Pathogenic Bacteria Found in Some Drainage in Port Harcourt.

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Abstract
Water borne pathogen contamination in ambient water bodies and related diseases are a major water quality concern throughout the world. Water borne pathogen contamination in ambient water bodies and related diseases are a major water quality concern throughout the world. On a rainy day the total heterotrophic bacteria counts were $1.49x10^7$, $5.96x10^7$ and $2.3x10^7$ while on a dry day it was $1.08x10^7$, $1.14x10^7$ and $8.2x10^6$ for CFC, IKOKU & RUMUOKORO respectively. Rumuokoro was found to have the highest total heterotrophic counts. Bacterial species isolated were Bacillus species, Micrococcus species, Staphylococcus, Enterobacter species, Escherichia coli, Proteus species, and Serratia species are causative agents of fatal diseases like gastro, typhoid, cholera, and food poisoning in humans. This study revealed that on a rainy day those working around this drainage will be exposed to both opportunistic and pathogenic organisms.

Introduction

Drainage system includes all components like drive way crossing and vegetative swales, over flow paths and flood paths which are needed to ensure that the substructure is properly drained. (Pidwirny, 2006). It is the system that collects the water surface and / ground water and directs it away, thereby keeping the ballast bed drained (Pidwirny, 2006). It protects the substructure from erosion, from becoming sodden and losing its load bearing capacity and stability. (Pidwirny, 2006). In geomorphology, drainage system, also known as river systems, are the patterns formed by the streams, rivers, lakes in a particular drainage basin. (Pidwirny, 2006). They are governed by the topography of the land, whether a particular region is dominated by hard or soft rocks, and the gradient of the land. (Pidwirny, 2006). A drainage basin is the topographic region from which a stream receives runoff, through flow, and ground water flow. (Pidwirny, 2006).

Water borne pathogen contamination in ambient water bodies and related diseases are a major water quality concern throughout the world. Pathogen contamination is a serious issue for almost all types of ambient water bodies, making its recognition and understanding essential (U.S.EPA, 2012). Water borne pathogen contamination was reported to be associated with inadequate sanitation becoming the major cause of diseases worldwide, whereas improved sanitation is known to have a significant positive impact in reducing the rate of, infection and death from the environment on health both in household and across communities (OECD, 2012, Carr, 2001).

Due to poor sanitary conditions of the drainage system in developing countries, a result of unregulated disposal of sewage, hospital waste, household waste etc., pathogenic bacteria have been encouraged to thrive in these systems (Breathnach et al; 2012). Water borne diseases such as diarrhoea, gastrointestinal illness associated with pathogenic bacteria have been the cause of many outbreaks (Craun et al 2006). In developing countries, such as Africa, water borne diseases affect millions (Fenwick, 2006). According to world health organisation (WHO), each year 3.4 million people, mostly children die from water related diseases (WHO, 2014). According to United Nations children's Fund (UNICEF) assessment, 4000 children die each day as a result of contaminated water (UNICEF, 2014). It was reported that over 2.6 billion people lack access to clean water, which is responsible for about 2.2 million deaths annually, of which 1.4 milion are in children due to water pollution and contamination of the aerosol (WHO, 2010). Improving water quality can reduce the global disease burden by approximately 4% (WHO, 2010).

The clinical impact of drain as reservoirs of microorganisms has not yet been fully explored although it is widely established that human excretions such as faeces, urine, oral-nasal aerosols, and skin flakes will carry microbial burden consisting of bacteria and/ or virus (Hamada and Abe, 2010). For instance, there are 120 different viruses in human faeces (RAO, 2012) and it has been reported that patient flora can be detected in drains (Hamada and Abe, 2010). Hota et al, 2009 elegantly showed the presence of *Pseudomonas aeruginosa* bio film in drainage systems and their role in the propagation of an outbreak (Hota et al: 2009). It is also known that bacteria such as *Staphyococcus aureus* promote the transfer of antibiotic resistance to other bacteria when present in bio film (Savage, et al; 2013). Pathogenic organisms found in the drainage system are capable of causing diseases to humans which can be spread through physical contact (Santosan, 2013). Therefore, when drainage system is not properly managed, pathogenic microorganisms (bacteria) can be introduced into the environment, which results to contamination of surface water, ground water, that pose threats to humans, animals, and the environments.

This study was carried out to identify pathogenic species of bacteria found in ikokwu, CFC and Rumuokoro drainage site in Port Harcourt, and also to examine the effects of these pathogens on the individuals living in that area. The aim of this study was to identify the different species of pathogenic bacteria found in Ikokwu, CFC, and Rumuokoro drainage site in Port Harcourt. The objectives were to evaluate the microbial load of pathogenic bacteria in the drainage and their possible effects of pathogenic bacteria in the health of individuals living around the drainage.

