ECOLOGICAL EFFECT OF ENVIRONMENTAL DEGRADATION ON WRONG CHANNELING OF SEWAGE WATER IN ABUJA MUNICIPAL AREA, F.C.T.

BY

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IN PARTIAL FULFILLMENT FOR THE AWARD OF POST GRADUATE (PGD) DEGREE IN ENVIRONMENTAL MANAGEMENT

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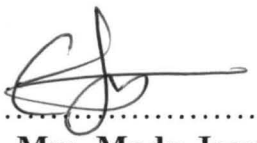
DECLARATION

I Mrs. Madu Josephine, hereby declare that this work was done by me under the supervision of Dr. H. A. Makun derived from published and unpublished work have been duly acknowledge and referenced with text.



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Mrs. Madu Josephine

28/11/08

.....

Date

CERTIFICATION

This is to certify that this project was carried out by Mrs. Madu Josephine and has been examined and approved as having met this partial requirement for the department of Geography of Environmental Management, Federal University of technology, Minna, Niger State, Nigeria.

28/11/08

Mrs. Madu Josephine — **Date**
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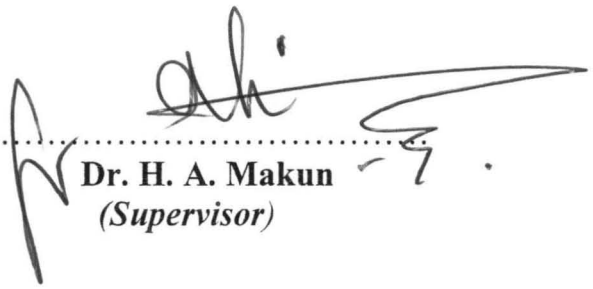

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DEDICATION

This work is dedicated to the almighty God for seeing me through my research work. I also dedicated it to my Husband and Children.

ACKNOWLEDGEMENT

I hereby give God the almighty the glory for the strength, wisdom and acknowledge give me to put this work together. I also appreciate my supervisor Dr. H. A. Makun who took all his time to make sure that this project becomes a reality. I will not fail to appreciate my Director General of National Biotechnology Development Agency, Prof. Solomon and my Departmental Director Dr. Onyia who real encourage me. I acknowledge Engr. John Nwachukwu for their immense support over my study.

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ABSTRACT

Water samples and soils were collected at five different sites from five (5) steams within Abuja metropolis (FCT) to determine how safe the streams or river water are for public consumption. These areas were Kubwa, Gwagwalada, Deidei, Mpape, and Gwawa rivers. The methods employed for the analysis were the standard methods for the examination of sewage water. The parameter used was bacterial load count. The result of microbial analysis indicates that total caliform (TC), were detected in samples from the sites; Fecal streptococcal, E. coli, and clostridium species were also detected out of the five sites, Gwagwa river contained the highest containment of clostridium organisms. From the results obtained, the likelihood of the outbreak of water borne diseases is very high hence necessary actions should be taken to forestall it.

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utilize oxygen released by photosynthetic algae, which are in turn absorbed materials released by bacterial activities as well as the introduced materials.

Aquatic pollution occurs when the self-purifying powers of water are unable to remove the materials added to it. This inability could arise from the fact that the time was not long enough or that the load by organic matters added into a body e.g. water, this directly or indirectly limits man's legitimate use or appreciated of that body of water. Such under tens include domestic, agricultural, transportation and recreational uses. Thus a materials when added to water dose violence to the observers aesthetic appreciation would be regarded as pollutant. Sewage are considered to be aesthetically offensive in the society. They contain an array of pathogenic viruses, bacteria, cyst of protozoa and eggs of helminthes that are capable of causing diseases infections in new hot (Rail, 1989).

Human excreta are the principle vehicle for the transmission and spread of a wide range of communicable diseases some of these diseases can cause sickness such as (amoebic diseases, dengue fever, hepatic A and E, e.t.c.) and death in societies where poverty and malnutrition are ubiquisitous.

