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Research article

CALIBRATING THE VARIATION OF POROSITY EFFECT ON BACILLUS TRANSPORT TO UNCONFINED BED AT EGBEMA IMO STATE OF NIGERIA

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Abstract

The effect of porosity on bacillus migration to ground water aquifer was carried out. This is to establish the variation of porosity on fast migration of microbes. Sample were collected from various locations using insitu method of sample collection, a standard experiment were performed to determine the rate of porosity on bacillus transport. The results from five different locations shows that the lowest level of porosity where found to be between 0.8 and 1.0 and the highest between 2 to 5 metres with average root square 0.929. This results also shows the rate of influence from soil porosity, it is confirmed to be one of the major cause of fast migration of bacillus contaminating ground water aquifers in the study area, more so the geological formation are found to influence the rate of porosity at different location, consequently ground water should be exploited to its optimum aquifer, base on the designed criteria stipulated, so that quality water can be made available to the people in the study area.

Keywords: calibrating porosity, bacillus transport and unconfined bed

1. Introduction

Water is an essential for source of revenue as well as socio-economic expansion of any community. However, it is early susceptible to contamination and utilization of contaminated water can resulted to epidemics and loss of many lives, especially in developing countries like Nigeria. Groundwater is normally a favoured source of water supplies due to its natural shelter against pollution. (Mato, 2002). In urban areas is a growing environmental problem in the world. But in developing countries, it frequently results from unsystematic disposal of municipal (especially widespread use of on-site sanitation systems) wastes, industrial effluents, and urban agriculture. In low-income countries the situation is motivated by rapid urbanization, which is characterized by insufficient provision of water supply, sanitation, solid waste and drainage infrastructure. This dependence may rise in future due to deterioration in quality of surface water sources. However, operation is not controlled and no adequate groundwater quality monitoring and protection mechanisms have been installed. Therefore, the impact of human actions on Groundwater quality is not yet properly implicit, which is a key element in Sustainable use of the source (Mato 2002). Water is an indispensable resource for man's life. And the universal demand for fresh water doubles every 20 years (Foster, 1999). This increasing demand is putting massive stress on water resources. Since many of the surface water sources have been degraded or washed-out, due to exposure to pollution, changes in climates and over-exploitation, much stress is being exerted on the groundwater sources. Groundwater can be described as subsurface water that occurs in voids and permeable geological formations. And it accounts for about 97% (excluding permanently frozen water) of the Earth's useable freshwater resource (Leopold, 1974). It plays an important role in maintaining soil moisture, stream flow and wetlands. Over half the world's population depends on groundwater for drinking water supplies. In the united kingdom, for example, about 30% of the public water supplies are derived from groundwater, in the united state of America about 50%, 99% and in Denmark 70% in Germany (Mato 2002). In Tanzania, 30% of the population is directly depending on groundwater (Materu, 1996).Groundwater, however, is vulnerable to pollution and over-exploitation. The pollution commonly results from human activities, where chemicals, susceptible to percolation, are stored and spread on or beneath the land surface. It has become increasingly evident that inadequately controlled groundwater exploitation and indiscriminate disposal of wastes to the ground widely result in significant deterioration of groundwater quality (Foster *et al.*, 1996). This deterioration has contributed to a larger extent to escalating water supply cost, increase in water resource scarcity and growing health hazards, especially in urban areas (Morris *et al.*, 1997). Surely missing reported, that in the state of California U.S.A, the contamination of many aquifers with industrial and agricultural chemicals made water from these aquifers unsuitable for drinking purposes, making it necessary to import water from the Sacramento-San Joaquin Delta and other uncontaminated sources. These are some of the existing challenges of abstracting groundwater for the town dwellers within the urban environment. Therefore, a balance and perceptive between urbanization process and groundwater safeguard strategies need to be developed. Otherwise, the contamination of groundwater in urban areas would remain a growing public health hazard, particularly in developing countries where both economic and industrial resources, needed to clean polluted aquifers, are scarce. The most common quality impact of inadequately controlled aquifer Exploitation, particularly in coastal situations, is the intrusion of saline waters another one is the contamination of deeper (semi-confined) aquifers, where they are below a shallow poor quality phreatic aquifer affected by anthropogenic pollution and/or saline intrusion (Janssen, et al 2002). This occurs as a result of inadequate well construction, leading to direct vertical seepage and/or pump-induced vertical leakage, with penetration of more mobile and persistent contaminant species. Evidence has been accumulating since the 1980s of widespread draw down of piezometric surface by 20-50 m or more of various Asian megacities, as a result of heavy exploitation of alluvial aquifers. Both of aforementioned side effects are quite widely observed (Foster and Lawrence, 1996; Foster, 1999). Cities like Bangkok (Thailand), Jakarta (Indonesia), and Manila (Philippines) have severely suffered from uncontrolled aquifer exploitation to the extent of substituting the water supply by long distance import of surface water (Munasinghe, 1990; Schmid et al., 1990; Foster and Lawrence, 1996). Although the city of Dhaka (Bangladesh), groundwater remains the sole source of water supply, still the control over exploitation is reported to be inadequate (Foster, 1999). There are three significant attributes that differentiate any source of groundwater contamination: the amount of localization and the kinds of contaminants emanating from them. A sanitary landfill is a point source of groundwater pollution and produces a reasonably well-defined plume in many instances (Demenico and Schwarts 1998, Tesfaye, 2007). The loading times past describes how the concentration of a contaminant or its rate of invention varies as a function of time at the source. Leachates rates at a landfill site are controlled by seasonal factors or by a decline in source strength as mechanism of the waste such as organics, biodegrade (Demenico and Schwarts 1998). Many factors persuade Leachates composition; these include the types of wastes deposited in the landfill, the amount of precipitation in the area and other site-specific conditions. The rates of biological and chemical activities taking place in the landfill can also affect Leachates quality by altering the way that waste dissolves in or migrates with Leachates. The presence of chemicals in groundwater and drinking water is an important factor in determining the risk posed by landfill sites. However, it does not tell us what effect, if any, the utilization of contaminated water has on human health. There are studies of adverse health effects prompted by the contamination of water used for drinking water and other household uses by hazardous substances from waste dumping sites (mainly sites where chemical waste drums were buried) (Tesfaye,2007). Literature on contaminated water and prospective health effects are more widespread than that existing in this section, which focuses only on water contamination directly related to the disposal of waste (Tesfaye 2007). The 1991 review by the US National Research Council gives a more comprehensive review of studies on contamination of domestic water supplies and health effects and concludes that although the available literature is scanty and not conclusive, drinking water contamination could lead to adverse health effects (National Research Council. Environmental Epidemiology 1991). A number of studies followed the contamination of two drinking-water wells in Santa Clara County, California, and other developing nations with chlorinated solvents that had leaked from an underground waste storage tank. Residents living near one of the contaminated wells reported a cluster of adverse pregnancy outcomes, mainly spontaneous abortions and congenital heart defects. A first investigation confirmed a significant excess of cardiac anomalies in the service area of the water company that operated the contaminated well compared to those among residents of an unexposed area. The excess was found within the potentially exposed time period and not in an unexposed time period after the well was closed. (Tesfaye, 2007).