Materials and methods

Description of sampling area

The sampling site is Ikokwu drainage located at 36 Olu Obansanjo road, Port Harcourt Rivers state, besides where car parts are sold and repaired between Longitude 6.99847 and 659'54.504''E and Latitude 4.79749 and 4.47''50.952'' N and the second is at CFC between Longitudes 7.00343 and 701'2.36'' E and Latitude 4.79564 and 4.47'44.286'N and the third sampling site is at Rumuokoro. The three study area was chosen because of the large population of people living and working in the vicinity, lack of proper hygiene and environmental sanitation can result to intense contamination of infection.

Sample collection an Isolation of pure cultures

Standard field sampling kits were used for sample collection. The water samples were collected into sterile sample bottles labelled A, B and C at different points and transported to the laboratory.

Microbiological analysis

Surface water in the drainage were analysed when it has rained and when it has not rained for total aerobic heterotrophic bacteria by the dilution plate count method. 1ml of each of the samples were aseptically transferred into a sterile test-tube containing 9.0ml diluents (normal saline) with a sterile class 1ml pipette as described by Akinde and Obire (2008).Subsequently six fold (10-6) serial dilutions were prepared from the 10-1 dilution of each of the samples. A 0.1ml aliquot of 10-4and 10-5 dilution were aseptically removed with a sterile pipette and spread on well-dried nutrient agar and MacConkey Agar plates for bacterial isolation and enumeration in triplicates. The inoculated plates were incubated at 370C for 18-24 hours. Colonies which developed on nutrient agar and MacConkey agar plates were counted as total heterotrophic bacteria (THB).

Characterization and Identification of isolates
Characterization and identification based on their cultural, morphological and biochemical characteristics. The presumptive identification of isolates shall be done with reference to Bergey's Manual of Determinative Bacteriology (Holt et al., 1994).

Biochemical analysis
Standard methods were used for the following chemical tests below were performed for the identification and characterisation of bacteria isolates according to the manufacturer's instruction:

- Grams staining
- Catalase test
- Oxidase test
- Coagulase test
- Indole test
- Motility test Methy red- vogues proskauer test (mrvp)

Results
Table 1: Total heterotrophic bacteria count of water sample collected from Ikokwu, CFC and Rumuokoro when it has rained.

Sample	Total heterotrophic bacteria count	
	Nutrient agar	MacConkey
CFC	$1.49X10^7$	$6.2X10^6$
IKOKWU	$5.90X10^7$	$4.07X10^7$
RUMOKORO	$2.35X10^7$	$1.70X10^7$

Table 2: showing the three different drainage when it has and has not rained

SAMPLE	TOTAL HETEROTROPHIC COUNT			
	WHEN IT HAS RAINED		WHEN IT HAS NOT RAINED	
	NA	MA	NA	MA
CFC	$1.49X10^7$	$4.63X10^6$	$1.08X10^7$	$4.63X10^6$
IKOKU	$5.96X10^7$	$4.07X10^7$	$1.143X10^7$	$6.07X10^6$

RUMUOKORO	$2.35X10^{7}$	$1.70X10^{7}$	$8.2X10^{6}$	$4.26X10^{6}$

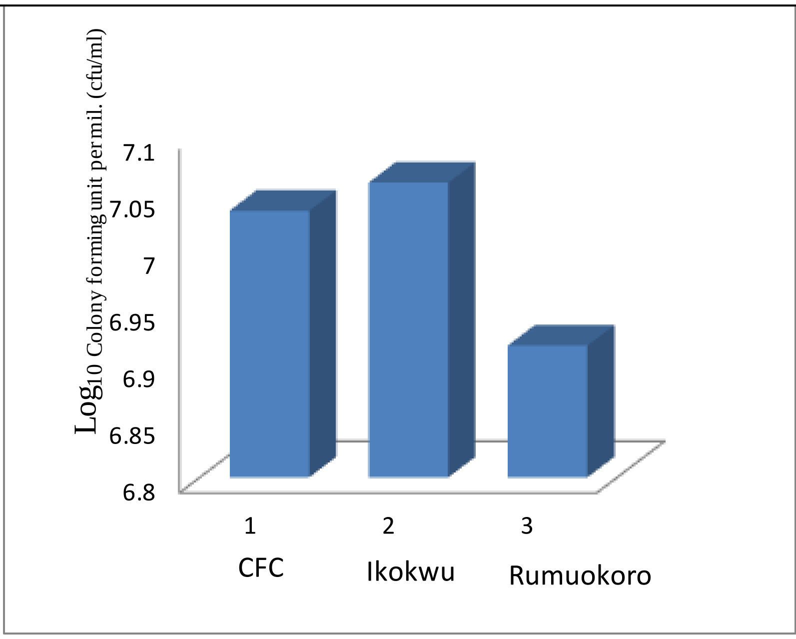

Fig1. Graphical representation of colony forming units of nutrient agar and MacConkey agar bacterial growth from CFC, Ikokwu, Rumuokoro sampling sites when it has rained

