are illegal. If he alleges by affidavit that he was not communicated with full particulars of the offence, the police officer's diary can be perused to verify his claim of oral communication of such particulars.³⁰ When the provisions of section 50 have not been complied with, the non-consideration of such non-conformance by the court when considering the question of bail operates to the prejudice of the arrested person and the order is liable to be set aside on this ground.³¹ This provision carries out the mandate of Article 22(1) of the Constitution of India.³² The grounds can be communicated even impliedly by conduct.³³

(h) Search of arrested person: Section 51 is the only provision which allows a police officer to make a personal search of arrested persons, but it comes into operation after arrest (with or without warrant) and not before. No search witness is legally necessary. If there is any and such witness is found unreliable, the evidence of the police officer can be looked to. Search by the police of the person of the accused does not contravene Article 20(3) of Constitution. Search should be made in the presence of respectable and independent witnesses. But this provision under section 51, as has been held, does not permit medical examination of the accused without

his consent. Forcible examination of the body of an arrested person without his consent, through a doctor for procuring evidence against him is not permissible and amounts to assault. Examination of accused by doctor not for benefit of health but by way of second search is not permitted in law without his consent.³⁴ The consent need not be in writing. It has, however, been held that an accused person can be taken to a doctor for the examination of injuries on his body to ascertain whether he could not have participated in an occurrence.) So, if an arrested person under intoxication is taken to a doctor who records his physical features and other symptoms, it is not hit by Article 20(3) of the Constitution of India.³⁵ On the other hand, it has been held in yet another case that the police have no legal right to take an accused by force to a doctor to examine whether he was intoxicated and he cannot be convicted under section 353, IPC for assault and escape as he had the right of private defence. Examination of the body of the accused often reveals valuable evidence. It may however, be noticed that, therefore, the lacuna in the matter has now been removed by insertion of new provision in a separate sections specifically authorising medical examination of an accused person.

With regard to provision of this section the reference may be made to Article 20(3) of the Constitution of India which is a guarantee to the accused against testimonial compulsion. But any incriminating object *e.g.*, a stolen article or document or other form of evidence can be seized from the person of the accused, or if he happens to swallow a stolen property he can be taken to a doctor with a view to have X-rayed or the article extracted. Similarly, a police officer may seize a blood stained cloth worn by a person charged with murder. Incriminating documents, things, etc., which are in the possession of the accused may also be seized by issue of a search warrant, though the court cannot direct him to produce them.³⁶ The principle appears to be that though an accused cannot be compelled to produce any evidence against himself, it can be seized under process of law from the custody or person of the accused by the issue of a search warrant. The constitutional protection in Article 20(3) prohibits compulsion or force. In obtaining oral or written

³⁰ Ajit Kumar Sarmah v. State of Assam, 1976 Cr LJ 1303 (Gau).

³¹ Govind,a Pd. 79 CWN 474.

³² Govind Prasad v. State of West Bengal, 1975 Cr LJ 1249 (Cal).

³³ Pranab Chatterjee v. State of Bihar, (1970) 3 SCC 926: 1971 SCC (Cri) 17: 1971 CAR 114.

³⁴ *Bhandar*, 35 CWN1212: AIR 1931 Cal 601.

³⁵ Palani Goundan, AIR 1957 Mad. 546.

³⁶ Sharma M.P. v. Satish Chandra AIR 1954 SC 300.

testimony. An accused has the right to decline to produce any such incriminatory document. Relying on *Sharma's* case it was held in many cases¹ that the issue of a compulsory process for the production of any document which is reasonably likely to support the prosecution case infringed Article 20(3). But these observations in *Sharma's* case were declared subsequently by the Supreme Court as obiter³⁷ and consequently now law on the subject is as under:

1. An accused person cannot be said to have been compelled to be a witness against himself simply because he made a statement while in police custody without anything more. In other words, the mere fact of being in police custody at the time when the statement in question was made would not, by itself, as a proposition of law, lend itself to the inference that the accused was compelled to make the statement, though that fact, in conjunction with other circumstances disclosed in evidence in a particular case, would be a relevant consideration in an enquiry whether or not the accused person had been compelled to make the impugned statement.
2. The mere questioning of an accused by a police officer, resulting in a voluntary statement which may ultimately turn out to be incriminatory, is not "compulsion".
3. Giving thumb impression or impression of foot or palm or finger or specimen writing or showing parts of the body by way of identification is not included in the expression "to be a witness" in Article 20(3).
4. To be a witness" in the ordinary grammatical sense means giving oral testimony. Case law has gone beyond this strict literal interpretation which bears a wider meaning, namely, bearing testimony in court or out of court by a person accused of an offence orally or in writing. To be a witness" in this sense may be equivalent to "furnishing evidence" (as held in *Sharma's* case) but not in the larger sense so far as to include giving finger impression etc.
5. "To be a witness" means imparting personal knowledge of relevant facts by oral evidence or statement writing but process for production of other evidence whether documentary or material (nor imparting personal knowledge of facts) in

the possession of the accused does not come within the prohibition of Article 20(3).

In view of the decision of the Supreme Court in *Kilthikalu* which has the effect of confining the privilege under Article 20(3) to testimony, oral or written, that privilege has also the least chance of attaching to non-testimonial physical evidence provided for in section 53 as stated above.

3. Right to Know the Ground of Arrest

In every case of arrest with or without a warrant the person arresting shall communicate to the arrested person without delay the grounds of his arrest and if the arrest is made in bailable offence, the person shall be informed of his right to be released on bail. It is mandatory.

Arrest without compliance of this provision will be. If particulars of offence are not communicated to an arrested person. Then his arrest and definition are illegal. Once this duty is cast on the arresting officer, he must make proper record of what he does in pursuance of the requirement of law.³⁸ Every police officer arresting without a warrant any person other than a person accused of a non-bailable offence is required to inform the person arrested that he is entitled to be released" on bail, and that he may arrange for sureties on his behalf (Section 50(2) Cr. P.C). Timely information of the grounds of arrest serves the arrested person in many ways. It also enables him to apply for bail, or to make other expeditious arrangements for his defence Section 50(1) carries out the mandate of Article 22(1) of constitution Section 55 of Cr. P.C., underlines the procedure when police officer deposes subordinate arrest without warrant. A verbal order is sufficient if arrest is to be made in the presence of the police officer giving the order, otherwise a written order from him is essential for legal arrest. Arrest without written order is illegal.

3.1. Right of being produced before a magistrate:

That is a police officer making an arrest without warrant shall without unnecessary delay and subject to the provisions herein contained as to bail, take or send the person arrested before a magistrate' or court having jurisdiction in the case.

In case of every arrest, the person making the arrest is require to produce the arrested person before the magistrate within 24 hours, exclusive of the time necessary for the journey from the place of arrest to

³⁷ Mohammad Dastgir v. State of madras AIR 1960 SC 756.

³⁸ Vikram v. State 1996. Cr.L.J. 1249 Calcutta.

the magistrate's court. (Section 57 of Cr.P.C.). It is constitutional and legal requirement and must be strictly observed, (*Khatris case*)³⁹

Detention in custody cannot exceed 24 hours. Journey time to Magistrate's court may be excluded but the period must be reasonable (Sec. 76 of Cr. PC.). Though a limit of 24 hours is allowed, there is no absolute right to keep in custody till that period and in no case, can a police officer detail for a minute Longer if he can send the accused to a magistrate at once, except upon some reasonable ground. The practice is well settled that even on holidays an arrested person is to be produced before the magistrate (Section 167 Cr. PC.) allows it only in special cases mentioned therein i.e. when investigation cannot be completed within 24 hours and it should be for reasons to be stated in writing and not as a matter of course, whenever the police ask for it. The right his also been incorporated in the constitution under Article 22(2). This right has been created with a view to prevent arrest and detention for the purpose of extracting confession or as a means of compelling people to give information and to prevent police stations being used as though, they were) prisons a purpose for which they are unsuitable and not meant.⁴⁰

3.2. Right to be examined by medical practitioner:

Section 54 of Cr.P.C. Lays down for examination of arrested person by medical practitioner at the request of the arrested person. The accused must be informed of his right. (*Sheela Barse v. State of Maharashtra*).⁴¹ If any arrested person alleges at the time, when he is produced before a magistrate or at any time during the period of his detention in custody, that the examination of his body will afford evidence, which will disprove the commission by him of any offence or which will establish the commission by any other person of any offence against his body, then the magistrate on the request of the arrested person, is required to direct the examination of his body by a registerd medical practitioner. However, the magistrate need not give such a direction if he considers that the request for

examination has been made by the arrested person for the purpose of vexation or delay for defeating the ends of justice.

It also enables the person concerned to establish that the offence charged was not committed by him (for example in rape cases) or that he had been subjected to physical injury while in custody.

3.3. Right to Consult Counsel:

Any person accused of an offence before a criminal court or against whom proceedings are instituted under code of criminal procedure, may of right be defended by the lawyer of his choice. The right begins from the moment of arrest. The consultation with the lawyer may be in the presence of the police officer but not within his hearing. The right to consult and to the defended by a legal practitioner of accused's choice is now Recognized in Article 22(1) of Constitution.

Section 304 of Cr. PC. 1973, provides for legal aid to the accused at state expense in certain cases, when he is unable to hire 'a lawyer to defend him. The right to free legal service is reasonable, fair just and implicit In Article 21 of Constitution (*Maneka Gandhiv. Union of India*) In *Janardan Reddy v. State of Hyderabad*,⁴² "the Supreme Court observed that a court of appeal or revision is not powerless to interfere, if it is found that the accused was so handicapped for want of legal aid that the proceedings against him may be said to amount negation of a fair trial. Therefore Criminal Procedure code has also made a provision to provide a lawyer to the indigent accused person in a trial before a court of session.

In *Hussainara Khatoon v.State of Bihar*.⁴³ The Supreme Court after referring the constitutional directive contained in Article 39(A) regarding equal justice and free legal aid has explicitly observed that the right to free legal service is clearly an essential ingredient of reasonable, just and fair procedure for a person accused of an offence and it must be held implicit in the guarantee of Article 21. This is a constitutional right of every accused person who is unable to engage a lawyer and secure legal services on account of reasons such as poverty, indigence or in communication situation and the state is under a mandate to provide a lawyer free of cost to him.

³⁹ AIR 1981 Cr. L.J. 470. SC

⁴⁰ Varshney Anup. 'Rights of Accused' The Indian Journal of Criminology and Criminalistics, Volume XXVIII, Issue No. 3 Sept. to Dec. 2007. p34.

⁴¹ 1975 Cr.L.J. 1249 Calcutta.

⁴² AIR 1951.SC 217.

⁴³ (1980)1. SCC 98.

4. Statements to police not to be signed - use of statements in evidence:

The words of Section 162 Cr. P.C. are wide enough to include a confession made to a police officer in the course of an investigation. The statements if reduced in writing then it shall not be signed by the maker of the statement. The prohibition extends to all statements (confessional or otherwise) during a police investigation made by any person whether accused or not (in police custody or not), whether reduced to writing or not, subject to the proviso. In view of the ban in the section, no witness can be asked, what he said to the police during the investigation, nor may a police officer be asked what a witness said to him, no may any be stander be questioned as to what he heard another person say to the police during the investigation. Statements of accused before the police cannot be used as substantive evidence.

Section 162 Cr. P.C. imposes a complete ban on the use of statements recorded by the police officer under section 161 of Cr. P.C. for the purpose of corroboration or as substantive evidence. Such a statement can be used by the accused and with the permission of the court by the prosecution only for the purpose of contradicting the witnesses who has made such a statement in the manner provided by section 145 of Indian Evidence Act. 1872.⁴⁴

Section 162 does not refer to every statement recorded by the police but only to statement in the course of an investigation under chapter 12 into cognizable and non-cognizable offences, The ban does not apply to any statement to the police before starting investigation.