2. Materials and Method

Sample were collected applying insitu method of sample collection in the study location at five different site locations volumetric method were applied used for soils containing different types or foreign materials which would interfere with advance trimming. The calibrated specimen cutter method is particularly were suitable for obtaining volumes of silt and other types of soils having little cohesion. Apparatus. The apparatus should consist of the following :(i) Calibrated ring-shaped specimen cutter, hereinafter referred to as a volumetric cylinder. Types and sizes of volumetric cylinders due vary widely; General requirements are that a volumetric cylinder be made of materials not susceptible of rapid corrosion and that it be as large as possible in relation to the samples being tested. The inside of the cylinder should be polished to a smooth finish, and sharp cutting edges should be provided on the base. It is very important that no voids form between the sample and cylinder; to facilitate detection of such voids, a volumetric cylinder of transparent Lucite with detachable steel cutting edges may be used.

3 Results and Discussion

Table 1: Porosity variation with depth at different locations

Depth	**Porosity Locations**				
	1	2	3	4	5
0.2	0.27	0.26	0.22	0.12	0.28
0.6	0.28	0.28	0.24	0.13	0.27
0.8	0.28	0.29	0.25	0.15	0.26
1	0.25	0.25	0.26	0.16	0.24
1.2	0.24	0.23	0.27	0.18	0.23
1.4	0.23	0.19	0.27	0.19	0.21
1.6	0.21	0.19	0.26	0.20	0.21
1.8	0.2	0.19	0.27	0.18	0.18
2	0.19	0.18	0.27	0.18	0.19
2.5	0.18	0.17	0.27	0.18	0.24
3	0.18	0.16	0.26	0.19	0.26
4	0.17	0.15	0.27	0.19	0.27
5	0.18	0.16	0.27	0.19	0.29