In most areas in FCT there are millions of people who lack basic hygienic and acceptable method of sewage excreta disposal. However government or international agencies should be willing to spend large sum of money to improve this situation.

There is a community reorganization that the source of stream pollution pose grave health risk, not only humans, but to all aquatic organisms and the environment in which they live immediate attention must given to reducing these source of pollution if we are to sage our selves. (Samson, 2001).

Sewage and domestic waste was thrown into the streets where it flowed along open channels. Rats were plentiful and provided food for predatory in nineteenth century, the system of sewer and water carriage involved which did not produce many problems while the populations served remained scattered or reasonably small, but which gave rise to populations rivers and streams as the size of town grew. The problems produced were mainly inland or terrestrial however; little of the marine environment was affected apart from estuaries within the boundaries of or close to large cities.

Typical source of organic pollution include sewage from domestic and animals source, industry waste from food processes, however, in many situations the anthropogenic pollution overwhelms the given system. The amount of dissolved suitability for irrigation, drinking and industrial uses.

In general, water with total dissolved solid are most suitable for drinking high dissolved solid may leads to body. A large number of area in our aquatic environment support rare species and ecologically very sensitive. They need special protection since, the water (Act, 1974) provides for maintenance and restoration of wholes men's of aquatic resources which is directly related to ecological health of the water bodies, it is important that ecological health of the water bodies is given trust priority in the water quality goal (Yewandessen, 2003).

1.2 AIMS AND OBJECTIVE

- To determine the microbial load at different sites of streams near sewage area in the FCT metropolis
- To quantify the microbial load of water resource during run off event and compare the loads with regular wrong channeling
- To quantify the microbial load of soil samples at the stream sites.

CHAPTER TWO

2.0 LITERATURE REVIEW

It is well documented foecal contamination of drinking water has caused numerous disease outbreaks because the risks of disease outbreaks correlate with the incidence of feacal contamination and hence, the possible presence of disease-causing organism.

However, different microbiological faecal indicators are used in different countries and jurisdiction. Therefore, it is important to understand the potentials and limitations of these indicator organisms before realistically implementing guidelines and regulations to safeguard our water resources. This review considers the history of indicator organisms, the evolution of analytical methodologies (biochemical and molecular) and addresses the advantages and limitations of current faecal indicator micro-organisms. (Haward and Fetal, 2003).

When toxic substances enter a body of water they will be dissolved, become suspended in water or get deposited on the bed of the water body. The resulting water pollution causes the quality of the water to deteriorate and affects aquatic ecosystems. Pollutants can also seep down and affect groundwater deposits. Because of this, pollutants enter groundwater, rivers and other water bodies such water, which ultimately ends up in our households is often highly contaminated and can carry disease – calling microbes. (Phillips, 1997).

- Sewage originating primarily from kitchen, bathroom and laundry sources.
- Waste from food preparation, dish washing, washing, garbage-grinding, toilets, baths, showers and sinks.

Domestic sewage contains a wide variety of dissolved and suspended impurities. Having mounted to a very small traction of the sewage by weight, but it is large by

volume and contains impurities such as organic materials and plant nutrients that tend to rot. The main organic materials are food and vegetable wastes. Plants nutrients come from chemical soaps, washing powders, etc. Domestic sewage is also very likely to contain disease causing microbes. The various substances that we use for keeping our house clean add to water pollution because they contain harmful chemicals. Most detergents and washing powder contain phosphates which are used to soften the water, in washing powders affect the health of all forms of life in the water (Ellion, 1998).

When sewage enters a lake stream, micro-organisms begin to decompose the organic materials. Oxygen is consumed as micro-organisms use it in their metabolism.