4.1. Examination of Accused by Medical Practitioner at the Request of Police Officer

Examination of accused by medical practitioner at the request of police officer: Section 53 authorises an examination of the arrested person by a registered medical practitioner at the request of a police officer, if from the nature of the alleged offence or from the circumstances under which it was alleged to have been committed, there is reasonable ground for believing that such an examination will afford evidence. A specific legal provision in this regard has been considered necessary because under the existing general provision relating to the search of an arrested person⁴⁵ forcible medical examination of the body of

an accused cannot be held without his consent.⁴⁶ Such a provision would not offend Article 20(3) of the Constitution.⁴⁷ Without a statutory provision compulsory medical examination of the accused would have been illegal.⁴⁸

An examination of the body would reveal valuable evidence and may take various shapes, e.g. (a) examination of the body for ascertaining the accused's part in a sexual offence, or for finding out the injuries received by him; (b) examination for identification mark; (c) examination of internal parts, taking of fluids (e.g. in intoxication case) and so on. The provision further provides that the person of a female is to be examined only by, or under the supervision of a female registered medical practitioner.⁴⁹

4.2. Examination of arrested person by medical practitioner at the request of the arrested person:

Section 54 provides that when a person who is arrested, whether on a charge or otherwise, alleges, at the time when he is produced before a Magistrate or at any time during the period of his detention in custody that the examination of his body will afford evidence which will disprove the commission by him of any offence or which will establish the commission by any other person of any offence against his body, the Magistrate shall, if requested by the arrested person so to do, direct the examination of the body of such person by a registered medical practitioner unless the Magistrate considers that the request is made for the purpose of vexation or delay or for defeating the ends of justice. The provision was not recommended by Law Commission, but was inserted on the recommendation of the Joint Committee Report,⁵⁰ which observed that such a provision is desirable, in order to enable the person concerned to establish that the offence charged was not committed by him or that he had been subjected

⁴⁴ Prakash Sen's case 1998. Cr. L. J. 1275 Calcutta.

⁴⁵ Under section 51.

⁴⁶ *Bhandar*, AIR 1931 Cal 601; *Hanuman*, 36 CWN 1152; AIR 1932 Cal 723; *Deoman*, AIR 1959 Bom. 284.

⁴⁷ *State of Bombay v. Kathi Kalu Oghad*, AIR 1961 SC 1808: (1962) 3 SCR 10: (1961) 2 Cr.LJ 856: (1963) 1 SCj 195: 1963 MLj (Cr) 97.

⁴⁸ Law Commission of India 37th Report, para 183 and 41st Ref. Vol. 1. para 5.

⁴⁹ Section 46(2)

⁵⁰ Report of the Joint Committee of the Parliament dated 4-12-1972, p.9.

to physical injury while in custody. The accused must be informed of his right under section 54.⁵¹

4.3. Procedure when police officer deposes subordinate to arrest without warrant:

Section 55 authorises an officer-in charge of a police station for making an investigation under Chapter XII to depute a subordinate officer to arrest without warrant any person by an order in writing. Any officer subordinate is not limited to police officer (as in sections 41, 42, 57 etc.), but may be any other subordinate officer, e.g., Chowkidar.⁵² The jurisdiction of the police officer under this section is not excluded by the Magistrate issuing a warrant. "

4.4. Police to report apprehensions:

The object of section 58 is that the Magistrate should be kept informed of all arrests without warrant by the police in order that he may see whether their powers were being exercised properly or abused, or to detect infractions of sections 56 and 57 and also to enable him to issue promptly such order as may be necessary in regard to the person arrested, as it is his duty to see that persons are not unnecessarily kept - in custody.

4.5. Arrest to prevent the commission of cognizable offences:

Under section 151 two prerequisites are necessary, (1) the police officer knew that the offender had a design to commit a cognizable offence, and (2) that the commission could not be otherwise prevented.⁵³ The officer must know that the person is designing to commit a cognizable offence. An apprehension that he may commit an offence is not sufficient.⁵⁴ If an arrest or attempt to arrest is made without any emergency contemplated by the section it is illegal and resistance or retaliation against use of criminal force is justified.³ There is no absolute *dictum* that under no circumstances can the High Court go into the question of proper exercise of

the discretion by a police officer in arresting under section 151.⁵⁵

4.6. Right to be Produced before Magistrate within 24 hours of Arrest:-

Two sections of the Code deal with this right of the accused, which are discussed as under:

(a) Person arrested to be taken before Magistrate or officer in-charge of police station: This right is contained in section 56 of the Code, according to which if the police does not think it fit to take bail, the arrested person has to be taken to the Magistrate having jurisdiction, i.e., jurisdiction to try the case.⁵⁶ Person arrested should not be kept in any other place but sent immediately to the Thana.⁵⁷ He can be discharged on personal bond or bail⁵⁸ or under a Magistrate's order under section 167.

Police officer, who finds that the order under section 55(1) is not valid, he can exercise his own powers independently under section 41(1). Under section 56, production must be before the Magistrate having jurisdiction.⁵⁹ Under Article 22(2) of the Constitution, production must be before the nearest Magistrate. It need not be interpreted to mean a Magistrate with judicial powers.⁶⁰ The construed appeal is that the arrested person' is to be produced before the nearest Magistrate having other power to deal with the case.

(b) Person arrested not to be detained more than twenty four hours: We have already discussed this provision, as contained in section 57, under "Protection against arbitrary arrest and right to know specific ground of arrest".

Right to consult and to be defended by a counsel of his choice and to get free legal aid in case of economically disabled accused: Apart from ensuring a fair prosecution, a society under the Rule of Law has also a duty to arrange for the defence of the accused, if he is too poor to do so. Free legal aid to persons of limited means is a service which the modern State, in particular a Welfare State, owes to

⁵¹ *Sheela Barse v. State of Maharashtra*, AIR 1983 SC 378; (1983) 2 SCC 96; (1983) 2 SCR 337; (1983) 1 SCALE 140; 1983 Cr LR (SC) 207; 1983 Cr LJ 642; 1983 SCC (Cri) 353; 1983(1) Crimes 602.

⁵² *Bahubal*, 10 CWN 287.

⁵³ *Md. Ali*, AIR 1965 All 161.

⁵⁴ *Balraj Madhok v. Union of India*, AIR 1967 Del 31; 1967 Cr LJ 865.

⁵⁵ *Yellappachari v. State of Mysore*, (1974) 1 Kant Lj 152; *Revamappa v. S.N. Raghunath*, 1983 Cr Lj 321 (Karn).

⁵⁶ *Gulam Mohammad Azimuddin v. State of Madhya Pradesh*, AIR 1959 MP 147; 1959 Cr LJ 600.

⁵⁷ *Behary*, 71 WR Cr 3.

⁵⁸ See Chapter 33 of Cr PC

⁵⁹ *Gulam Mohammad Azimuddin v. State of Madhya Pradesh*, AIR 1959 MP 147; 1959 Cr LJ 600.

⁶⁰ *Hariharnand*, AIR 1954 All 601.

its citizens⁶. The provisions to deal with this right under the Code are discussed as under:

(c) Right of person against whom proceedings are instituted to be defended: Section 303 recognises the right of any person brought before the criminal courts to answer any charge or accusation to be defended by a lawyer of his choice. A person against whom no process has been issued is neither an "accused" nor a "person against whom any proceedings have been instituted" and he has no right to be represented by a pleader during a preliminary enquiry under section 202.⁶¹ An application by the police for remand under section 167⁷ is a "proceeding" under the Code and the right to be represented begins at least from that moment after arrest.⁶² Recording of confession is a "proceeding" within section 303. It is absolutely essential for all Magistrates to explain to the accused, before proceeding to record confession, his fundamental right under Articles 22(1) and 20(3) and provisions of section 303 that he has a right to consult his lawyer.⁶³

The right to consult and to be defended by a legal practitioner of accused's choice is now recognized in Article 22(1) of Constitution. Arrest and trial in jail in hot haste on the next day without an opportunity to defend or inform⁹ the accused of their right under Article 22 of Constitution and section 303 is in a sense a denial of fundamental rights.⁶⁴

5. Legal aid to accused at State expense in certain cases:

Section 304 places on a statutory footing the right of the accused without sufficient means to engage a lawyer to be defended at the expense of the State in regard to Sessions trials with a provision also enabling the State Government to extend this right by notification to any class of trials before other court in the State. A representation by a lawyer at Government expense to an accused person has been provided for statutorily, appointment of such lawyer to defend such an accused and the facilities to be allowed to such lawyers by the courts and the fees payable to such lawyers by the Government have also been provided for statutorily under sub-section (2) making the same governable by rules under this sub-section(2) that are to be framed by the High Court

with the previous approval of the State Government.⁶⁵

6. Discussion:

The right of bail is one of the most important rights granted to the accused by the Code Section 436 says that it is the right of every accused arrested on a bailable offence to be released on bail. Section 50(2) specifies that where the person is arrested for a bailable offence, the police officer shall inform him of the right to be released on bail so that he can arrange for sureties. In *Hussainara Khatun v. Home Secretary, State of Bihar*, the Supreme Court held that pre trial release on personal bond should be allowed where the person to be released on bail is indigent, not having the adequate means to furnish a bond and there is no substantial risk of his absconding. Section 35 of the 2005 Amendment Act added an explanation to Section 436 which says that if an accused is unable to give bail within a period of one week, it shall raise a presumption that such person is indigent for the purpose of the section.

Even in non-bail able offences, the accused may be release on bail at the discretion of the Court if it is reasonably satisfied that such release will not endanger public peace. Moreover, certain special concessions has been made for women, children and the infirm with regard to their right of acquiring bail in non-bail able offences.

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⁶¹ Sheikh Chand, 8 Cr LJ 20.

⁶² Evans, 27 Cr LJ 1169.

⁶³ Kuthu Goala, 1981 Cr LJ 424 (Gau)

⁶⁴ *Hansraj*, 1956 AIR 641.

⁶⁵ Ashutosh Dr. 'Rights of Accused', Universal Law Publishing Company, New Delhi, 2009 edition, p 25.

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The changing role of the law in interdependent society

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Abstract: The changing role of law in interdependent society is a classic work on contemporary thought. This changing role of law has complex interaction with social change, its intervention into economics and the environment, it balance public power and private rights, its place in the growth of international order, its own changing role in the interdependent society from ancient to till date, with insight, imagination and an exciting breadth of scholarship. Today alternatives of economic competition, public regulation and public enterprise examines the changing role of law in the society. "The impact of law in changing surroundings on some areas, such as family law, the last decade has brought fundamental changes in many countries, with respect to matrimonial disputes divorce, abortion, the status of illegitimate children, property, and other matters due to the local panchayat and land laws of different countries. The important thing is that some time law play an important role to change the society and some time society has great impact to change the law.

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Key Words: Law, Social Change, Industrialisation, Economic Development, Sovereignty, Custom

1. Introduction:

From the very beginning of industrialization and urbanization in Europe, Bentham expected legal reforms to respond quickly to new social needs and to restructure society. He freely gave advice to the leaders of the French revolution, because *he believed that countries at a similar stage of economic development needed similar remedies for their common problems.* However, *Savigny believed that only fully developed popular customs could form the basis of legal change.* As customs grow out of the habits and beliefs of specific people, rather than expressing those of an abstract humanity, legal changes are codifications of customs, and they can only be national and never universal. There are two contrasting views on this relationship: Law is determined by the sense of justice and the moral sentiments of the population, and legislation can only achieve results by staying relatively close to the prevailing social norms. Law and especially legislation, is a vehicle through which a programmed social evolution can be brought about. In general, a highly urbanized and industrialized society like the US law does play a large part in social change, and vice versa, at least much more than is the case in traditional societies or in traditional sociological thinking. [eg. In the domain of intrafamily relations, urbanization, with its small apartments and crowded conditions, has lessened the desirability of three-generation families in a single household. This social change helped to establish social security laws that in turn helped generate changes in the labor force and in social institutions for the aged.]

2. The impact of Social changes on legal changes:

In a broad theoretical framework, social change has been slow enough to make custom the principal source of law. Law could respond to social change over decades or even centuries. Today the tempo of social change accelerated to a point where today's assumptions may not be valid even in a few years from now. The emergence of new risks to the individual as a result of the decrease of the various family functions, including the protective function, has led to the creation of legal innovations to protect the individuals in modern society. Eg provisions of workers compensation, unemployment insurance, old-age pensions. Many sociologists and legal scholars assert on the basis of a large amount of accumulated data that technology is one of the great moving forces for change in law in three ways: The computer and easy access to cyberspace, especially internet, also have inspired legislation on both the federal and the state levels to safeguard privacy, protects against abuse of credit information and computer crime.

3. The role of law in changing the social status:

The conversion of Rome from republic to empire could not have been accomplished except by means of explicit legal decree buttressed by the doctrine of imperial sovereignty. Law, far from being a reflection of social reality, is a powerful means of accomplishing reality – that is, of fashioning it or making it.

The Soviet Union succeeded in making enormous changes in society by the use of law.

In Spain law was used to reform agrarian labor and employment relations.

China also managed to moderate through law its population growth and as a result devote more of its resources to economic development and modernization.

