Studies on Bacteria in Drainage Systems in Gwagwalada Area Council, Abuja

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Abstract: Forty drainage water samples were collected from four areas in Gwagwalada area council, Abuja, Nigeria and screened for the presence of bacteria using Spread Plate Methods. The bacteria were identified on the basis of their morphology, cultural characteristics, biochemical test and Gram staining. A total of 7 isolates belonging to three genera were recovered. Maximum number (13/40, 32.50 %) of bacteria was recovered from Kuntunku, followed by Dagiri (9/40, 22.50 %), Agwandodo (9/40, 22.50 %) and the least number of bacteria was isolated from Phase I (7/40, 17.50 %). *Escherichia coli* and *Staphylococcus aureus* were equal in their prevalence and represented 25%, each while *Strepcococcus pyogenes* and *Salmonella typhi* were also the same and the least represented 12.50% each. The rate of isolation of the bacteria were tested at p = 0.05 level of significant. As a result of the pathogenic bacteria isolated from the drainage water samples in the Gwagwalada metropolis it is therefore recommended that the runoff from the drainage system should not be allowed to contaminate drinking water, because the isolated bacteria can cause several diseases of man.

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1. Introduction

Bacteria in drainage system present a degree of diversity without parallel in the biological world; they are found in all environments even those that are inhospitable to other live organisms. According to Horner-Devine *et al*. (2004) one of the important points of the bacterial ecology is the description of the distribution of the bacterial diversity along the environmental gradients. Urban runoff or wet weather flows include not only precipitation and wash off from lawns and landscaped areas, buildings, roadways and parking lots, but often separate sewer overflows or discharges resulting from inflow and infiltration (Lalor and Pitt 1998). Pollutants entering these receiving waters by way of urban drainage systems, or wet weather sewage overflows, may adversely impact many of the desired uses such as; stormwater conveyance (flood prevention), biological uses (warm water fishery, aquatic life uses, biological integrity, etc.), non-contact recreation (linear parks, aesthetics, boating, etc.), contact recreation (swimming and fishing), and water supply. Water Environment and Technology (1996a) reported that the National Water Quality Inventory released by the U.S. Environmental Protection Agency (EPA, 1983) showed only a slight improvement in the attainment of beneficial uses in U.S. receiving waters. Bacteria and nutrients were cited as leading problems, and urban runoff was cited as a leading source of these problems. Bacteria, in particular, are associated with limiting human recreational and drinking water use. Recent epidemiological studies have shown significant health effects associated with pathogens in stormwater contaminated marine swimming areas. Pathogens found in stormwater from separate storm drainage systems are a significant public health concern, as are pathogenic protozoa associated with likely sewage-contaminated stormwater (Ellis 1985). Bacteria present a degree of diversity without parallel in the biological world, they are found in all environments even those that are inhospitable to other live organisms. According to Horner-Devine *et al*. (2004) one of the important points of the bacterial ecology is the description of the distribution of the bacterial diversity along the environmental gradients. In freshwater systems these studies can also contribute to activities designed to monitor the water quality and the impact of human activities on that quality (Tian *et al*., 2009; Sood *et al*., 2008). Although in some agricultural areas, studies have been carried out to analyze the effects on bacterial diversity of the chemical substances used for fertilization and pest control Johnsen *et al*. (2001) arrangements associated to cultivation (Weber *et al*., 2001; Hengstmann *et al*., 1999), these studies mainly analyze the impact of different factors on the biodiversity of the bacteria in the soil. In areas of rice cultivation the studies are concerned principally with the soil bacteria involved in the processing of the rice plant residues (Weber *et al*., 2001; Rui *et al*., 2009), rather than the biodiversity present in the water (Reche and Fiuza, 2010; Barreiros *et al*., 2011). The aim of this study was to isolate and identify the bacteria in drainage systems in Gwagwalada FCT-Abuja.

2. Materials And Methods

2.1 Sterilization of Glassware

The sterilization of glass wares such as conical flasks, beaker and test tubes after washing with detergent was carried out in hot air oven at 160º C for 2 hours according to the procedure given by Harrigan and McCance (1976).

2.2 Sampling Site

This research work was carried out at the Laboratory of the department of Biology School of Sciences Federal Capital Territory College of Education, Zuba-Gwagwalada, Abuja, Nigeria.

2.3 Samples collection

A total of forty (40) drainage samples were collected randomly with ten (10) samples each from four (4) different sites in Gwagwalada area council, Abuja. Samples were collected from Agwandodo, Dagiri, Phase I and Kuntunku. At each location, $20cm^3$ of drainage water were collected with sterile containers and transported to the laboratory of Biology Department, School of Sciences Federal Capital Territory College of education Zuba, Abuja for the isolation of bacteria in the drainage systems and analyzed on the day of collection (Ellis and Wang, 1995).