Sewage contained water causes eutrophication, which is the increase in concentration of chemical elements required for life. The nitrates, phosphates, and organic matter found in human waste serve as a food for algae and bacteria. This causes these organisms to overpopulate to the point where they use up most of the dissolved oxygen that is naturally found in water, making it difficult for other organisms in this aquatic environment to live.

The bacteria are basically strangling to other organisms some of the organisms that do overpopulate from this can also be disease causing micro-organisms. Phosphate are also found in soaps and detergents, but there are other household products that we use everyday that can be toxic to many animals and humans if they are dumped directly into a water body. (Sharma 1995).

Bathers are at increase risk contracting illness due to bacteria and viruses presence in sewage effluent.

Gastrointestinal disorders have been linked to sewage pollution, with viruses implicated as the cause. Shell fish strain water through their gills to trap microscopic plants and animals for food. If the water was contaminated with disease causing bacteria, these could be consumed as food by shellfish when eaten raw or partially cooked, these shellfish can make people sick. Certain fish in contaminated water can accumulate high levels of toxic substances. When these foods are consumed frequently over a lifetime, they may increase the consumers' risk of adverse health effects. Detergents can cause liver and kidney damage while sewage water carries such as Giardiasis, Amoebic dysentery and Cholera (Haward, 2003).

It used to be said that the solution to pollution is "dilution". When small amounts of sewage are discharged into a flowing body of water, a natural process of stream Self-purification occurs. However, densely populated communities generate such large quantities of sewage directly into a nearby body of water, better to let it pass through a combination of physical, biological and chemical processes that remove some or most of the pollutants. This take place in sewage treatment plants. (Bunker S.G. 1985).

Sewage treatment plants neutralize and deactivate the chemicals found in the sewage water. They work by relying on the bacteria that is found in our colons, which eat away the nitrates, phosphates and organic matter that is found in sewage. These plants can be expensive to build and operate for many governments but there are cheaper alternative which rely on nature to do mist of the work. This is done by rebuilding or restoring wet lands, because the plant and bacteria found in the wetlands will do the same thing that bacteria in standard sewage treatment plants do. (Isiche, 1976).

The organic farming technique widely used in the Niger-Delta is highly susceptible to environmental changes affecting the soil, water and or deforestation because it is not technologically inspired, but rather land and labour intensive. Oil extraction and production has led to adverse environmental impact on the soil, forest and water of the Niger Delta communities. This has ultimately affected peasant agriculture in a variety of ways, which ultimately have caused problems of environmental refugees. Some of the landless farmers migrate to other more fertile lands. While some of the displaced farmers out-migrate to the urban areas in search of other means of livelihood. (Azibolamari, 1998).

Various harmful and toxic organic compounds when introduced into the natural environment during oil extraction such as during seismic work, oil spill, gas flares and several other forms of pollution changes, geochemical composition of the soil, river and other components lead to a drastic decline in output in both fishing and farming activities. (Staney, 1990) that "7.7% of the 797 people interviewed on the socio-economic impact of oil in Nigeria identified farm land pollution as a major problem".

The peasanats are very reactive to these changes because of the unavailability of modern farmaing and fishing techniques to meet the challenges of a declining soil and marine resources. The drastic tall in output of the long run effect of this is land degradatgion and immigration to other rural and urban areas, where pressure is exerted on the often inadequate and dilapidated infrastructure, leading to increase poverty.

In addition, (Ikporukpo, 1981) stated that most farmers are concern with problems of displacement without resettlement during oil spills". Gbadegesin (1997) further noted that "Apart from loss of farms, oil spills have led to extensive deforestation with no

adequate replanting practices. This in effect has shortened fallow periods, compounded land use degradation and led to a loss of soil fertility and consequently erosion of topsoil.

Elliot (1998) stated that "The slashed and burn agriculture traditionally practiced by shifting cultivators up to 10% of the world's population – is based on ecologically sound principles. It minimizes threats to the forest by leaving land fallow over period of time long enough for regeneration landless peasants whom have been forced from their own lands, increases the number of people pursuing such a subsistence life style, this contributes to deforestation through further encroachment on forestland lands and reductions in fallow time "oil resources" suffice it to note that in each of this export drive initiative, the local community people suffer greater problem of environment degradation and increasing poverty.