Attempted social change, through law, is a basic trait of the modern world. Many authors consider law as a desirable necessary and highly efficient means of inducing change, preferable to other instruments of change. In present-day societies, the role of law in social change is of more than theoretical interest. In many areas of life such as education, race relations, housing, transportation, energy utilization, protection of the environment, and crime prevention, the law and litigation are important instruments of change. Law plays an important **indirect role** in social change by shaping various social institutions, which in turn have a **direct impact** on society. [eg. Mandatory school attendance upgraded the quality of the labor force, which in turn played a direct role in social change by contributing to an increased rate of industrialization. The law interacts in many cases directly with basic social institutions, constituting a direct relationship between law and social change]. Social change through litigation has always been an important feature in the US. Whether the change produced by such action is considered 'constructive' or 'destructive,' the fact remains that law can be a highly effective device for producing social change.

4. The effectiveness of Law as an Instrument of Social Change:

Law must emanate from an authoritative and prestigious source. As an instrument of social change, law entails two interrelated processes: the institutionalization and the internalization of patterns of behavior.

Institutionalization of a pattern of behavior refers to the establishment of a norm with provisions for its enforcement.

Internalization of a pattern of behavior means the incorporation of the value or values implicit in a law (eg. Integrated public schools are 'good').

The extent to which law can provide an effectiveness for social change varies according to the conditions present in a particular situation. Even suggests that a law is likely to be successful to induce change if it meets the following seven conditions:-

Law must introduce its rationale in terms that are understandable and compatible with existing values.

Advocates of the change should make reference to other communities or countries with which the

population identifies and where the law is already in effect.

Enforcement of the law must be aimed at making the change in a relatively short time.

Those enforcing the law must themselves be very much committed to the change intended by the law.

The instrumentation of the law should include positive as well as negative sanctions.

The enforcement of the law should be reasonable, not only in the sanctions used but also in the protection of the rights of those who stand to lose by violation.

5. The importance of law to give changing structure of society:

In many instances, the state of the art of social change endeavors is not methodologically sophisticated enough to distinguish clearly among casual, necessary, sufficient, and contributory conditions to produce desired effects in society. The advantages of law as an instrument of social change are attributed to the fact that *law in society is seen as legitimate, more or less rational, authoritative, institutionalized, generally not disruptive, and backed by mechanisms of enforcement.*

Legitimate Authority A principal advantage of law as an instrument of social change is the general feeling in society that legal commands or prohibitions ought to be observed even by those critical of the law in question. To a great extent, this feeling of obligation depends on respect for legitimate authority and the perception of power. Webber says that there are three types of legitimate authority.

Traditional authority bases its claims to legitimacy on an established belief in the sanctity of traditions and the legitimacy of the status of those exercising authority. The obligation of obedience is not a matter of acceptance of the legality of an impersonal order, but rather a matter of personal loyalty [Rule-of-elders].

Charismatic authority bases its claim to legitimacy on devotion to the specific and usual sanctity, heroism, or exemplary character of an individual and the normative patterns that are revealed or ordained. The charismatic leader is obeyed by virtue of personal trust in his or her revelation or exemplary qualities [Moses, Christ, Mohammed, Gandhi].

Rational-legal authority bases its claims to legitimacy on a belief in the legality of normative rules and in the right of those elevated to authority to issue commands under such rules. In such authority, obedience is owed to a legally established impersonal order. "Rational" people "voluntarily" make a "contract" that generates the impersonal legal order.

6. The binding force of law:

Law is binding because most people in society consider it to be. Some consider the content of the law to command obedience, which, in turn, is seen as a compelling obligation. The law achieves its claim to obedience, and at least part of its morally obligatory force, from a recognition that it receives from those, or from most of those, to whom it is supposed to apply. Even when laws are against accepted morality, they are often obeyed. The extermination of more than six million Jews in Nazi Germany, clearly the most extreme instance of abhorrent immoral acts, was carried out by thousands of people in the name of obedience to the law. Milgram contends that the essence of obedience is that individuals come to see themselves as instruments for carrying out someone else's wishes, and they therefore no longer view themselves as responsible for their actions. Under certain conditions many people will violate their own moral norms and inflict pain on other human beings, and that succinctly underlines the notion that most people willingly submit to authority and, by extension, the law.

Sanctions for disobedience to the law are surely among the primary reasons that laws have binding force. "The law has teeth; teeth that can bite if need be, although they need not necessarily be bared." Sanctions are related to legal efficacy and are provided to guarantee the observance and execution of legal mandated to enforce behavior. To most people law is imposed externally in an almost coercive way. Today people are characterized by a "crisis of confidence" and alienation from social institutions because of uncontrollable economic conditions. Therefore, law is hardly an expression of their will. Few people participate in the formulation of laws and legislation. One of limitations of law as an instrument of social change is the possibility of prevailing conflict of interest. Other limitations related to the efficacy of law in social change include divergent views on law and the prevailing morality and about the values. The scarcity of resources causes conflicting interests. Decades ago, Karl Marx and Max Weber said that many laws are created to protect special economic interests. This is because economic interests are strong factors influencing the creation of laws. Weber recognized that besides economic interests law protects other interests too such as personal security, personal honor, and it guarantees political, ecclesiastical and other positions of authority and social preeminence.

Weber emphasizes two points:

a) Conflict of interests provide the base for the formation of laws that bring change; so the stratification of society and the preferences of those who promulgate the changes determine the role of laws in social change.

b) Law as an instrument of social change can be seen as the organization of power and processes that protect special interests in society and result in social change. However, a distinction should be made between what people claim as their interests and what their "true" interests are. There are many examples when people are organized to protect what they conceive as their interests. Blacks have been instrumental in the passage of many civil rights laws. Farmers have affected laws dealing with migrant workers, farm subsidies, importation of food items, etc. so it is the division of society into the "powerful" and "powerless" that simple? The mechanisms of change through law include large segments of the population. Even in democratic countries, the large-scale participation of citizens in social change is not feasible; however, the lack of participation doesn't mean lack of representation.

7. The role of law in making policy:

The law by itself can't bring directed social change but it is one component of many policy instruments that must be used in combination. In the case of social problems like drug abuse, race relations, law can be used effectively as a policy instrument. But, sometimes in order to bring change law should be an ingredient of a larger policy (the Act of Economic Opportunity that attempted to decrease poverty in US).

Usually law is used as an instrument of social change outside of a broader policy framework in reform oriented litigation, such as the restrictions of 1992 on abortion. But, broader issues concerning environmental or natural resources management issues should be reformed using broader policy making frameworks.

Morality and Values: The cause and effect relationship between law and change is very difficult to identify because the ability of law to produce change is probabilistic, contingent and sequential because even though some changes can occur, other factors such as the morality and values of society affect the efficacy and time lag of laws in causing change. On certain issues like truth, individual liberty, etc., a shared morality and shared values are essential to unify the society. However, not all values are essential and those should be able to change. To cause change, a law should be supported by the society. Its efficacy in change is limited on moral issues in society. Examples are the ineffectiveness of

laws prohibiting adultery homosexual marriage or sexual abuse. The laws prohibiting many drugs, especially marijuana, have been called the “new prohibition” to underline similarity with laws prohibiting alcohol usage. It seems that laws on important drives are more difficult to apply than those on less compelling drives. Marijuana is seen a source of pleasure for many people therefore control should be imposed only against polluted merchandise. Morris Grinsberg suggests that laws should deal only with acts that can be precisely defined and with external observable acts; and the laws should as far as possible respect privacy.

Consequently, laws most likely change external behavior, which are consequently later on followed by changes in attitudes, values and morals. So the range of the “external” is enlarged and sometimes affects personal preferences and tastes. In contrast, William Graham Sumner said that laws can regulate only behavior and not values, morals and attitudes. Examples are laws asserting equality for blacks which were not accepted by whites for many generations. On the other hand, this law that required change in behavior has gradually changed attitudes too. Today, the idea of racial superiority is no longer characteristic of whites.

The law can change morality and values under specific conditions. Even though there aren't enough empirical studies it is true that the efficacy of law depends on its adaptation to morality and values if it aims change.

RESISTANCE TO CHANGE

In most cases laws face resistance by members of society who find different reasons for their resistance such as their values, customs, or even the cost of change and sometimes because people feel threatened by the change. Knowing the conditions of change helps in the implementation of laws. *The factors that are a barrier to change are separated into social, psychological, cultural, and economic factors and all are interdependent.*

8. Discussion:

Social factors-

Vested interests-Change is opposed by individuals or groups who fear they will lose their power, prestige or wealth when the new law is introduced. Examples are vested interests of residents in a community who oppose zoning regulations or interstate highways, vested interests of faculty in getting research money, etc. Also, the efforts of the Soviet Union to assert independence of Moslem women against males were opposed by bands of males who murdered women that obeyed the law.

Social class-

In highly stratified societies, people of upper classes oppose changes because they fear losing privileges over the lower classes. Ex: in Pakistan people of different classes can go to the same schools, draw water from the same well etc. generally working class people supports changes while the lower and upper classes resist changes.

Ideological resistance-

It is quite widespread. Example: resistance of Catholic Church to laws and legislation on the removal of some restrictions on abortion and birth control. In 1982 a pill that ended pregnancy within weeks was developed in France. By 1990s it was available in France, Sweden and Britain But protests of antiabortionists and threats of US citizens no to use products of the company that sold the pill stopped its spread. From 2000 this pill has been approved in US. Usually religious assumptions, interpretations on power, security are not open to change.

Organized Opposition-

Sometimes individual resistance to change can be organized and channeled into social movements or lobbyists. Ex: John Birch Society has opposed acceptance and legal protection of pornography. The lack of opposition can be fatal as the example of Jews who didn't organize resistance.

Psychological factors-

Habit

Habits are behaviors that people are accustomed to and are comfortable with and as such habits resist change. Customs are collective habits of a society and trying to change them requires a reorientation of values and behaviors of society. Ex; introducing the metric system US was resisted.

Motivation

Is very important in accepting change through law. Some motivations are related to culture and may allow change and some focus on preserving status quo. Some motivations are universal such as the desire for prestige and economic gain but if those are threatened, change is resisted.

Ignorance

Is often the cause of prejudice and is related to the fear of the new. Ex: many individuals assumed that citrus fruit caused problems to the digestive tract Once it was proved otherwise, the resistance to citrus fruit faded.

Selective perception

Even in really law is intended to be universal, the perception of people on law is *selective* and varies with economic, cultural and demographic variables and also with attitudes, needs and values of people. A change is accepted easily if it is related to the interests of people and supports their values. Ex: in India law provides distribution of family-planning info and supplies. But many villagers refuse using contraceptives because they think the law aim to stop birth completely. The laws should be formulated clearly so there in misunderstanding by people.

Moral development

The obedience to law relies highly on a sense of obligation. Moral codes are another factor. Lawrence Kohlberg defines 6 stages of moral development:

1. **Obedience and punishment** - involves respect to superior authorities and avoidance of trouble **pre-moral stage**
2. **Instrumental relativism**- people try to satisfy needs by negotiating with others **pre-moral stage**
3. **Personal concordance** - people adhere to prevailing norms and comply with the majority
4. **Law and order** - people respect those in authority and focus on doing their duty
5. **Social contract** - contracts are used for commitments and people respect them
6. **Individual principles** - include conscience, mutual trust and respect as principles of behavior

If this theory is true, the law is limited on the stage of moral development of citizens which should be considered depending on their social class. If the majority is stages 1 and 2, institutional enforcement is used to maintain order. In stages 3 and 4 law is more limited and in 5 and 6 even more limited. But this depends on the conformity of law with beliefs and values of society.

Cultural factors**Fatalism**

Many cultural people believe they have no control over their lives and God or evil spirit causes

everything. They don't use fertilizers because they believe God is responsible for their success. They resist change because it is human-enacted and not from divine origin.

Economic factors

Today Limited economic resources and high costs are often a barrier to change. Change through law is very costly because of the instrumentation of legislation, administrative ruling or court decisions that are all costly. For ex. federal regulations have increased the costs of institutions of higher education thus, resist further changes and require modification of current regulations. The distribution of costs and benefits also effects resistance. If they are equally distributed there is little resistance but if benefits are low and costs are concentrated, resistance is high. Generally economic factors are decisive in affecting resistance to change. No matter how much somebody wants something if economic sacrifice is too great or they can't afford it, change doesn't occur.

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Abstract: Nowadays, e-banking is one of the most important priorities in the present era. All of top managers use from equipment and resources for e-banking. Meanwhile, we are going toward e-banking specially marketing and so on. Thus, every bank attempt to reach toward e-banking quickly. In this paper, we try to survey a set of banking G variables such as security, speed, up to date, confidence, trust, on time, availability, and so on. We study also relationship between e-banking and customers trust using electronic channels. We distribute 278 questionnaires among customers from central branch of agricultural bank (Damghan). In this paper, we survey on the education, old, sexuality. Finally we find significant relation among aforementioned variables. Moreover, we observed differences from trusteeship and truthfulness at two men and women societies toward e-banking variables too.