2.4 Growth media

Eosine Methylene Blue Agar, Salmonella Shigella Agar, Monitol Salt Agar and Nutrient Agar were used in this study and they were prepared according to the manufacturer's instructions, sterilized at 121ºC and pressure of 15Psi for 15 minutes (Beuchat, 1992). All the agars were used for the isolation and maintenance of pure cultures of the isolated bacteria.

2.5 Isolation of Bacteria in Drainage Systems

The water sample from the drainage systems were serially diluted up to 10-fold dilution and the dilution 10^8cell/ml and 10^{10}cell/ml were inoculated on the prepared Eosin Methelyne Blue Agar, Salmonella Shigella Agar and Monitol Salt Agar respectively using the spread plate method. The plates were then incubated at 37^{o}c for 24 hours in an incubator (Wang 1995, Field, *et al*. 1976; Cheesbrough, 2006).

2.6 Preparation of Pure Cultures of Bacteria Isolates

The young colonies of bacteria were aseptically transferred to fresh sterile Eosin Methylene Blue Agar, Salmonella Shigella Agar and Monitol Salt Agar respectively to obtain pure cultures. The pure cultures were maintained in slant culture and stored at 4 ^{o}C. The isolate was sub-cultured for further studies.

2.7 Identification of Bacteria Isolates

Isolates obtained were characterized and identified on the basis of their biochemical tests, Gram staining reaction and morphological assessment that is, macroscopic and microscopic features (Butler and Ferson, 1997; Cheesbrough, M., (2006). Among the characteristics used were colonial characteristics such as size, surface appearance, texture and colour of the colonies.

3. Results

3.1 Isolation Rate of Bacteria in Drainage Systems

The isolate *Escherichia coli* and *Staphylococcus aureus* 10 (25 % each) were the predominant species, followed Streptococcus pyogenes 5 (12.50 %), *Serretia marcescens* and *Pseudomonas aeruginosa* with 4 (10 %) each while *Bacillus subtilis* recorded the least value of 2 (5.0 %) as seen in Table 1 below.

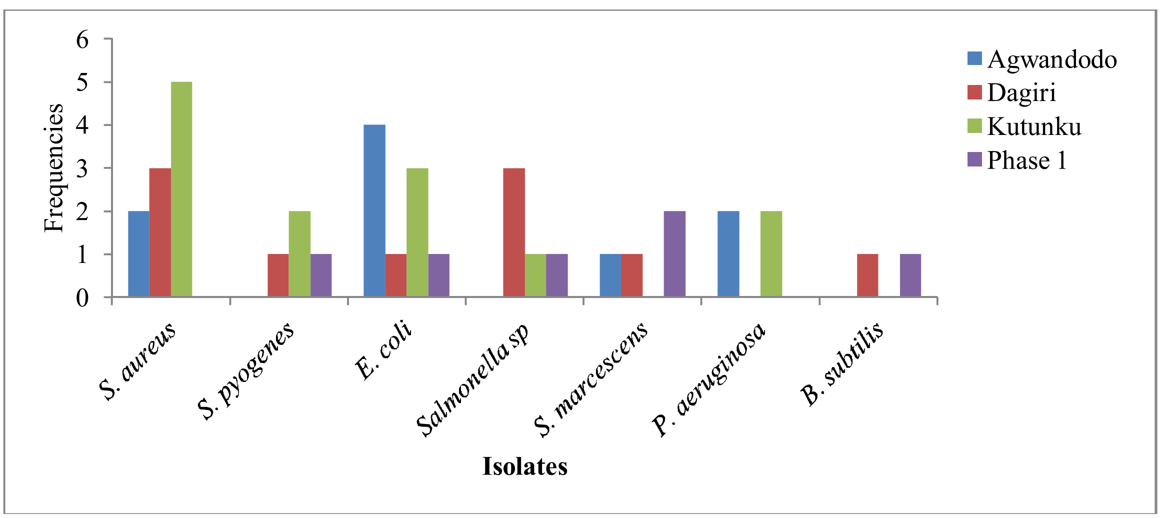

Figure 1: Isolation rate of bacteria in drainage systems in Gwagwalada area council, Abuja