2.1 MICROBIAL PARAMETERS

Coli form bacteria, Escherichia coli, fecal streptococcal and clostridium have been indicated in the five sites the sample are being collected. When detected in drinking stream water that the people living there are drinking stream water it shows that there is faceal and other bacteria measured before that is high rate of contamination during run off and for the consumer, a risk of inflection with pathogenic enteric microorganisms salmonellae, Entria, viruses, Giardia, (Trickere, 1997).

Test for coli form bacteria and Escherichia coli are the most important routine microbiological examination carried out in drinking water. They provide the most

sensitive means for detecting faceal contamination and disinfection and for monitoring water quality.

In the contest of this method selective and gram staining which acid from cultureing form all shades and size of yellow colonies on plate account after incubation of 24 hours at 37 c followed by gram stain by 4 hours are regarded as coli form bacteria. The E.coli oxidase negative produce acid from lactose and in dole from, and form all shades and sizes of yellow colonies on plate account (after incubation for 37 c). Both coliform bacteria and E.coli have been regarded as members of the family of Enterobacteriaccae. Most strains of E.coli produce bata-glucuronidase enzyme (Kampter, P. etal, 1991).

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.2.1 SAMPLING

3.2.2 WATER AND SOIL COLLECTION

In this study, water samples were collected from the five streams. In each site, ten (10) samples of water and three of soil were collected. All together 50 samples of water were collected. The streams are located in the Federal Capital Territory Municipal Area, Abuja. Distilled water, syringes, disposable bottles, marker, masking tape, hand gloves Petri dishes, colony counter, etc were used.

The samples were labeled with masking tape and marker. 10mls of the water samples were each collected on a different day. Each 10mlswas dispensed in a serial tube bottle mixed with already prepared Mckonkey Broth. The control samples were similarly treated and was cultured in sterile Petri dishes then were incubated at 37^0c for 24 hours. The selective media was dispensed on a plate and mixed with the samples. Colony were counted and recorded on each of the following days.

3.2.3 CRAM STAINING

A smear was made from each organism's growth on selective media using a wire loop, this was heated fixed and air dried. Crystal violet was used as the primary stain for 1 minute: this was washed off with tap water. Iodine was the mordant used for 30 seconds: this was again washed off with tap water

45% ethanol was the counter stained used: this was washed off with water counter stained used: this was washed up with water. Counter staining was a minute. It was wash off again and the slides dried and observed at 100 x magnification using oil immersion.

CHAPTER FOUR

4.0 RESULTS

The results of viable counts and different organisms isolated from samples obtained as different sites in five streams located in Abuja municipal area are given in table Tables 1- 10 below

Table 1.

Samples	**Viable plate count**	**Organisms isolated**
Edge A	200cfu/ml	*E. coli*
Edge B	225cfu/ml	*Coli form*
Edge c	204cfu/ml	*Fecal streptococcal*
Edge d	300cfu/ml	*Clostridium*
Middle a	210cfu/ml	*Clostridium*
Middle b	222cfu/ml	*Clostridium*
Middle c	245cfu/ml	*Clostridium*
Middle d	204cfu/ml	*Clostridium*
Middle e	200cfu/ml	*Clostridium*
Soil	250	

Table 2 Staining result of Kubwa River, sample.

MICROSCOPIC	OBSERVATION	SELECTIVE MEDIA
Sabouraud dextrose Agar.	White coloured growth observed.	Yeast & cocci (gm-ve).
Simmons citrate agar.	Blue coloured growth observed.	Cocci(gm-ve).
Nutrient agar.	Yellow coloured growth observed.	Rods(gm-ve) cocci(gm-ve).
Salmonlla shigell agar.	Black coloured growth observed.	Cocci(gm-ve)

Table 4: Staining results of Gwagwalada River Samples.