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Key words: trust ; availability ; banking system ; electronic banking

1. Introduction

In present era, the most important idea is easy and speeds at all of life aspects especially in the organizations and offices, banks and so on. Bank managers always try to implement the newest technologies and methods e.g e-banking. They provide various equipments such as ATM, mobile bank, phone bank, POS, credit cards... After this step, they should persuade and absorb customers for to use from these services. In IRAN, BANKS start to extend e-banking, recently. Agri cultural BANK tries to create customers satisfaction and more attraction. They developed core banking system and their advantages. One of the vital components is creation of trust among customers. If customers don't have any trust to Bank activities, Banks don't reach their goals and consequently, they become bankrupt. One of the aspects of E. commerce is e-banking. e-banking affects on the level of productivity and it is useful for the people, government and banks too (Esinger, 48, 1999). Thus, major goal of this paper is identification of relations among e-banking system and trust among bank customers (Damghan).

We survey to this question: Is there a relation between e-banking and trust customers (agri. bank of Damghan)?

2. Materials and Methods

There are numerous definitions in the E.banking. But in this paper, we present some of them:

- e-banking is optimization and consolidates all of the activities of a bank via using information technology. Moreover, it meets all of the customer's services. (blunth et al, 2005, IRAN management sciences quarterly, two year, 81-98, no 7).

- e-banking includes all of electronic channels that customers use from these channels e. G telephone, Internet, mobile, Digital TV.

- In short, E.banking refers to provide a set of the possibilities for bank staff to raise speed and efficiency to present bank services for customers. So customers can use from bank services without present at physical branches (electronic banking monthly, 1378, 22) e-banking at the world:

E.payment starts since 1918, i.e. when American banks move money through telegraph. Internet developed by academic professors for to share receipts since 1970. Then in later years, Internet became more popular for the people especially for businessmen like to extend their customers. A set of reasons were that lead to increase bankers interests toward Internet as follows:

-to encounter with huge amount Bankrupt customers.
-competition among non – bankers.

At 1994, Banks start to research in the Internet. They tried to suggest Internet services to their customers. Internet Banks offer lower prices in compared with physical banks. Moreover, these banks showed more interest to global markets and customer welfare.

Up to January 1995, there were only 24 hours banks on the internet. One year later, there were 800 banks to use from internet. Industrial experts estimated extra ordinary development of internet in the future. Therefore, new services and modern possibilities offer to the people, and customers can use bank services without present in the physical branches. Related theories with e-banking listed in the table 1 as follows:

Table 1- related theories with e-banking

Row	Researchers and approximate	Research
1	Fishbin and ajzen (1975)	They suggested «T R A » theory.this theory said cause – effect relation. Based on this theory, every behavior originates from purpose and aim. Purpose originates from internal norms and attitudes. In the e-banking system regarding this model, personal purpose and interest have a relation with to use from e-banking.
2	Devise (1989)	He offered «T A M » model. In this theory, to admission a technology, we should have two perception, usefulness and easy. In the other words, we admit informational systems and e-banking because of rational actions.
3	Ajzen (1991)	Planned behavior theory «T P B » said that often customers face with several selections and rarely should they use only one technology. There is high competition in to e-banking. This theory gives us better understanding about admission of a system.
4	Vankatesh et al (2003)	They present admission and application of technology U.T. A. U. T.
5	Amarji gill and alen flacnecher and michi sacher (2008)	They offer e-banking admission theory. This theory is based on a set of factors such as: competency of manager and staff, speed, up to date, to meet customers' needs by bank staff and customers.
6	Chi ping li, Gogang li and hisophen lin (2010)	e-banking is based on some variables such as: accessibility, accuracy, safety, speed, up to date, secrecy in the banking services.

Table 2- A complete comparison between traditional and E-banking (sanayei, 1380)

Traditional banking	E-banking
-Limited market	-Unlimited market
– competition among banks	-Competition among trade marks
– limited services	-Various services
-Focus on the cost	-Focus on the income
-Official time	Unlimited time (24 hours)
-Structure based on the paper and human personnel	-Mutual relations among banks
-revenue via profit margining	-Revenue via interest rate
-Relay on the physical branches	Services based on the innovation and creativity

2.1. Comparison between traditional and E-banking:

A complete comparison between traditional and E-banking as Table 2 above.

2.2. Technology model and effect of trust:

This model is underlying of technology acceptance percept of useful: the people use from a technology, when it is useful and easy. Thus personnel percept affects on behavior and technology acceptance. «Sharif camel 2003» argues that, trust is a mutual relations based on optimistic. Meanwhile, avoidance of uncertainty is very important at determination of behavior.

Model2. It leads to better understanding from customers' options (selections). In this model (Deivis et al 1989), two factors is important at to select a technology by customers as follows:

-Percept of easy usage³: I can use from this technology because of easy learning.

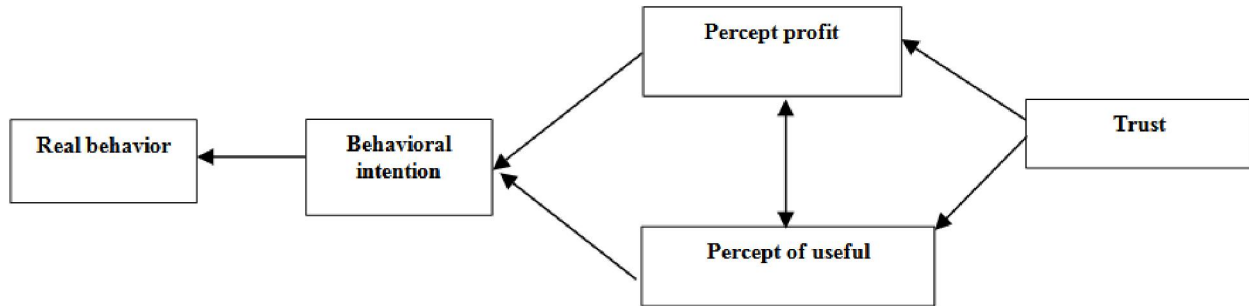


Figure 1- Technology model and effect of trust

A research assumption is as follows:

- There is a relation between accuracy and customers trust in the E-banking.
- there is a relation between secrecy and customers trust in the E-banking.
- there is a relation between safety and customers trust in the E-banking.
- there is a relation between E-banking services speed and customers trust.
- there is a relation between up to date and customers trust in the E-banking.
- there is a relation between customers' accessibility to E-banking services and customers trust.
- variables of E-banking vary among demographic elements (sexuality, age, and education levels).

2.3.Methodology

This research is applied and it has two parts. Library studies use for edition of theoretical fundamental and literature. Then we use questionnaire and field studies for collection of information and testing of assumptions. At first, we identify theoretical resources and definitions and so on. Then, statistical society includes 1000 people (agricultural bank customers in Damghan branches) with different year's groups. To determine of statistical sample, we calculate below formula: $n = \frac{N \times t^2 \times p \times q}{N \times d^2 + t^2 \times p \times q}$.

Our samples are 287 people. We collect data by question air (made by ourselves).

Of course, we study several questionnaires (chi ping li, gogiang li, hisophen li and bomill sa model and in go Han) too. We consider effective factors on the e-banking in the questionnaires.

More over we use central indexes methods such as averages, frequency, mode, distribution indexes, percents, variance deviation. Meanwhile we use statistical parameters, for example regression test (step by step), affect coefficient and Mann – Whitney test and Kreskas Wallis Test.

2. Result Analysis

Descriptive statistics showed that customers' years' mode and average (the most frequency) is between 30 to 39 years old at our sample. Then, the lowest frequency is related with 50 to up (year's group). Women have the most frequency among our sample. In the other words, women are the biggest group among bank customers. In this sample, the most frequency customers are related whit license educational group and the lowest frequency is related with top license educational group and higher group. Other statistical tests as follows:

We observe at table 3, significant level of these variables (accessibility, safety, secrecy, up to date) is higher than five percent. Thus, we conclude that there between men and women at confidence level 95% at this variable (accuracy, speed).

Table 3- Mann-Whitney u test

	Accessibility	Accuracy	Safety	Secrecy	Speed	on.time
Mann-Whitney U	8823.500	8134.500	9499.000	9121.500	7732.000	8595.000
Wilcoxon W	17208.500	16519.500	17884.000	17506.500	16117.000	16980.000
Z	-1.218	-2.227	-.168	-.738	-2.835	-1.531
Asymp. Sig. (2-tailed)	.223	.026	.867	.461	.005	.126

0: E-banking variables are similar for different year's groups.

H1: E-banking variables aren't similar for different year's groups.

We conclude that sigs are higher than 5%. Then, we prove assumption H0. In the other words, aforementioned variables are different among various years group.

Of course, accuracy and speed variables had sigs lower than 5%. Then these variables (accuracy-speed) were very important for 30 to 39 years group. (The lowest answer for 50 to up year's group).

Table 4- Kruskal Wallis Test- Grouping Variable: age

	Accessibility	Accuracy	safety	Secrecy	Speed	on.time
Chi-square	2.867	7.800	.052	3.169	3.993	2.604
Df	3	3	3	3	3	3
Asymp. Sig.	.413	.050	.997	.366	.262	.457

H0: E-banking variables are similar among the customers with different educational levels.

H1: E-banking variables aren't similar among the customers with different educational levels.

We showed that (table 5), sigs are higher than 5%, then we prove assumption H0.in the other words,

e-banking variables are similar among different year's groups. Accuracy and speed variables showed that the most frequency for education is related to top license and doctoral.

Table 5- Kruskal Wallis Test- Grouping Variable: education

	Accessibility	Accuracy	Safety	Secrecy	Speed	on.time
Chi-square	2.659	7.984	2.945	2.553	5.476	4.848
Df	3	3	3	3	3	3
Asymp. Sig.	.447	.046	.400	.466	.140	.183

We conclude that (table 6) there are mutual relations between e-banking variables and customers trust. Sigs amount is lower than 5%, then we can say that there is a relation with confidence level 95%

Table 6- relations between e.banking variables

		Trust	Accessibility	Accuracy	Safety	Secrecy	Speed	On. Time
Sig. (1-tailed)	Trust	.	.000	.000	.000	.000	.000	.000
	Accessibility	.000	.	.003	.000	.000	.000	.002
	Accuracy	.000	.003	.	.000	.000	.000	.004
	Safety	.000	.000	.000	.	.000	.000	.000
	Secrecy	.000	.000	.000	.000	.	.000	.000
	Speed	.000	.000	.000	.000	.000	.	.000
	on.time	.000	.002	.004	.000	.000	.000	.

Assumptions of regression test suggest that: How much e-banking affects customer trust? We observed (table 7) determination coefficient (R2) equals 0/45. In the other words, dependent variables (e-banking factors), F sig equals 0/000 and it has it has significant

effect.

Thus, there is a relation between independent and dependent variables. Therefore, at least one of the independent variables factors can change on the dependent variables.

Table 7- Regression test

Model	Correlation coefficient	Determination factor	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.671a	.450	.438	.46740	.450	36.994	6	271	.000

- a. Predictors: (Constant), on. time, accuracy, accessibility, safety, secrecy, speed
 b. Dependent Variable: trust

4. Discussions:

In our country, e-banking has considerably progress recently. Customers and banks need to modern technology (e-banking). e-banking has several advantages e.g. decrease of cost and expenditure, decrease of transportation in the physical branches and so on. Agricultural bank start to extend underlying structures for e-banking. Thus, we try to absorb the more customers. One of the most important problems is to create trust among customers to use from e-banking services. In present era, personal information. Bank is one of the places that save this information. Then, secrecy, confidence, safeties are very important for customers and their opinions (norms and attitudes).

Banks have numerous mechanisms to improve processes of trust-making. In short, customers should feel confidence and secrecy, safety.

Behavior and services.

In the paper titled, "A survey of relations e-banking services on the customers trust at the agricultural bank", we use from various theories and several researches. We conclude that agricultural bank can be success somewhat at the trust-making among its customers. Effective factors on the e-banking include speed, on time, secrecy and confidence. These factors should improve to increase trust levels to e-banking. Meanwhile, we understand that (with considering Krooskal Walis test) there aren't any difference among customers (with different years groups and with different education levels) regarding to e-banking variables. More over there aren't any difference among men and women (after Mann-Whithney test) at the aforementioned variables. Of course we observe somewhat difference among men and women at the accuracy and speed variables.

Finally, recommendations for better electronic banking services offered by the author:

1-if we can eliminate a set of weaknesses and problems at e-banking; we can persuade and foster customers to use from these services and possibilities.

2-we suggest to branches managers to increase customer's trust, for example improvements for accessibility variable (to provide high speed internet for customers additionally), we can use professional

planners to establish diverse program e.g. web pages planning, mobile software, phone bank and so on.