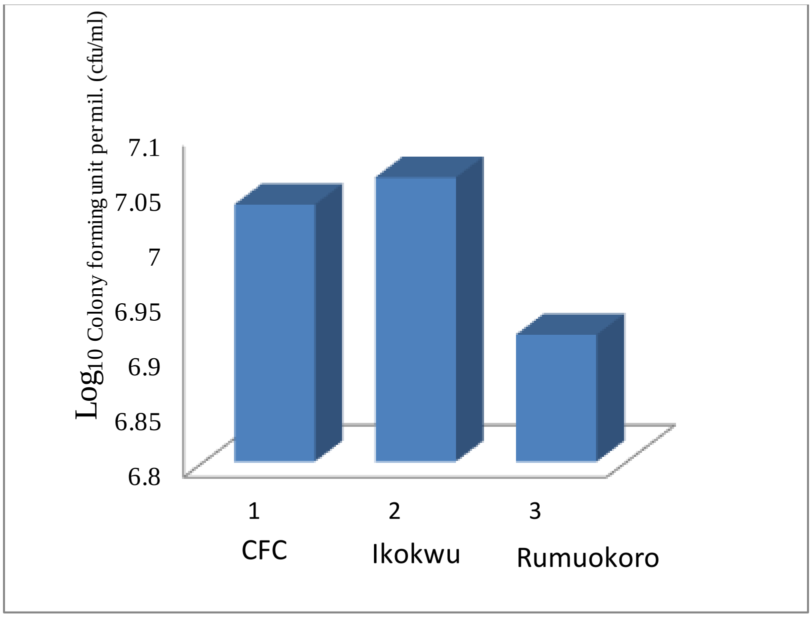

Fig 2. Graphical representation of colony forming units of nutrient agar and Macconkey agar bacterial growth from CFC, Ikokwu, Rumuokoro sampling sites when it has not rained

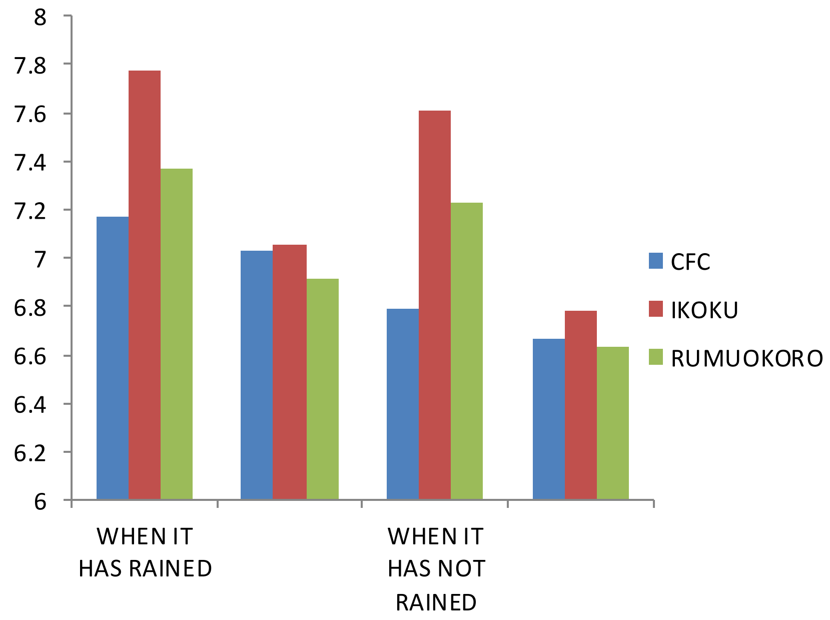

Fig3: Graphical representation showing comparison of the three drainage system when it has rained and when it has not rained.

Discussion

The intense presence of these bacteria in drainage systems is dangerous because they can also cause opportunistic infections. Clearly, drainage is a reservoir for microbes and antibiotic residues. It is also clear that human excretions such as faeces, used oil from mechanic shops, urine, oral-nasal aerosols, and skin flakes carry microbial burden consisting of bacteria and microbes in drains and pipes adheres to the surfaces of drains and draining pipes as microbial biofilms, creating a complex ecosystem of different microbes that are fed by organic and inorganic matters (Hota *et al.*, 2009).