MICROSCOPY	OBSERVATION	SELECTIVE MEDIA
Sabourand dextrose agar	White coloured growth	Yeast & -ve cocci.
Simmons citrate agar	Blue coloured growth	Yeast & -ve cocci.
Nutrient agar	Yellow coloured growth	-ve rods & -ve cocci.
Salmonella shigella agar	Black coloured growth	-ve cocci.
Macconkey agar	Pink coloured	-ve rod.

Table 5 Viable plate counts from Deidei River samples.

SAMPLE	VARIABLE PLATE COUNT	ORGANISM ISOLATED
Edge A	200cfu/ml	E.coli
Edge B	225cfu/ml	Coliform.
Edge C	204cfu/ml	Fecal streptococcile.
Edge D	300cfu/ml	Clostridium sp.
Edge E	240cfu/ml	
Middle A	210cfu/ml	Coliform bacteria.
Middle B	222cfu/ml	Feacal streptococcal
Middle C	245cfu/ml	E.coli
Middle D	204cfu/ml	E.coli
Middle E	200cfu/ml	E.coli
Soil	250cfu/ml	

Table 6: Staining results of DEIDEI RIVER samples.

ICROSCOPY	OBSERVATION	SELECTIVE MEDIA
Sabouraud dextrose agar	White coloured growth observed	Yeast & -ve cocci
Simmons citrate agar	Blue coloured growth	Yeast & -ve cocci
Nutrient agar	Yellow coloured growth	-verods& -ve cocci
Salmonella shigella agar	Black coloured growth	-ve cocci.
Macconkey agar	Pink coloured	-ve rod -ve cocci

Table 7: Viable plate count results from Gwagwalada River samples.

SAMPLES	VIABLE PLATE COUNT	ORGANISMS ISOLATED
Edge A	180cfu/ml	*E.coli*
Edge B	204cfu/ml	*Coli form*
Edge C	205cfu/ml	*Fecal streptococcal*
Edge D	300cfu/ml	*Clostridium*
Edge E	250cfu/ml	
Middle A	280cfu/ml	
Middle B	294cfuml	
Middle C	200cfu/ml	
Middle D	218cfu/ml	
Middle E	284cfu/ml	
Soil	208	

Table 7: Viable plate count results from Gwagwalada River samples.

SAMPLES	VIABLE PLATE COUNT	ORGANISMS ISOLATED
Edge A	180cfu/ml	*E.coli*
Edge B	204cfu/ml	*Coli form*
Edge C	205cfu/ml	*Fecal streptococcal*
Edge D	300cfu/ml	*Clostridium*
Edge E	250cfu/ml	
Middle A	280cfu/ml	
Middle B	294cfuml	
Middle C	200cfu/ml	
Middle D	218cfu/ml	
Middle E	284cfu/ml	
Soil	208	

Table 8: Staining results of Gwagwa River samples.

MICROSCOPY	OBSERVATION	SELECTIVE MEDIA
Sabouraud dextrose agar	White coloured growth observed	Yeast & -vecocci
Simmons citrate agar	Blue coloured growth	Yeast & -vecocci
Nutrient agar	Yellow coloured growth	-verods & vecci
Salmonella shigella agar	Black coloured growth	-vecocci.
Macconkey Agar	Pink coloured	Veroid -Vecocci

Table 9: Viable plate counts of Mpape river samples.

SAMPLE	VIABLE PLATE COUNT	ORGANISM ISOLATED
Edge A	264cfu/ml	*E.coli*
Edge B	200cfu/ml	*Coliform.*
Edge C	255cfu/ml	*Fecal streptococcil*
Edge D	390cfu/ml	*Clostridium*
Edge E	210cfu/ml	
Middle A	150cfu/ml	
Middle B	192cfu/ml	
Middle C	202cfu/ml	
Middle D	195cfu/ml	
Middle E	200cfu/ml	
Soil	300cfu/ml	

Table 10: Staining results of Mpape River samples.