On the other hand, to increase security, we can use fire walls, anti-virus, passwords production equipments (TOKEN) with powerful algorithms (high efficiency). Our bank should use from foreign banks experiences and modern electronic sciences to increase users accessibility and their trust.

Note that banks should not allow to unauthorized personnel to access to customers information.

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Determination of Porosity and Density of rocks in Kwali Area Council, North-Central Nigeria.Abdulsalam N.N.¹ and Ologe O.²¹ Department of Physics, University of Abuja, Nigeria² Department of Chemical and Geological Sciences, Al-Hikmah University, Ilorin, Nigerianassnaem@gmail.com, toyin.ologe@gmail.com

Abstract: Porosity and density of rocks were determined in Kwali Area Council of the Federal Capital Territory, Nigeria. This study was done towards determining rock samples densities and porosities when wet and dry; ultimately determine their specific gravity and reveals their significance to human race. The methods employed include laboratory method, computational approach which was guided by Archimedes Principle. The result suggests that density and porosity are controlled by fundamental processes that are common to all rocks. And the close correspondence of the measured and lithology porosities and densities therefore indicates that the computational approach adequately handles these textural and mineralogical variations. However, great variations are observed in both density and porosity for a particular identical rock types. Gneiss for example varies in both porosity and density from 15.79% to 36.17% and 2.60g/cm³ to 2.83g/cm³ respectively for the four samples of gneiss. The variation in density and porosity for a particular rock type gives an insight on the need of investigating even the same rock types before using them for a particular project, as some rocks have been subjected to greater pressure, temperature and weather conditions than others due to variations in geographical locations. It is apparent from this study to note that there is considerable overlap between different rock types and consequently, identification of a rock type is not possible solely on the basis of porosity and density data.

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Keywords: porosity, density, specific gravity, rocks, lithology

1. Introduction

Earth science deals with the study of the earth, its history, changes and its place in the universe. A rock is defined as an aggregate of one or more minerals that have been brought together into cohesive solid (Tillery, 2005). The principal factors controlling the strength of solid rocks are density and porosity (Augustinus, 1991). Density is important in various undertaking in the mining industries; thus Specific gravity is used in the separations of minerals. Architects and Geoscientist used the knowledge of density in the design of bridge, flyovers and other structure (Abott, 1998). The economic evaluation of a petroleum accumulation demands knowledge of the distribution of physical property (porosity) in rocks. The mining of rocks and minerals for their metal ore content has been one of the human advancements, which has progressed at different rates in different places including Nigeria because of the kind of metals available from the rocks of a region (Blatt and Robert, 1996). There is an apparent increase in the collapse of buildings, bridges, flyover, and roads and as well as other structures in both developed and developing countries including Nigeria. The alarming increase in both population and infrastructure development in Kwali Area council has necessitated the need for proper structural planning and development of these infrastructures and building. However, poor planning

and inability to carryout pre-developmental geophysical studies and the non-diagnostic property of a particular rock type in construction of building or bridge have led to lot of structural problems which result in dilapidation of building, lost of resources and death during collapse of buildings. The average compositions of rock-forming minerals (Poldervaart, 1955); the diagnostic properties of some common minerals and rocks; the intrinsic properties controlling rock strength, which include density and porosity are important variables used in investigating all the rock forming minerals in the studied area. Therefore, this research work is aimed at;

- Collection of rock samples of true representation,
- Computation of their particle densities and porosities when dry and wet; ultimately determine their specific gravity,
- Relate the measurements to lithological data in order to compare the accuracy and precision of experimental methods, and
- Reveal their significance to human race.

2. Location, Accessibility and Geology

Kwali is one of the major settlements in the Federal Capital Territory. It is located at the intercept of latitudes 8⁰30' N and 8⁰55' N and longitudes 6⁰45' E and 7⁰05' E of the equator and about 70km away from the federal capital city. The area covers a total of 1,700400 square kilometers or 8,895 hectares,

located at the centre of very fertile agricultural area with abundant clay deposits. It is located along Kaduna - Lokoja road. The survey areas are part of the Nigerian basement complex, which occupied mainly hills and dissected terrain (Dawam, 2000). The rock types include schist, gneiss and some older granite. The map in figure 1 shows the various locations where the samples were collected.

Physiography and climate

Kwali Area Council is largely drained by River Gurara. The drainage pattern is mainly dendritic and the area is characterized by slightly undulating topography; this shows that the area is generally hilly with most part 70 m above the sea level. The climate of the area under study is tropical with a mean maximum monthly temperature of about 37°C. The start of rain is from March and end around October (Dawam, 2000). This gives rise to frequent rainfall and a noticeable increase in the mean annual total. The mean annual rainfall is approximately 1038.5 mm. The sunshine of the area ranges between 8 to 10 hours during the period of January to April/May. The annual temperature is between 23.5-38°C, while the average air pressure of the area is about 1050 millibars.

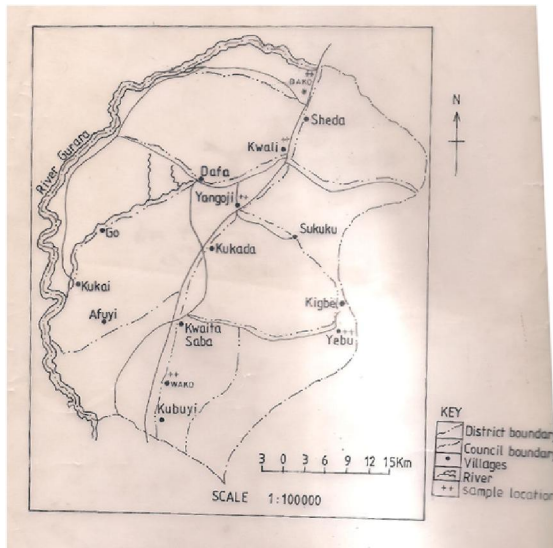


Figure 1: The approximate field location showing the survey areas

3. Materials and Methods

The materials used for this study include spring balance, thread and stand, beaker or cylinder (plastic), bucket, water, rocks sample and graduated cylinder (5000ml). The methodology used involved a laboratory method for the determination of porosity and density of some surface sample of rocks in some selected locations within the area of study. This method was observed on a small sample of rock in a laboratory (Athy, 1930), and was guided by

Archimedes principle. Rocks samples were collected from all the locations within the area council so as to obtain a specimen of true representation. After the collection, they were broken into a measurable size and shape, dried properly for six hours so as to remove the moisture contents; before the actual measurement was taken.

Porosity verification was done with the aid of the equation below:

For a rock of matrix volume, V_m the porosity, Φ is derived as follows

$$\Phi = \frac{V_p}{V_b} = \frac{V_b - V_m}{V_b} \quad (1) \text{ (Muller, 1967).}$$

$$\text{Where } V_m = \frac{W_d - W_w}{P_f} \quad (2)$$

$$V_b = \frac{W_s - W_w}{P_f} \quad (3)$$

Putting (2) and (3) into (1) to obtained

$$\Phi = \frac{W_s - W_d}{W_s - W_w} \times 100\% \quad (4)$$

Where, V_b = bulk volume of rock

V_p = pore space of rock

W_d = dry (air) weight of sample

W_w = wet weight of the sample

W_s = saturated weight of sample

P_f = density of fluid (water)

In the same vein, the relative density also known as specific gravity (SG) of rock was verified with the aid of equation below; Mathematically;

$$\ell = \frac{M_d}{V} \quad (5)$$

$$\text{Specific Gravity} = \frac{W_d}{W_d - W_w} \quad (6)$$

Where,

Weight of rock in air = W_d

Loss of weight in water = $W_d - W_w$.

Density = ℓ

For this experiment, water was used as the fluid ($P_f = 1.0\text{g/cm}^3$).

The dry weight (W_d) of each sample was taken using the spring balance. Followed by respectively taken the reading for the wet weight (W_w) after the sample was been submerged in water. The samples were then soaked for 24 hours (till the samples are allowed to be saturated) in a bucket of water. After which the samples were reweighed as the saturated wet (W_s). The porosity is then computed using the relation given in equation (4). The dry weight (W_d) of each sample was taken using the spring balance. The graduated cylinder was then filled with water to a level that covered the sample completely; the volume

of the water was taken as V_1 . By means of a thread, each sample was fully submerged in the cylinder containing the water. And the volume was then recorded as V_2 . The total volume, V of each sample was obtained by subtracting V_1 from V_2 . i.e. $V = V_2 - V_1$. The density was then computed using the relationship given in equation (5). Hence specific

gravity (SG) obtained using the relation in equation (6).

4. Results and Discussion

All data presented below have been subjected to careful computational and statistical analysis and have been shown to be highly significant.

Table 1: Density Data Presentation

S/NO	Classes of rock	Rock Type	W_d (N)	W_w (N)	M_d (gm)	V_1 (cm ³)	V_2 (cm ³)	V (cm ³)	Density (gm/cm ³)	S.G
KWALI										
1	Sedimentary	Sandstone	1.05	1.03	105	600	650	50	2.10	52.5
2	Sedimentary	Dolomite	2.62	2.60	262	600	710	110	2.38	131
3	Sedimentary	Halite	1.50	1.45	150	600	670	70	2.14	30
4	Igneous	Glass	1.20	1.17	120	600	650	50	2.40	40
YEBU										
1	Igneous	Granite	0.97	0.80	97	600	638	38	2.55	9
2	Sedimentary	Dolomite	0.70	0.65	70	600	630	30	2.33	14
3	Igneous	Glass	1.25	1.15	125	600	650	50	2.50	12.5
4	Igneous	Basalt	0.95	0.90	95	600	635	35	2.71	19
YANGOJI										
1	Sedimentary	Sandstone	2.00	1.90	200	600	690	90	2.22	20
2	Igneous	Gabbro	1.35	1.26	135	600	645	45	3.00	15
3	Igneous	Glass	0.75	0.65	75	600	630	30	2.50	7.5
4	Metamorphic	Gneiss	1.05	0.95	105	600	640	40	2.63	20
WAKO										
1	Sedimentary	Sandstone	1.25	1.10	125	600	650	50	2.08	8.33
2	Sedimentary	Limestone	1.56	1.42	156	600	660	60	2.60	18.75
3	Sedimentary	Halite	1.70	1.60	170	600	680	80	2.13	17
4	Igneous	Glass	1.00	0.95	100	600	640	40	2.50	20

Table 2: Porosity Data Presentation.

S/NO	Classes of rock	Rock Type	W_d (N)	W_w (N)	W_s (N)	POROSITY
KWALI						
1	Sedimentary	Sandstone	1.05	1.03	1.15	83.33%
2	Sedimentary	Dolomite	2.62	2.60	2.65	60%
3	Sedimentary	Halite	1.50	1.45	1.60	66.67%
4	Igneous	Glass	1.20	1.17	1.25	62.50%
YEBU						
1	Igneous	Grainite	0.97	0.80	1.02	31.82%
2	Sedimentary	Dolomite	0.70	0.65	0.75	50.00%
3	Igneous	Glass	1.25	1.15	1.30	33.33%
4	Igneous	Basalt	0.95	0.90	1.10	75.00%
YANGOJI						
1	Sedimentary	Sandstone	200	1.90	2.30	75.00%
2	Igneous	Gabbro	1.35	1.26	1.40	35.71%
3	Igneous	Glass	0.75	0.65	0.80	33.33%
4	Metamorphic	Gneiss	1.05	0.95	1.15	50.00%
WAKO						
1	Sedimentary	Sandstone	1.25	1.10	1.30	25.00%
2	Sedimentary	Limestone	1.56	1.42	1.82	65.00%
3	Sedimentary	Halite	1.70	1.60	1.60	50.00%
4	Igneous	Glass	1.00	0.95	1.05	50.00%

Table 3: The approximate Lithological porosity for some common rock types (Athy, 1930).

ROCK TYPES	POROSITY (%)
Limestone	7.00 – 56.00
Sandstone	5.00 – 30.00
Dolomite	0.00 – 20.00
Fractured basalt	5.00 – 50.00
Karst limestone	5.00 – 50.00
Shale	0.00 – 10.00
Fractured crystalline rock	0.00 – 10.00
Dense crystalline rock	0.00 – 5.00
Weathered granite	34.00 – 57.00
Weathered gabbro	42.00 – 35.00
Schist	4.00 – 49.00
Quartz	6.00 – 65.00

Table4: The approximate Density ranges for common rock types and ores (Phili et al, 2002).