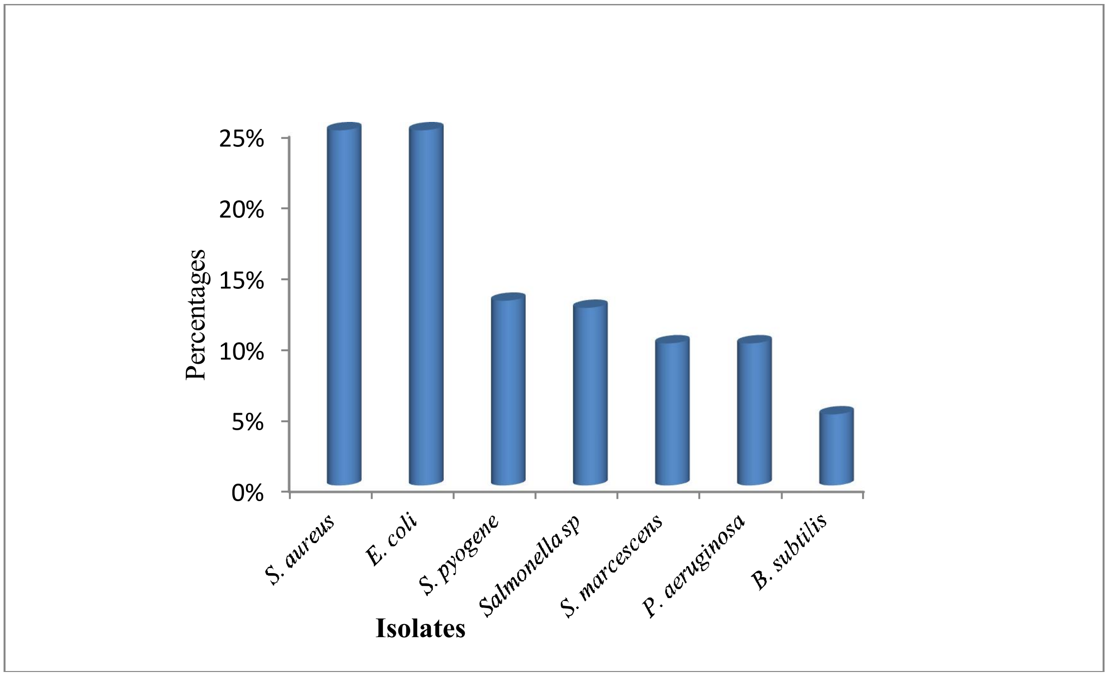

Figure 2: Percentage of bacteria in drainage systems in Gwagwalada area council, Abuja

3.2 Identifications of Bacteria from Drainage System

Isolates obtained were characterized and identified on the basis of their biochemical tests as well as sugar fermentation test, Gram staining reaction and morphological assessment that is, macroscopic and microscopic features. Among the characteristics used includes: colonial characteristics such as size, surface appearance, texture and colour of the colonies and the result obtained were shown in Table 2 below.

Table 2: Biochemical characteristics of isolates

Isolates	Biochemical tests						Probable organisms
	Catalase	Coagulase	Gram reaction	Iodole	Citrate	Oxidase	
A	+	+	+	-	-	-	*Staphylococcus aureus*
B	-	+	+	-	-	-	*Streptococcus pyogenes*
C	-	-	-	+	-	-	*Salmonella typhi*
D	-	-	-	+	-	-	*Escherichia coli*
E	-	-	+	+	-	-	*Bacillus subtilis*
F	-	-	+	-	-	+	*Pseudomonas aureginosa*
G	-	-	-	-	-	-	*Serretia marcescens*

4. Discussions

The seven bacteria belonging to seven genera were isolated from drainage system in Gwagwalada FCT-Abuja. The bacteria were identified on the basis of colony morphology, cultural characters, pigmentation as *Stapylococcus aureus, Streptolococcus pyogenes, Escherichia coli*, *Salmonella typhi, Serretia marcescens, Pseudomonas aeruginosa* and *Bacillus subtilis* as shown in table 1. It appears from this study that *Staphylococcus aureus* and *Escherichia coli* are the most prevalent bacteria in drainage systems and also dominant species that were isolated from 10 drainage water samples (each cover about 25.00%) followed by *Streptocococcus pyogenes* and *Salmonella typhi* with 5 isolates each, which covered about 12.50%, this agree with Butler and Ferson, 1997; Schiff and Kinney, 2001). *Serretia marcescens* and *Pseudomonas aeruginosa* also have the same number of isolates (4 each) which covered about 10% of the total isolated organisms. The least number of isolate was recorded for *Bacillus subtilis* with two (2) number of isolate (covered about 5% of the total isolated drainage bacteria). Isolation rate of drainage bacteria shown that Kuntunku recorded the highest number of bacteria 13 (representing 32.50%), followed by Dagiri with 11 (representing 27%), Agwandodo 9 (representing 22.50%) while the least number was recorded in Phase I 7 (representing 17.50%) as shown in table 1 and figure 1 respectively, this also agree with (Borst and Selvakumar 2003). It appears from this study that *Staphylococcus aureus and Escherichia coli* are also present in the in drainage systems and also dominant species that were isolated from 10 drainage water samples of four different regions in Gwagwalada such as Agwandodo, Dagiri, Kuntunku and Phase I.

5. Conclusion

As a result of the pathogenic bacteria isolated from the drainage water samples in the Gwagwalada metropolis it is therefore recommended that the runoff from the drainage system should not be allowed to contaminate drinking water, because the isolated bacteria can cause several diseases of man.

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