MICROSCOPY	OBSERVATION	SELECTIVE MEDIA
Sabouraud Dextrose Agar	White coloured growth observed	Yeast & -ve cocci
Simmons citrate agar	Blue coloured growth	Yeast & -ve cocci
Nutrient agar	Yellow coloured growth	Rods (- ve) & cocci (- ve)
Salmonella Shigella agar	Black coloured growth	-ve cocci.
Macconkey Agar	Pink coloured	-Ve roid -Ve cocci

CHAPTER FIVE

5.0 DISCUSSION AND CONCLUSION

5.1 DISCUSSION

Water remain the primary commodity for the existence of all life and its diversified use in various facets of technological society like food processing, transportation and irrigation can not be over – emphasized. Studies have demonstrated inflection cycles between animals environments Including effluents, surface water, insects, birds, rodents and man. These cycles being responsible for high contamination of food and feedsa and hence the numerous infection in man (Kampel, 1977).

The bacteriological analysis of water is very important because of the increasing incidence of water related diseases, water serve as a vehicle for numerous pathogens (Kim and Stone, 1980 . the bacteriological load of any given water source e.g. River, well tap, Hawked e.t.c it is directly related to the level of pollution. Water pollution is a phenomenon in which there exists an over load of wastes materials or heat such that the ability for self purification is lost. The quality of such water deteriorates as undesirably changes occur in its physical, chemical and biological properties. (NEST, 1991).

Water grossly polluted with human excretal matter, domestic sewage, animal and other human waste contain bacteria in large number (Lewis and Louites, 1992).

These waste pollute water by introducing into its viruses, bacteria, and protozoan. The test for their presence must therefore be carried out on a qualitative basis because consumption of such water without treatment can cause water borne diseases such as typhoid, infectious hepatitis, cholera and dysentery (NEST, 1991). Diarrhea diseases remain the leading infectious cause of infant and child mortality and morbidity in many developing nations.

Upto 1 billion episodes of diarrhea yearly affect children under 5 years of ages in places like Asia, Latin America and Africa (Stephen and Tracey, 1991). Stephen and Tracey, extrapolating from estimates from the World Health Organization and published reports, estimated that the total morbidity burden for all ages in these ranged from 3 to 5 billion infections per year. The mortality rate has been estimated to be a high as one in ten for children in this age group and diarrhea diseases have been found to account for more than one – third of pediatric deaths in parts of this region (NEST, 1991).

Additionally, there exist significant adverse physical, mental and social disabilities occurring from the synergistic relationship between diarrhea infection and malnutrition and dehydration, often these will persist in the affected population through out their life span (Stephen and Tracey, 1991). The synergism also lowers the general health status of the affected population. The resultant increased susceptibility of young children mortability from other causes. More significant, however, are the "hidden burden" of diarrhea affected poverty, deprivation, debility and the inability of surviving children to achieve their social, cultural and genetic potentials L (Lonergan and Vansickle, 1991).

The surest confirmation of serious and widespread water pollution in Nigeria is in fact the level of incidence of water related diseases. The most serious of these are dysentery, cholera and typhoid. Cholera, infantile diarrhea and dysentery are the second commonest health problems or complaint after malaria in Nigeria (NEST, 1991). Before 1970, cholera was very rare in tropical Africa. But in that year and epidemic of the diseases broke out in Nigeria and several thousands deaths occurred. The diseases is now endemic and local outbreaks now take place across the country particularly during each dry season

which unfortunately has persisted through out the year at least in the northern part of Nigeria (NEST, 1991).

In recent years, Abuja has experienced a great increase in developmental project such as roads construction and new industries, in an attempt to urbanize the FCT, the result of which is the improper sewage disposal and the dumping of effluents mostly untreated that has increased the level of pollutants. Theses pollutants not only drained into ground water but also streams, rivers and lakes which are the primary sources of water supply.