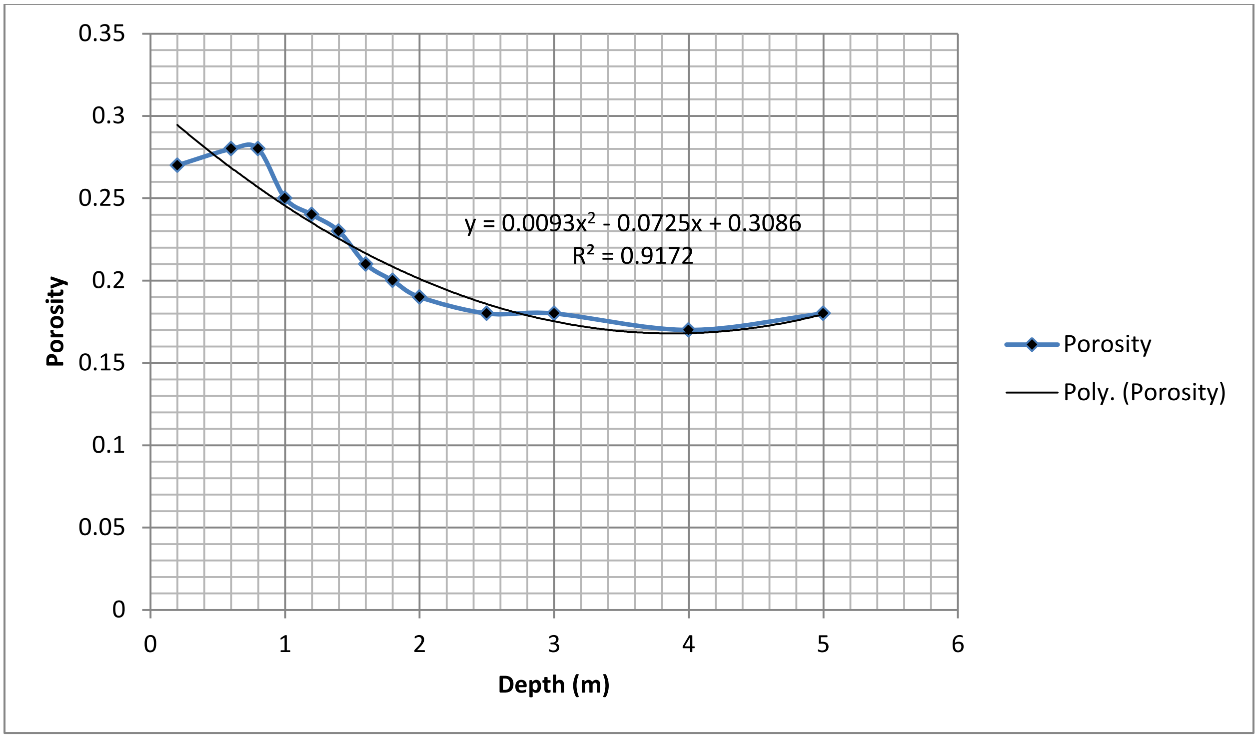

Figure 1: porosity of soil formation at different depth

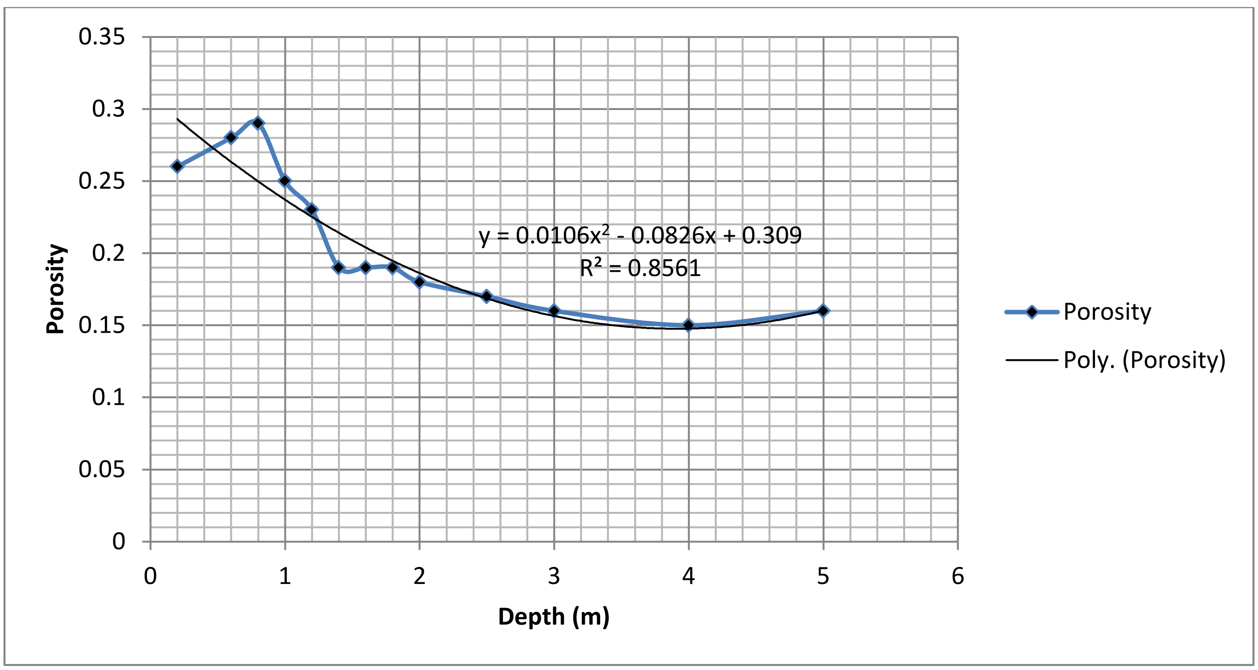

Figure 2: porosity of soil formations at different depth

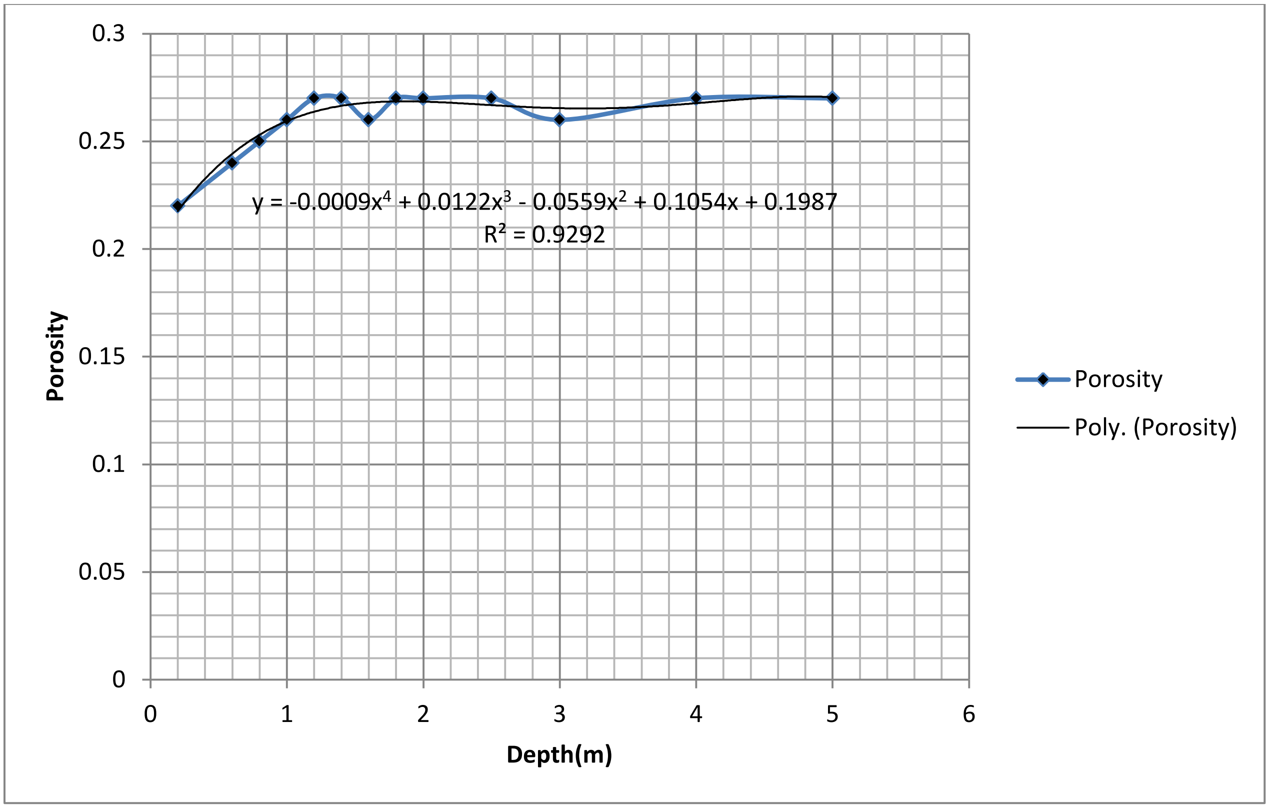

Figure 3: porosity of soil formation at different depth

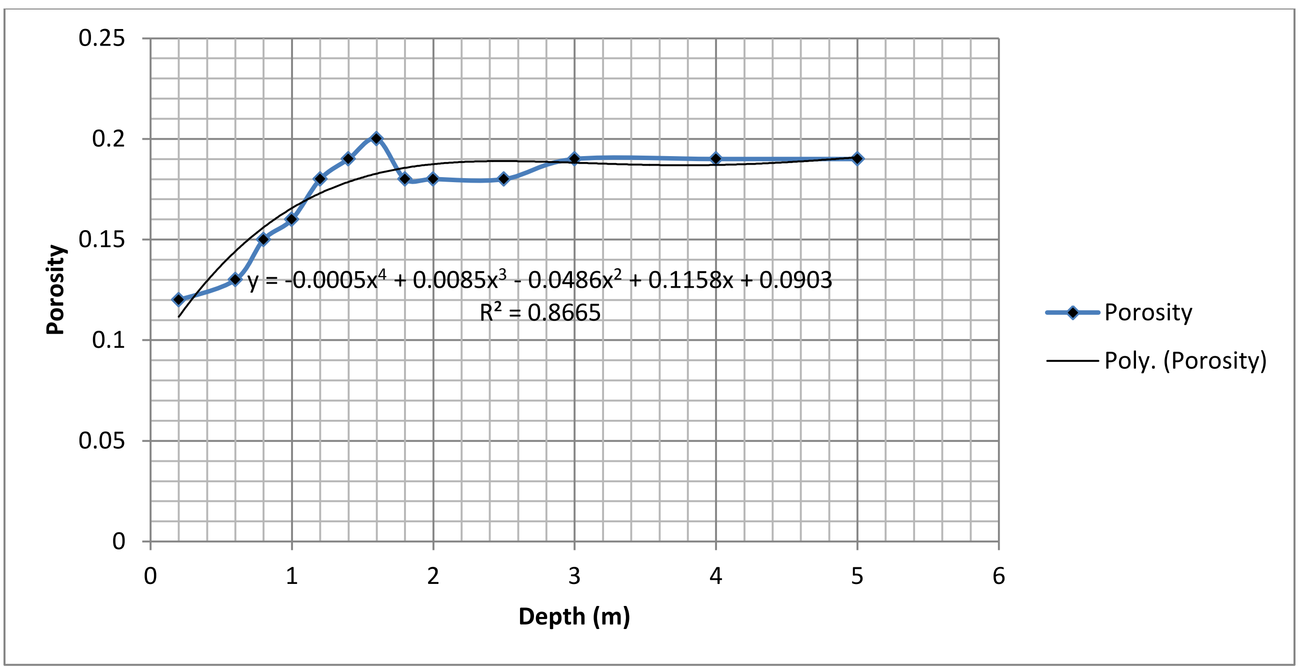

Figure 4: porosity of soil formation at different depth

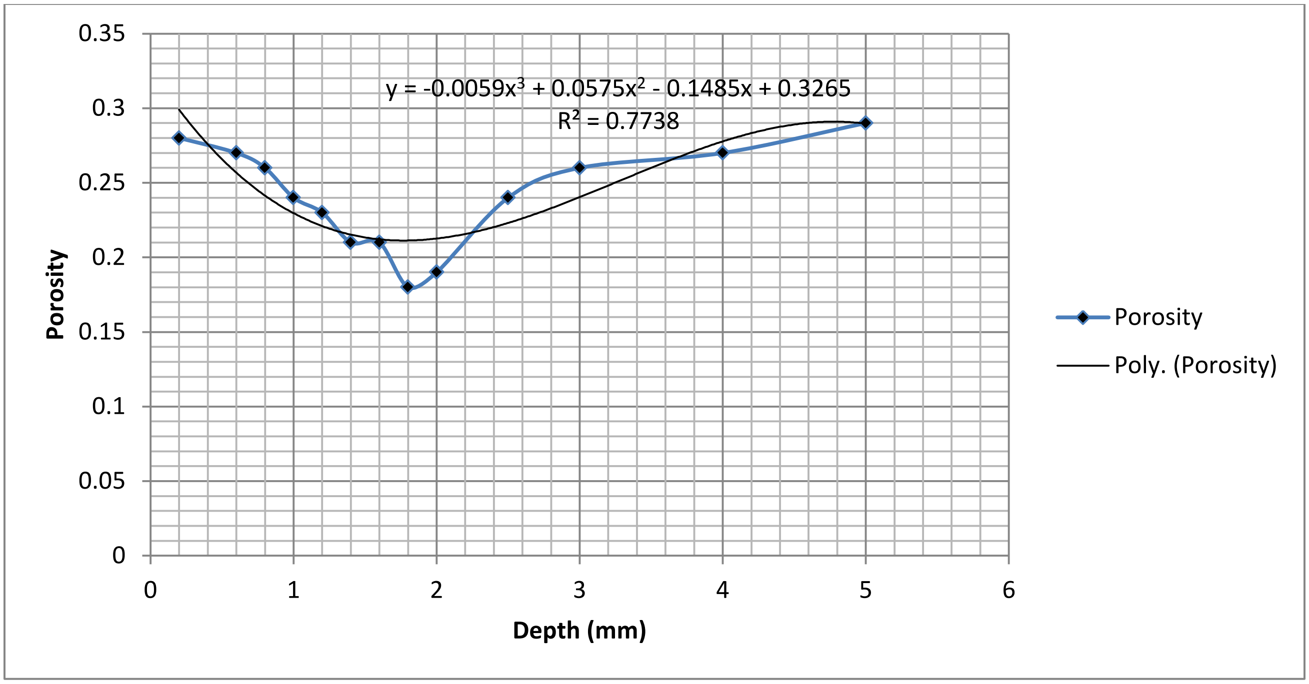

Figure 5: porosity of soil formation at different depth

The results of figure 1and 2 shows an increase in soil porosity with depth to 0.8m depth, beyond which porosity values decrease with depth up to about 2.5m between 2.5 to 5m depth, a porosity assumes a constant values 0.18 and 0.17 for location1and 2 respectively. Their various predictive models are presented with location 1 having R^2= 0. 