ROCK TYPES	RANGE OF DENSITY (g/cm ³)
Alluvium (wet)	1.96 – 2.00
Clay	1.63 – 2.60
Shale	2.06 – 2.66
Sandstone	2.05 – 2.55
Limestone	2.60 – 2.80
Chalk	1.94 – 2.23
Dolomite	2.28 – 2.90
Glass	2.40 – 2.80
Halite	2.10 – 2.40
Granite	2.52 – 2.75
Granodiorite	2.67 – 2.79
Anorthosite	2.61 – 2.75
Basalt	2.70 – 3.20
Gabbro	2.85 – 3.12
Gneiss	2.61 – 2.99
Quartzite	2.60 – 2.70
Amphibolites	2.79 – 3.14
Chromite	4.30 – 4.60
Pyrrhotite	4.50 – 4.80
Magnetite	4.90 – 5.20
Pyrite	4.90 – 5.20
Cassiterite	6.80 – 7.10
Galena	7.40 – 7.60

Comparison Of The Results Obtained With The Lithological Data

Lithological data and measured values of density and porosity of rocks are compared using tables 3, 4, 2 and 1. Virtually all the measured values of both density and porosity are within the lithology range given in table 3 and 4. This suggests that density and porosity are controlled by fundamental processes that are common to all rocks. And the close correspondence of the measured and lithology porosities and densities therefore indicates that the computational approach adequately handles these textural and mineralogical variations.

However, great variations are observed in both density and porosity for a particular identical rock types. Gneiss for example varies in both porosity and density from 15.79% to 36.17% and 2.60g/cm³ to 2.83g/cm³ respectively for the four samples of gneiss. These may be due to three major important reasons:-

- i. Measurement errors due to the inherent uncertainties in input and calibration data on the instrument used.
- ii. Geometrical variables. Micro scale variation in texture (the grain size and the degree of sorting).

iii. Physicochemical variables are also important. These include temperature, stress, chemistry of the pore water, mineralogy and weathering process.

From review of the written works with artistical value that was carried out by various researchers in different parts of Nigeria proved beyond reasonable doubt that the density and porosity of the rock is an important field of study due to its accessibility of the effects of geographical variations on geophysical parameters. The result gotten by various researchers from different part of the country show some inter-relationship in the value obtained (e.g. comparing the value obtained in Federal Capital Territory and the one obtain from Ondo State, Nigeria) ranging from 2.00g/cm³ to 3.06g/cm³ and 2.63g/cm³ to 2.18g/cm³ respectively. Both area ranges from 2.00g/cm³ to 3.06g/cm³. The researched work shows that the density of rocks determines it's weathering; that is the denser the rock, the higher the weathering rate. This give a clear insight to what is likely to be obtain, when the density is high the rock is slightly prone to weathering and disintegration. So the density of some rock specimens determines its usefulness in construction work.

From the result obtained by Alhassan et al; (2011) that carried out measurements of rocks densities in Gwagwalada area of Federal Capital Territory gives a result in the range of 2.00g/cm³ to 3.06g/cm³ which is similar to the present results in this study. This may be because they both have the same geological settings.

Conclusion

Kwali area council from the experimental result is seen to be made up of sedimentary and igneous rocks. Glass is found to be common to all the locations. Dolomite a twin to limestone which is found to be present in all except Wako. It is used for agriculture, chemical and industrial application as well as cement construction. Halite a sedimentary type of rock found in Kwali, Yangoji, and Wako, it is used for food preservation, preparation of sodium hydroxide, soda ash, caustic soda, hydrochloric acid, chlorine and metallic sodium. Gabbro also an igneous rock found only in Yangoji location is also used for all sort of construction and has the highest density 3.00g/cm³. Gneiss the only metamorphic rock found Yangoji part of Kwali area council. It is used as a building material such as flooring ornamental stones, gravestones, facing stones on building and work surfaces. And finally limestone which is only found in Wako use as aggregate or base for road and

foundations, purification of molten glass and also for agriculture and industrial use. The highest porosity values (83.33%) with its correspondence density value (2.10g/cm³) are represented by sandstone. Porosity and pore-system interconnectivity are therefore two very important controls on sandstone reservoir quality as they determine the rock's ability to store and to transmit fluids. The variation in density and porosity for a particular rock type gives an insight on the need of investigating even the same rock types before using them for a particular project, as some rocks have been subjected to greater pressure, temperature and weather conditions than others due to variations in geographical locations. Gneiss, for example has porosities and densities ranging from 15.79% to 36.17% and 2.6g/cm³ to 2.83g/cm³ respectively. It is apparent from this study to note that there is considerable overlap between different rock types and consequently, identification of a rock type is not possible solely on the basis of porosity and density data.

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The reasons for the existence of fundamentalism in Afghanistan

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Abstract: After the Soviet war in Afghanistan, fundamentalists, issues were raised by the global media due to certain reasons, becoming known and important to the world. The way of presenting, explaining, and expanding this matter which has become “The first issue in the world politics” relates to the motivation and aim of politicians whose aims and benefits were linked to those of Afghanistan’s. It has been said that a majority of 99% of people adhere to Islamic law. Consequently, the atmosphere and growth circumstances are quite appropriate for religious theories to propagate, although they may be considered extremist. On the other hand, as discussed in the followings, Russia’s invasion to Afghanistan and the formation of communist governments with their anti-religious reforms saddened the Muslims of Afghanistan greatly, in a way that every individual or group propagating the Islamic theory or promising the religious reign would be welcomed. Especially, Mujahidin groups raised a flag against Russian invaders, as well as promoting the religious theory, and sought a war with them for the independence of Afghanistan practically.

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Key words: Afghanistan, fundamentalism, the reasons for the formation of fundamentalism, Islamic theory

1. Introduction

One of the significant problems involved in the geographical politics of Afghanistan is the issue of Pakistan. Afghanistan is a neighbor of Pakistan from North, South, and East. Hence, three border lines of Afghanistan are surrounded by Pakistan. Pakistan is a potential threat and even a practical one to Afghanistan in the acute circumstances of political or military importance. The most notable matter in this case is to protect and empower fundamentalists and send them to Afghanistan from Pakistan. A problem which is even shown by the documents of training and arming Afghan and Arab fundamentalist who have been sent to Afghanistan with the centrality of Pakistan. The Afghan writer of the book “My banned face” considered Pakistan obviously involved in the chaos, difficulties, and military hardships of Afghanistan. For instance, he writes, “According to Mujahidin’s agreement, Pakistan is not willing to have a powerful nation right in front of her borders. They want to tear us apart because of their lack of unity. While our country is unstable due to ethnic wars, Pakistan can happily continue to pose her invasive politics against India and benefits from financial support by the US.” The other problem is the existence of China on the East side of Afghanistan. The neighborhood of these two countries can’t mean any harm to Afghanistan in political and civilized wars brought by the superpowers. It must be emphasized that such a country is going to be globalized. China possesses factors like power, population, and land. Not only does China’s present economic power own almost all of the markets in the region, but also the world capitalists are afraid of the fact that the global markets get to the hand of China. After the disappearance of the

Soviet Union as one of the two poles of the world system and incapability of the European Union to maintain a political balance in the international order, China can play a major role in the balance with her economic power. On the other hand, China jeopardizes the West, having a “non-western civilization” as a superior hegemonic civilization. This peril encloses the entire western civilization. China’s nuclear power adds up to the other factors and makes her a threat to the future of the west. Therefore, Samuel Huntington, in his book “The Clash of Civilizations”, describes China as a threat to the future of the west because of having a “Confucian Civilization” while benefiting from the nuclear weapon and a geography which is near the Islamic world in the area. The whole matters of China are problematic for Afghanistan which has common border with it, because China’s rivals will have plans in order to prevent and obstruct this country’s power, so Afghanistan is won’t be immune to them. Afghanistan’s neighborhood with Iran is another problem. Being upset of Iran’s Islamic revolution, the West has been trying constantly to practice the theory of Islamic revolution in the area and the world for three decades, applying various methods of inaction, failure, or prevention (Chater, David.2009). On the other hand, the progresses made by the Islamic Republic in different realms especially the nuclear issue have been considered worries for the West. Therefore, Iran is a determinative problem for the West in terms of geography and politics. This matter was of high importance to the Communist System at the time of the Soviet Union. So, it is obvious that the western powers to interfere in Afghanistan’s affairs in order to use the advantage of having borders with Iran. Even occupying Afghanistan by the western

forces and their prolonged presence in this land could be an important step in order to control and monitor the Islamic Iran directly. The fact that Afghanistan's nation is Muslim, along with Persian race and language in that country and many interests and cultural intersections between the two nations of Iran and Afghanistan can't be hidden to the eyes of world powers. These matters could be the reasons for direct and indirect interference in Afghanistan, making the independence, peace, and security of that country unstable. Given the poverty and deprivations which have been caused through decades of war and struggle in Afghanistan, the country is fertile and rich in terms of resources and mines. The mines of gold, silver, copper, iron, and even emerald and lazuli are fortunes drawing avaricious attentions of others to this country (Rizivi, N. 1988).

Undoubtedly, the stability and safety of Afghanistan with the existence of a national, powerful government could exploit the resources and mines to the advantage of the nation. However, will the greedy foreigners who always try plunder other countries in the world politics allow this? Looking at Asian countries, Samuel Huntington considers their economic growth as a reason for their self-confidence to increase amongst Asian societies, believing this matter causes the world political order to shatter. The result of this western doctrine is that it is necessary to block the way Asian countries seek to grow economically in order to prevent or deter their imminent victory over the West especially the US. Hence, it can be understood how the West is trying to prevent Afghanistan as an Asian country possessing an important geopolitical position from benefiting from the available resources and mines. A researcher has evaluated the geopolitical position of Afghanistan in this way: The Soviet Union's military attack on Afghanistan was made in the framework of geopolitical features. When the armed forces of the Soviet Union entered the geographical territories of Afghanistan, the possibility of gaining access to the economic resources of the Persian Gulf increased, adding up as much as 1500 kilometers to the geo-economic resources of the Persian Gulf.

2. The reasons for fundamentalists to be present in Afghanistan

It has been clarified in the previous discussions that the fundamentalism ideology and fundamentalists entered the political and military grounds the years before the emergence of Taliban. As a result of such studies, it can be easily understood that Taliban and Al-Qaeda were firstly the followers of the fundamentalists, who were active in Afghanistan from the early 70s, in terms of ideology and belief. Secondly, their victory and progress until the formation of a government was not only a strange fact, but it was also the result of different factors, especially the war of

power between fundamentalist groups (Davidson, Lawrence (1998) . A war in which the Mujahidin groups take part before the emergence of Taliban, but Taliban became the only powerful group in the country by defeating them. Therefore, the existence of Taliban and studying the reasons and the quality of their existence do not need intellectual and ideological roots. What need to be precisely followed are the quality, reasons, and factors of the military-political presence of Taliban and their progress. The financial, reinforcing factors and military, political supports require discussion on both Mujahidin and Taliban. Thus, the reasons get reviews as follows:

2.1. The first reason: Foreigners' interests

Ahmed Rashid, the Pakistani reporter, writes:

Taliban's wounds are constant reminders of the 20-year wars which left over 1.5 million dead people and destroyed the country. The Soviet Union spent 5 billion dollars in Afghanistan only in one year, out of an overall amount which was 45 billion dollars, to annihilate the Mujahidin. The US helped the Mujahidin around 4 to 5 billion dollars between the years 1980 and 1992. America, the European, and the Islamic countries helped the farmers mostly with lethal weapons, and they used these weapons for destructive purposes. This was a totality of foreigners' intervention because of their interests. However, the Saudi Arabia's intervention can be considered for ideological purposes (war against communism). The initial bankroll of the fundamentalists outside Afghanistan was the government of Pakistan. This government has clearly supported the political activists and party leaders to commencing the parties, as well as harboring those who were wanted. A more important point in this regard is providing the facilities for armed rebellions inside Afghanistan. It has been written on this matter, "Although the fundamentalists had been repeatedly suppressed, they continue to exist as underground movements until 1973 and most of them immigrated to Pakistan after Davood took over the poser. There, they got closer to the Pakistani fundamentalist groups and the intelligence agencies which became more and more important during the conflicts in Afghanistan."

Pakistan's supports of fundamentalist groups are a lot, before coming to Afghanistan for the war. It has been said, "In early 1975, the first groups trained by I.S.I attacked the military bases of Davood's regime in the valley of Panj-Sheer. They were led by the Islamic community, the majority of Tajiks. The Islamic community and party were the largest fundamentalist group which later received America's aid."