From the result obtained, the total heterotrophic bacteria count of water sample in table 2 collected when it has not rained showed that the water sample collected at that time had the lowest number of bacteria species because when there is sunlight the temperature of the drainage system is high and therefore only thermophiles can thrive in that drainage. When it has rained the bacterial species proliferate more because of high deposits of debris and organic matters in the drainage. Bacterial species isolated were *Bacillus species, Micrococcus species, Staphylococcus, Enterobacter species, Escherichia coli, Proteus species*, and *Serratia species* are causative agents of fatal diseases like gastro, typhoid, cholera and food poisoning in humans.

Holt *et al.*, (1994) also reported that *Bacillus* is a genus of gram-positive, rod-shaped bacteria and a member of the phylum Firmicutes *Bacillus* species are obligate aerobes (oxygen reliant), or facultative anaerobes (having the ability to be aerobic or anaerobic). They test positive for the enzyme catalase, citrate when there has been oxygen used or present. Ubiquitous in nature, *Bacillus* includes both free-living (non-parasitic) and parasitic pathogenic species. Under stressful environmental conditions, the bacteria can produce oval endospores that are not true 'spores', but to which the bacteria can reduce themselves and remain in a dormant state for very long periods. These characteristics originally defined the genus, but not all such species are closely related, and many have been moved to other genera of the Firmicutes (Madigan, 2005).

From the result obtained, *Micrococcus specie* is a genus of bacteria in the Micrococcaceae family. *Micrococcus* occurs in a wide range of environments, including water, dust, and soil. Micrococci have Gram-positive spherical cells ranging from about 0.5 to 3 micrometers in diameter and typically appear in tetrads. They are catalase positive, oxidase positive, indole negative and citrate negative. *Micrococcus* has a substantial cell wall, which may comprise as much as 50% of the cell mass as reported by Kocur *et al.,* (2006).

Serratia is a *specie* of rod shaped, gram negative bacteria in the family Enterobacteriaceae a human pathogen. They are catalase positive, oxidase negative, indole negative, citrate positive.

The characteristics of *Enterobacter* and *Escherichia coli* observed from the result portray these bacteria as genus of common Gram-negative, facultatively anaerobic, rod-shaped, non-spore-forming bacteria of the family Enterobacteriaceae. Several strains of these bacteria are pathogenic and cause opportunistic infections in immunocompromised (usually hospitalized) hosts and in those who are on mechanical ventilation. The urinary and respiratory tracts are the most common sites of infection. The genus *Enterobacter* is a member of the coliform group of bacteria. It does not belong to the faecal coliforms (or thermo tolerant coliforms) group of bacteria, unlike *Escherichia coli*, because it is incapable of growth at 44.5 °C in the presence of bile salts. Some of them showed quorum sensing properties as reported before by Tan *et al.,* (2014).Cabral (2010), also reported that the genus *Enterobacter* and Escherichia coli ferments lactose with gas production during a 48-hour incubation at 35-37 °C in the presence of bile salts and detergents. It is oxidase-negative, indole-negative, and urease-variable.

Total Heterotrophic plate count in table 1 and 2 shows that Enterobacter and Escherichia coli are mostly found in drainage and sewage drains as stated by Sonali, (2011), that coliforms like Escherichia and Enterobacter, micrococci, are facultative clostridia and streptococci predominate during first course of sewage decomposition. Diluted sewage provides aerobic conditions for the growth of these aerobic and facultatively aerobic bacteria. Such condition is obtained when sewage is discharged into the water body like a river. Under these conditions, organic matter containing protein, carbohydrates and fats is completely oxidized by aerobic bacteria.

Conclusion

The result obtained confirmed the concern that pathogenic bacteria are present in drainage sites and it is of great importance, since it is associated with diseases that causes harm to humans and animals living in that area. This study also showed that the disease can be gotten more easily when it has not rained and the drainage has not been washed by rain water. This implies that individuals living within the drainage site are at risk of infection since the bacteria can be disseminated into homes through contact with water during walking, which is capable of causing diseases especially in immune compromised individuals. Proper and regular cleaning of the drainage reduce the spread of pathogenic bacteria to humans.

Recommendations

These recommendations should be considered by government, environmentalists and including individuals:

- Discharge of used oil, untreated industrial and domestic effluent into the drainage channels should be stopped; environmental protection agencies (EPAS) should enforce this strictly.
- Feasibility study should be carried out before drainage is constructed to ensure that it is located at the proper site.

- Regular medical check-up should be carried out by drainage environmentalist.
- People should be advised not to live within areas close to a drainage as they may be exposed to the spores from pathogenic bacteria and even fungi.
- Laws governing the dumping of refuse at drainage sites should be enacted and enforced.
- Individuals should be educated on the effect of unhealthy drainage as it can cause harm to individuals and animals within the vicinity.
- It is necessary for environmentalist to apply the knowledge of these bacterial species associated with drainage system in the decomposition of organic matter in the environment using biotechnology in bioremediation; degradation of waste water treatment containing soluble and particulate organic materials such as ultra-activated sludge.

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