917 and R^2 = 0.856 for location 2. A similar trend in variation of porosity with depth depicted in figure 3 and 4, where porosity increases with depth up to 1.6m depth. Although lower values of porosity are obtained with depth in figure 4 as compared to this in location 4 figure 4. Constant porosity values are obtained from 4m depth in location 3 optimal of location 4 where n value constant value from 3m depth. The respective predictive model porosity models have R^2 = 0.929 and R^2 = 0.866 for locations 3 and 4 respectively. Figure 5 porosity variations with depth shows decreasing trend up to 1.8m depth after which an inventory trend commenced up to 4m. Beyond which a stabilizing trend occur. Porosity effect on microbial migration to ground water aquifers from the results generated at the study area are found to be influenced from the variation in deposition of the formation. This has developed different level of porosity at different location in the study area, the variation established from this study implies that the migration of microbes at those location between the shallow depth, will definitely generate high accumulation of microbes, that can migrate to ground water aquifer within a short period of time, the study area from geologic history are confirmed to be deltaic environment, it is at different formation, there are lots of transition zone at the state in general. Therefore it become imperative that the study area formation should be defined, as this has explained the behaviour of the microbial transport, generating these results as presented. The results has also explained why it is imperative to designed a borehole whereby cement groughting that will prevent pollution transport from microbes before it is constructed and the reason of drilling it to its optimum aquifer, so that good quality that is free from contaminant of microbes can be achieved.

4. Conclusion

From every point of indication, the effect of porosity on microbial migration is of serious concern in the production of good quality ground water in the study area. This study shows that the rate of pollution emanating from soil high rate of porosity also explained, it show how porosity contribute to fast migration of microbes to ground water aquifers. The variations of porosity as presented from the results also establish the slight variables of porosities at different depth; these determine the rate of migration with respect to time at different location. But in general concept, the results shows that the exploitation of ground water aquifers, it should be design base on the stipulated criteria, so that quality ground water that meet up world health organization standard can be provided to the settlers in the study area. Government should ensure that standards are strictly adhered in other to avoid lots of water related diseases that is killing thousand of people every year in the country.

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