Thus, in the following years in which the fundamentalists fought against the Soviet army, a war which was meant to save the country from the hands of occupiers, the Central Intelligence Agency of America

(CIA) encouraged the military regime of Zia Al-Haq, who was the president of Pakistan at the time, to commence the military supporting plan to help the rebels. David Newsom, deputy of the US secretary of foreign affairs at the time, said in this regard, "CIA and ISI (Inter-Services Intelligence of Pakistan) cooperated on the military training plan of the rebels and collaborating newly received helps from China, the Saudi Arabia, Egypt, and Kuwait." A specialist of Afghanistan's affairs has found out that the major strategic aim of Pakistan is to weaken the national capabilities through civil wars which destroy the warfare, industrial plants, and communicative paths. Achieving this purpose has been initiated since the presence of Russians in Afghanistan. Establishing a weak and cooperative government in Afghanistan, turning Afghanistan to a market for Pakistani goods, disconnecting or diminishing Afghanistan's political-economic relationships with India and Iran, taking control of communication paths of Central Asia and the Indian Ocean, transforming Afghanistan to a retaining country, diffusion barrier of Russia and India, and making Afghanistan a field for military training maneuvers. Therefore, the Islamic fundamentalists have benefited from Pakistan's support during their armed conflicts. Hence, it must be said, "Pakistan's government have been supporting and arming the fundamentalist since 1970s and the presidency of Zulfikar Ali Bhutto. Then, the strategy of financial and weaponry supports continued in the following years, and the ideological educations of fundamentalists were conducted in Pakistan's schools."

The US state took actions after the communist governments which were dependent on the Soviet Union emerged in Afghanistan. America helped the fundamentalists through Pakistan. China helped the fundamentalists on account of neighbors' interests. Arab countries like the Saudi Arabia gradually affected the fundamentalists with ideological educations as well as financial supports.

Huntington has written, "Most of the financial supports given to Afghans were done by the Saudi Arabia. The Saudis gave the Afghan resistance a 525-million-dollar help from 1984 to 1986. They agreed to afford 61% of a total of 715 million dollars, which means 436 million dollars, to cover the war expenses while the rest was supposed to be covered by the United States of America. The Saudis gave Afghanistan's government 193 million dollars in 1993. The Saudi Arabia's assistance was at least equal to or perhaps more than 3 to 3.3 billion dollars which the US spent in this war. Almost 25 thousands volunteers of Islamic countries, mostly the Arab ones, participated in this war. Most of these volunteers who had been recruited in Jordan were hired and trained by Pakistan's securities agencies. Also, Pakistan was the distributing

operator of Americans' money, allocating 75% of these financial supports to the Islamic fundamentalist groups." Generally, foreign intervention in Afghanistan can be considered beyond financial, military, and political supports. This means that fundamentalist manpower entering Afghanistan has been one of the main factors of the foreign intervention. For example, it has been said, "Many Muslims came to Afghanistan from other countries in order to take part in the war in the mid-1980s. The reason for some of them to participate in the war was Jihad or the sacred war. Rescuing Afghanistan from the hands of occupiers was a sacred aim which pleased God and brought worldly honor to the participators of the war."

It is clear that sending such armed forces to Afghanistan was not possible without the approval and support of the mentioned governments. A research has considered Pakistan's interests leading to intervention in Afghanistan like this, "To Afghan Mujahidin and the national forces of this country, the Jihad was ended after the Soviet forces exit the country, and forming a government to run the country was the major objective, however, this policy was against Pakistan's aims. Therefore, Arab Salafists and non-Afghan fighters who had come to Afghanistan to fight a Jihad against infidels became highly important in the security and intelligence system of Pakistan and formed a shadow government."

2.2. The second reason: The US and its interests in Afghanistan

A question is raised that what was so important about Afghanistan for the US to bind the highly great expenses of helping the fundamentalists in war with the Soviet Union? In other words, what were the objectives and interests of the US by intervening in Afghanistan? What would the reasons be? To answer, some reasons pointed out by an analyst can be taken into account:

The first reason is in regard of Afghanistan's geo-politic position. Because this country is near India, China, Russia, and Iran, which can easily be monitored through Afghanistan. Valentine Prosokov writes, "Some practitioners of political geography affairs consider the possibility that Russia and Iran contemplate creating a military-economic-political block based on their common interests and mutual respect, aiming to achieve a regional stability. A block in which India and China can step in certain circumstances as a consequence. It may turn to a powerful barrier in the way of hegemonic affairs of the United States of America which declares every nook and cranny on earth with a slight smell of oil to be inside its own perimeter of vital interests."

The second reason is that Afghanistan is rich in mineral resources, like other Middle-Eastern countries.

The third reason concerns the agricultural fields in Afghanistan. Around 90% of the world poppy is provided in these fields. Taking control of the trade of this ominous material, the US makes a large benefit and achieves its interests.

The fourth reason is that turning Afghanistan to the center of crisis makes the world forget about other issues including Israel and Palestine. The US plays the role of world leader very well.

The policy of inhibiting America explains the important purpose and incentive of the US by staying in Afghanistan while supporting and intervening in fundamentalists' affairs. What is discussed as a dual inhibition considers Iran and Iraq. Ravidov has written, "It was Washington's policy to control Iran and Iraq, which Clinton's government called a dual inhibition."

A Russian researcher believes, "Our country was called the axis of the world in ancient times, and Iran may now want to take over her former role. It is not wondrous that some practitioners of the political geography affairs consider the likelihood that that Russia and Iran contemplate creating a military-economic-political block based on their common interests and mutual respect, aiming to achieve a regional stability. A block in which India and China can step in certain circumstances as a consequence." This belief is on the same page with Huntington's Clash of the Civilizations theory, so it makes the policy of inhibiting America in the interventions feasible (Hopkins, B. D. 2008).

3.2. The third reason: The socialist governments

The record of fundamentalism fighting in Afghanistan indicates that the religious beliefs of most people have mad the political leaders and activists emerge. The parties and their famous leaders, who were later known as Mujahidin, had been the fundamentalists who were in bottleneck due to the political activities during the time of Davood Khan. Their departure to Pakistan during the time of Zulfiqar Ali Bhutto was a way for the continuity of the political campaigns with the purpose of "Establishing a religious government." "The Islamic state" and "The Islamic republic" which was mentioned by Mujahidin at the time meant the religious authority with the law enforcement.

The images remained of communist governments in Afghanistan indicates that the social reforms were against the religious appetite of Afghani people and made them to conflict and struggle. For instance, it has been said, "The committed Marxists and supporters of the Soviet Union who were in power took steps in the government after Davood Khan. An example is the land reforms saying anyone owing more than 214 acres of agricultural land was supposed to give in the extra acres."

These reforms made a lot of Afghans angry. Plus, another factor causing anger amongst Afghans was the fact that communism is associated with atheism. According to communistic beliefs, the social progress can't be achieved as long as people give prayers credit and trust in God in order to solve the problems in life. Therefore, this worry dawned on Afghans that the trust in God and getting guidance from the Quran became lower in importance.

It became obvious that the religious beliefs of Afghani people, most of whom believing in them, didn't approved of the "Atheistic communist government." Hence, the social reforms based on communistic thoughts changed the belief disagreements to conflicts and then uprising and rebellion (Maley, William (2009).

The party leaders and political activists who were of religious fundamentalists gain more power in this period than before and the time of Davood Khan's presidency. Generally, fundamentalism grew against the ruling ideology, having been accepted by people in large scale. This problem had another reason, apart from the conflict between religious beliefs and the atheistic communism. That reason was "The existence of a dependent government on the Soviet Union in Afghanistan," which gradually led to the invasive raid of the Soviet army. Therefore, the rebellion and riot of fundamentalist people of Afghanistan and their political efforts in parties and communities were done to 2 ends which are firstly, fighting against the atheism of communism in order to remove this government and set up a religious one, and secondly, fighting the occupiers to achieve political and geographical independence of Afghanistan which was lost (Graham Fulle. 1991).

It is obvious that the leaders of fundamentalist parties take the lead in such circumstances. Speaking of the religious laws and picturing the future in the religious reign, these leaders stated the people's desires and sought to implement it. The writer of "My banned face", who is of serious opponents of fundamentalism and Afghan fundamentalists, pays attention to different problems indicating "The practical fundamentalist beliefs amongst people of Afghanistan." He writes on one subject, "My mother examined the neighbor women for free every other day. The women whose husbands were so strict that didn't let them go to the hospital and be placed under the care of male doctors. That's why many doctors in Kabul, especially the women specialists, are female."

The female Afghan writer talks about Kabul, the capital city of Afghanistan. A city which she had named modern before the reign of fundamentalists. Hence, it can be concluded that the religious culture of Afghan people required religious saviors to encounter communism, those who could replace communists and execute Islamic laws the reason for Noor Muhammad

Torki to be less powerful compared to Abdul-Rahman was that he placed the purpose in destroying the basics of social interaction fundamentally.

The communist government stated that marriage portion had to be abolished. Marriage did not need to be based on family. Women possessed the same writes as men, and education was mandatory for girls.”

3. Discussion

The significant matter on fundamentalists in Afghanistan is that these Islamic fundamentalist were at foreigners' service as a tool in the first place. They became an instrument to promote the interferers' incentives and aims without their own knowledge. Thus, although they tried to achieve two goals of “Fighting for the belief” and “Fighting for independence,” their efforts were actually made for the intervention, penetration, and progress of the West in Afghanistan. Hence, the US was the last winner of war in Afghanistan, instead of the fundamentalists and the people. Peter Marsedon clarified this matter and wrote, “The US government tried to establish a government in Afghanistan with roots in small fundamentalists groups and academic circles of the elites in an effort to make the Soviet Union unstable. This “Viable tool” was later followed in the behaviors of Taliban and Al-Qaeda.”

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Optimal Design of Wastewater Collection Networks Based on Production Rate of hydrogen Sulfide (h_{2s})

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ABSTRACT: Unfortunately, nowadays, like the sewage collection network water supply systems just based on hydraulic parameters (quantity) are designed. The quality of wastewater produced, while that in adverse condition is very efficient. H₂S production given that the relationship is in direct proportion BOD₅ waste more time on the network will be more Barely also increased and this is related to hydraulic parameters. Must therefore between wastewater quality and hydraulic parameters of a relationship can create the best system design is achieved. In tropical cities due to high temperatures during the year chemical reactions are accelerated, the rate has been rising, especially H₂S gases increased, destroyed sewage collection network and had to be seen along most of sewage collection networks already the end of the project did not have favorable conditions caused great financial burden on their maintenance will be contrary to the sustainable development.

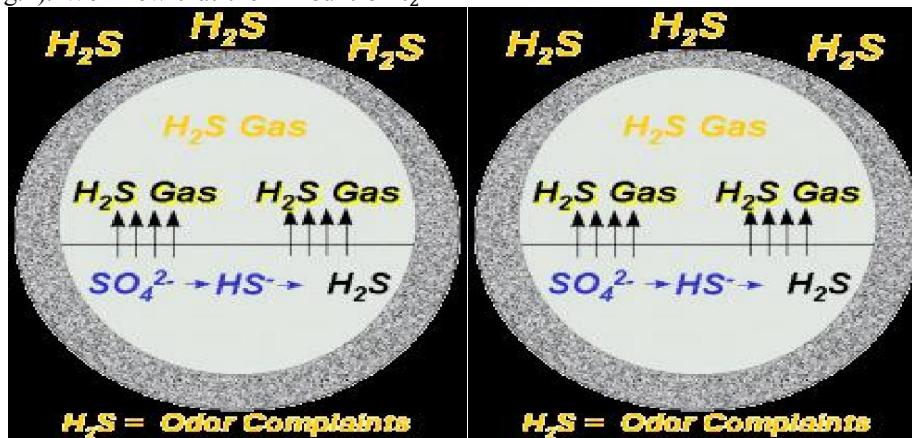
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Keywords: Wastewater Collection Network, h_{2s} , Quantitative and Qualitative Parameters of Wastewater, Sustainable Development.

Introduction:

Corrosion and Unpleasant Odors Produced By Wastewater Collection Networks, Especially in Tropical Regions Have Caused Great Economical and Health Damage. These Issues Require That in order to Prevent Huge Waste of Money, appropriate Solutions Should be Presented to Prevent these Problems. h_{2s} production of Wastewater Collection Networks is Based on Amounts of Organic Sulfur Which is Derived From Proteins, Inorganic Sulfur From the Sulfur of From Detergents. These material in the Absence of Dissolved Oxygen, Produce h_{2s} Gas Due to the Activity of Sulfate_ Reducing Bacteria. Because of Turbulence, this Gas Enters Headspace Sewers. Humidity and Oxygen are Need for the Oxidation of H₂S by Sulfur Oxidizing Bacteria, and as a Result, Produced. This Acid Corrodes Concrete by Dissolving its Calcium (fig.1). We know that the Amount of h_{2s}

in Excess of The Standard Level Will Cause Health Problems and Great Financial Costs, so it Must be Investigated And Estimated. The Basis of Most Prevention and Control Methods is Prevention From h_{2s} Production, or After it is Produced, the Oxidation Should be Carried Out Prior to Its Entry Into the Headspace of the pipe. in this Way, it Will Be Controlled. However, the Main Discussion of This Research is About Presentation of a Proper Method to Design Wastewater Collection Networks Given the Hydraulic and biological Parameters in Which We Could Significantly Reduce or Minimize The Amount of h_{2s} Production. But Nowadays Design process is Only Based on Hydraulic Parameters. During the Investigations, We Observed that There Were Several Mathematical Models in This Regard Which We set as Our Main Criterion for this Research.