The bacteriological survey therefore is aimed at assessing and detecting the presence of pathogens e.g. E. Coli, Streptococcus Faecalis, Salmonella and Shigella Species and the bacteriological pattern of different streams located in Abuja municipal area.

The wrong channeling of sewage water into Kubwa River (typified by unacceptable discharge of domestic sewage, faces and urine into river run off) has led to pollution of the river.

This pollution which is on the increase daily due to man made activities of using the bridge result in slightly viscous water being channeled into the main Kubwa river often creating aesthetic unpleasantness.

As a result of continuous discharging of domestic sewage into the river, the pollution culminates and consumers contact a lot of diseases while using it.

The soil bank shingle average count of 208cfu/ml each could be due to the rains washing the microbial load from the soil bank, to the edge and middle river (off sure respectively). Yeast, cocci and gram negative rods found in the water and soil samples occurs with the work of Gareth, (1976) in which unicellular fungi (yeast), gram negative aerobic rods

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APPENDIX

CALCULATION FOR COLI FORM TEST

DATA

Medium used	=	makonckey Broth
No. of samples	=	13
Quantity of mls per test tube	=	10mls
Quantity of control	=	10mls
Total No. mls	=	140mls

From manufacturer's direction

40g = 160 Litres

Xg = 140 (cross multiplication)

$$\frac{40 \times 140}{1000} = xg$$

= 5.6g

= 5.6g of Mackonkey Broth was dissolve in 140ml of water

VIABLE PLATE COUNT

DATA

Medium used = plate count Ager

No. of samples = 13

Total mls per plate = 20mls

13 x 20 = 260 + 20

Total No. mls needed = 280mls

From manufacturer's direction

17.5g = 1000 Litres

Xg = 280 mls

$\frac{17.5 \times 280}{1000} = xg$

= 4.9g

= 4.9g of plate Agar was dissolve in280mls of water.

ISOLATION SELECTIVE MEDIA

CALCULATION OF SELECTIVE MEDIA USED

Sabouraud Dextrose Agar

DATA

No. of samples = 13

Total mls per plate = 20mls

Quantity of mls for control = 20m

13 x 20 = 260 + 20

= 280mls

From manufacturer's direction

65g = 100mls

Xg = 280ml

$$= \frac{40 \times 140}{1000}$$

= 18.2

18.2 of sabouraud Dextrose Agar was dissolve in 790ml of water

CALCULATION FOR SIMONS – CITRATE AGAR

DATA

No. of samples = 13

Total mls per plate = 20

Quantity of mls for control = 20

13 x 20 = 260 + 20

= 280mls

From manufacturer's direction

22.5g = 1000 litres

Xg = 280ml

$$= \frac{22.5 \times 280}{1000}$$

= 6.3g

6.3g of summon Citrate Agar was dissolve in 280mls of water

CALCULATIONS OF SALMONELLA SHIGELLA AGER

DATA

Total No. of mls needed = 280ml

From manufacturer's direction

60g = 1000mls

Xg = 280

$$= \frac{60 \times 280}{1000}$$

= 16.8g

16.8g of Salmonella was dissolve in 280ml.

CALCULATION FOR NUTRIENT AGAR

DATA

Total No. of mls needed = 280mls

From manufacturer's direction

28g = 1000 litres

Xg = 280ml

$$= \frac{28 \times 280}{1000}$$

= 7.84g

7.84g of Nutrient Agar was dissolve in 280ml of water

CALCULATION FOR MAcCONCKEY AGAR

Total No. of mls needed = 280mls

From manufacturer's direction

50g = 1000 litres

Xg = 280ml

$$= \frac{50 \times 280}{1000}$$

= 14g

14g of MacConckey Agar dissolve in 280ml of water. Agar was dissolve in 280mls of water.