As you see in (Fig. 1), h_{2s} Produced From the Surface of Wastewater Rises, and is Mixed With Headspace Air of Collection Networks and Sulfuric Acid is Formed;

There Fore, The Greater The Concentration of h_{2s} is, More Concentrated Acid Would be Produced and Corrosion Would be Greatly Exacerbated. next, We Will see That These Conditions Depend on Hydraulic and Biological Parameters of the Flow.

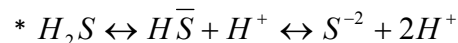
Research Background:

That Wastewater Collection Networks in Our Country Have Not a History, Applying Both Effective Hydraulic and Biological Parameters Has Not Been Considered in Design and Maybe the Only Solution is taken to be the use of Oxidizing Materials Which They put Into Sewers, But This Method is Not Just Engineering Method. However, Due to Higher Levels of Health and Increasing Advance in Science, Further and More Comprehensive Studies are Required. Outside Iran, (Pomeroy) in 1970 Did Research in the Field of the Formation of h_{2s} and Corrosion Phenomenon Which Were Affected By Factors Such as Bod (Biological Oxygen Demand), Temperature, Slope of Sewer Lines. Ratio of H/d, and Flow Rate, Another Important Research That Can be Noted Is Related to England Water Company in Britain. This Company _Which is One of the Largest Water Companies in England And Wales_ Covers 27500 KMS, Which Supplies Wastewater Collection Network For a Population Amounted to 5/8 Million People. In This Network, There are 28300 KMS of Sewer, 3904 Pumping Stations, and 1578 Refineries. Due to the Flatness of Ground and Corrosion Conditions, Extensive Research Has Been Carried Out Using Chemical Materials, Natural and Artificial Ventilation, oxygen Cylinders, Liquid Oxygen and Ozone. Another Study on Applying Chemical Materials to Prevent Production of h_{2s} Has Been Carried Out By Mary and Smitz in Which the Suggested Amount of Hydrogen Suggested Amount of Hydrogen Peroxide and Chlorine Required For Oxidation of Each Part of h_{2s} are 1/5 and 25_170 Parts By Weight, Respectively. According to Another Similar Research By ben and Scott, the Amount of Chlorine Required Has Been Reported 150 (MG) Per Liter. However What Can be Seen From Used Resources is That Actually in Most Parts of the World, Especially Developing Countries, This Design Process is Not Considered, and This Means High Financial Charges For Maintaining Wastewater Networks.

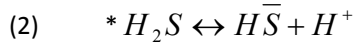
Problem Statement:

Raw Sewage(Wastewater) Includes Large Amounts of organic and Nonorganic Materials Many of Which are Useful for Micro_ Organisms. Microbial Transformations Begin With Compounds of Organic Materials in Wastewater Network. During This Transformation, Amounts Of Organic Materials are Eliminated, and it Can Be Said That Collection Networks, Them Selves, Act as a Wastewater Treatment System. Dissolved Oxygen, Ammonia, Sulfate, And Organic Materials are Constant Compounds in Wastewater, While Nitrogen is Among Those Substances that are not Found(or can be Found in Small Amounts) in Household Waste. In the Gravity Sewage Collection Networks, h_{2s} Production is Increased When The Flow occurs in Pipes Slowly and Aeration in the System is Low or Weak; That is, h_{2s} Production is in Anaerobic Environment; However, h_{2s} Production has a Direct Relationship With Temperature. In Addition, in Wastewater Collection Networks Part of The Network May be Designed Under Pressure. In The Case of Main Pressure Pipes, The Main Cause of h_{2s} Production is Retention Time More Than 1-2 Hours, and in Pressure Pipes With Small Diameter, The Main Cause of h_{2s} Production is the Mass Attached to the Walls of The Pipe. While in Main Pipes With Large Diameters, the Main Cause of h_{2s} Production Is the Fluid Inside the Pipes. Given That Other Design Parameters are constant, These Effects Can be Presented as a Connection Between Pipe Diameter and The Amount of h_{2s} Production, Which can be an Applied research.

Also, Biological Activity in Bed Load(De Posited Materials) in Wastewater Network Can be an Important Factor in h_{2s} Production. However, We Should Know That When we Want to Include Biological Parameters, Industrial Waste water is Very Important Since Industrial Waste water Includes Large Amounts of Organic Materials And Sulfur That Are Very Effective in h_{2s} Production. Calculation of The Concentration of Poisonous h_{2s} Gas and its Acidity is of Great Importance. H₂O Based on Chemical Equilibrium is Converted to Sulfur.



Chemical Equilibrium Established in The Above Relation has a Strong Association With Ph. Ph in Wastewater is Typically Between 6/6- 7/2. In This Range, Chemical Equilibrium Between h_{2s} and hs^- is Very Sensitive. A Δ ph=./2 Change in This Distance Causes a Change of About %30 in The Amount of h_{2s} Concentration Production. Accordingly, The Distinction Between hs^- and h_{2s} is Not so Clear. Calculation of Chemical Equilibrium Between hs^- and h_{2s} is Expressed According the Following Relation:



(3) $k = \frac{[HS^-][H^+]}{[H_2S]}$

h_2s Represents the Concentration of the Sulfide. h^+ Represents Hydrogen Concentration in the Environment. k Shows the Concentration of h_2s . k is equilibriums Constant, and its Rate at the Temperature of 250 is: $k = 9/12 \times 10^{-8}$

(4) $pH = -\text{Log}[H^+]$

$R = 8.3144 \text{ j / mole / k}$ $\ln \left[\frac{k(T)}{k(T_0)} \right] = \frac{\Delta H}{R} \left[\frac{1}{T_0} - \frac{1}{T} \right]$

Where R is Gas Constant. T_0 = Temperature of 25c. T is Also Related to This Temperature.

$\Delta H = \Delta HS^- - \Delta H_2S = -1603 + 3806 = 22.3(\text{kg / mole})$

After Describing Chemical Equations of h_2s Production, Mathematical Models Associated With the Issue Were Investigated in Which 5 Models Were Better other Models, Including:

$r_a = 0.5 \cdot 10^{-3} u(C_{BOD_{Total}})^{0.8} \cdot (C_{so_4^{-2}})^{0.4} \cdot 1.139^{(T-20)}$	(6)
$r_a = 0.228 \cdot 10^{-3} C_{BOD_{Total}} \cdot 1.07^{(T-20)}$	(7)
$r_a = 1.10^{-3} C_{BOD_{Total}} \cdot 1.07^{(T-20)}$	(8)
$r_a = k \cdot 10^{-3} (C_{COD} - 50)^{0.5} \cdot 1.07^{(T-20)}$	(9)

In These Investigations, There is a More Effective and Comprehensive Including an Effect of Hydraulic and qualitative Parameters of The Wastewater. Relationship Between Parameters is Given in The Form of a Relations Called (Z) Which is Described as Follows:

$Z = \frac{3 \cdot BOD_5 \cdot 1.07^{(T-20)}}{\sqrt{S \cdot Q}} \cdot \frac{P}{b}$ (10)

It's Parameters are Defined as Follows:

BOD: Biological Oxygen Demand After Five Days. (B): Width of Flow Level. (T): Temperature ("c"). (Q): Discharge of Wastewater Rate m^3/s . (p): internal wet Environment ("m"). (s): Slope of Sewer, "dimensionless". Described Formula is a Model Based on Which we Can Tell How Much is h_2s Rate in Wastewater Network and Which Classification of h_2s Measure Ments This Amount Belongs to, and Which Expression is Risk Chance. However (Z) is a Formula That its Value is Relevent to Changes in Hydraulic Parameters in Wastewater, and Based on Which we can Guess and obtain Proper Design Parameters. Large Biological Loads Cause too Much Increase in h_2s Production Which Results in Exacerbadted Corrosion. reduction in Section of the Network is Effective in Gas Production. Reduction in Setting Slope of Pipes is an effective Factor in Gas Production. Temperature and Biological Constant are Very effective. So all Designs Should be Prepared By Hydraulic Parameters and put into Described Relations in Order to Check Out the Cause of Destruction and Corrosion in Networks; Namely, h_2s . However, the best Relation is Relation(10). Thus we Can tell Which Class of The Gas Production Each Pipe in Collection Network Belongs to. In Addition, We Can See That There are 4 Classifications For h_2s Production.

*Table(1): Rate And Like LaHood of h_2s Production According to Formula(Z)

Lower Limit	Parameter	Upper Limit	Risk Assessment
0	Z	5000	Does Not Exist
5000		10000	Likelihood of h_2s Production
10000		25000	High Likelihood of h_2s Production
25000			Dangerous, High h_2s Production

Discussion and Conclusion: Investigations Determined That Quantitative

And Qualitative Parameters have Significant Impact on h_{2s} Production. All Mathematical Relations Described are Effective in Determining Rate in Wastewater Collection Networks.

Problems That May Arise Due to High Sulfide Production Include Production of Poisonous Odors Which Put People's Health in Danger, Corrosion of Cement and Metals Used in Networks Construction, and Blocking Wastewater Treatment Process in Networks. This Means Inconsistency With Sustainable Environmental Developments in all Aspects. In Relations 6, 7, 8, and 9 We Can See That h_{2s} Production Rate is Dependent on Qualitative Parameters of the Wastewater. Barely (BOD ORCOD) Has a Significant Role in This Relations, That Should be Always Calculated for Estimating h_{2s} Rate. Mathematical Model (8) Has Biological Factor (K) Whose Value Depend on type of Wastewater (urban and Industrial Wastewater 6,7,8, are More Efficient For Wastewater Collection Pressure Pipes. In This Study, Mathematical Relation (Z) Having all Quantitative and Qualitative Parameters, Was Evaluated Highly. Wastewater Collection Networks are Designed Half_ full; There Fore, We Should Consider Best Ratios of H/D (Height of Wastewater to the Diameter of Pipe) $\frac{q}{Q_{full}}$, $\frac{v}{V_{full}}$, $\frac{a}{A_{full}}$, $\frac{p}{P_{full}}$ at The Entire Design Time. The effects of h_{2s} Production Rate on Individuals' Health and Health Issues Were Also Studied. The Results are Given in Table (2).

Table (2): Production Rate Along With Individuals' Reactions

h_{2s} rate in the Surrounding air "PPm"	Individuals' Reactions
< 0/13	odorless
1	With Slight Odor
5	With Clear Odor
10	Health Limitations to Work During the Day
10-50	Limited eye irritation and Discomfort
30	With Very Unpleasant Odor
50-100	Minor Problems to Senses of Sight and Smell, and to Breathing Just in one Hour Contact time
100-1000	Unconsciousness and Death

*Suggestions: 1_ Designing Urban and Industrial Wastewater Collection Networks Should not be Based on Hydraulic Relations, Rather Best Designing Should be Based on Quantitative and Qualitative Parameters. 2_ as we saw, qualitative Parameters are Very effective in h_{2s} production; There fore, in Order to decrease h_{2s} production, Industrial Waste Must Be Prevented From Entering Urban Wastewater Collection networks Directly. 3_ in Order to Avoid Wasting Enormous Financial Costs (Maintenance and Replacement) Affected By Corrosion in Pipes, Model (Z) Must Be Included While Designing For Best Design. 4_ Continuous Good Monitoring During Implementation of Networks is Mandatory. 5_ Considering the Impact of Temperature Factor in Accelerating Biological Reactions, it Should be Pursued More Seriously in

Cities With Warm Climates. 6_ Using Model (Z), We Can Determine Best_ Type Networks in Terms of Material and Coatings Against Corrosion. 7_ Economical Issues Caused By Changes in Networks Design Should Be Studied. 8_ By Including The Unpleasant Odor is Produced By Wastewater. 9_ Most Iranian Cities Do Not Have Wastewater Treatment Plants, so The Wastewater Produced, Directly Enters Aquatic Ecosystems. If h_{2s} Rate is Higher than allowed Limit, There is a Possibility Of Toxicity to Aquatic Organisms, so it is Necessary To Include These relations.

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