Sjournals
Scientific Journals
Scientific Journal of Environmental Sciences (2012) 1(4) 51-57

Contents lists available at Sjournals
Scientific Journal of Environmental Sciences
Journal homepage: www.Sjournals.com

Original article

Model prediction and evaluation to monitor the behaviour of thermotolerant transport in homogeneous formation in Isiokpo rivers state of Nigeria

S.N. Eluozo
Subaka Nigeria Limited Port Harcourt Rivers State of Nigeria.

*Corresponding author; Subaka Nigeria Limited Port Harcourt Rivers State of Nigeria.

A R T I C L E I N F O

Article history:
Received 25 October 2012
Accepted 18 November 2012
Available online 28 November 2012

Keywords:
Model prediction
Thermotolerant
Aquiferious zone
Isiokpo rivers

A B S T R A C T

Model prediction and evaluation were to assess the model that can be applied to solve the challenges of Thermotolerant transport in the study area, the model are from experimental results through, an equation from the experiments value were resolved, it generated theoretical values, these values were compared with developed analytical model values, both values compared faviourable well, the model where able to confirm the rate of high degree of substrate utilization base on the rate of concentration in Aquiferious zone, high degree of porosity has influence fast migration of microbes as presented in the figures, this condition are also from the influence on the geologic history of the study area, shallow aquifers that deposit in the study locations were as a results from these dimension, the deltaic nature in the study area are also one of the influence of fast migration of Thermotolerant to ground water aquifers, the comparative models are imperative, because microbial transport has a lots of influence, and in most cases the behaviour of Thermotolerant is not linear, the model that can solved these sources of pollution from these dimension should be thoroughly evaluated, this is to ensure that the models can definitely solve the problem of Thermotolerant transport in the study area, the models haven't been assessed has produced a good result, it will definitely solve the transport of Thermotolerant transport in the study area.

1. Introduction

Aero monads are distributed widely in freshwater and are part of the natural aquatic ecosystem; concentrations increase with increased nutrient concentrations in water (Rippey and Cabelli 1980; van der Kooig and Hijnen 1988) with a strong association between *Aeromonas* concentration and pollution (Wada 1984). It occurs in water, soil, and foods, particularly those coming into contact with water during processing, and refrigerated foods, such as seafood and dairy products. It may be found in source waters and may colonise distribution systems. It will grow in the presence of low chlorine levels, especially when the water temperature is high. It tends to be associated with surface waters.

It has become difficult in recent years to construct reservoirs for surface storage of water because of environmental concerns and because of the difficulty in locating suitable sites. An alternative, which can reduce or eliminate the necessity for surface storage, is to use an aquifer system for temporary storage of water. For example, water stored underground during times of high stream flow can be withdrawn during times of low stream flow. The characteristics and extent of the interactions of ground water and surface water affect the success of such conjunctive-use projects. As the Nation's concerns over water resources and the environment increase, the importance of considering ground water and surface water as a single resource has become increasingly evident. Issues related to water supply, water quality, and degradation of aquatic environments are reported on frequently. The interaction of ground water and surface water has been shown to be a significant concern in many of these issues For example, contaminated aquifers that discharge to streams can result in long-term contamination of surface water; conversely, streams can be a major source of contamination to aquifers. Surface water commonly is hydraulically connected to ground water, but the interactions are difficult to observe and measure and commonly have been ignored in water-management considerations and policies. Many natural processes and human activities affect the interactions of ground water and surface water. The purpose of this report is to present our current understanding of these processes and activities as well as limitations in our knowledge and ability to characterize them (Thomas, 1998). Contamination of drinking water by pathogenic microbe's viruses, bacteria, and protozoa – is considered as one of the most important water supply problems of our day. Current concern is focused on cryptosporidium parvum, a protozoan parasite that moves from host to host as an oocyst (Carey et al., 2004). An outbreak of Cryptosporidium parvum caused the death of over 100 citizens of Milwaukee, Wisconsin, in 1993 (MacKenzie et al., 1994). Water utilities are increasingly using bank filtration to remove microbes from surface water supplies and to reduce the need for disinfection (Tufenkji.et al., 2002; Gollnitz et al., 2003). Bank filtration uses alluvial aquifer sediments to filter microbes from river water. The effectiveness of microbe removal by bank filtration removal depends on the characteristics of the pumping-induced groundwater flow, the alluvial sediments, and the solution chemistry. Removal can be difficult to predict because of physical and geochemical heterogeneity of the alluvial sediments and the pore waters. One form of geochemical heterogeneity in alluvial aquifers that affects microbe removal is the nature and abundance of organic matter. Organic matter is present in the sediments as lignin, proteins, kerogen, and black carbon derived from terrestrial plants in discrete phases and mineral coatings at concentrations ranging up to a few percent. In the pore waters, organic matter is present as dissolved humic substances and organic acids of lower molecular weight at concentrations up to a few milligrams of carbon per liter. During bank filtration, the nature and abundance of dissolved organic matter is altered by a variety of biological processes and sorption (Miettinen et al., 1994; Cosovic et al., 1996; Gru¨ nheid et al., 2005). In aquifer sediments, minerals like ferric and aluminum oxyhydroxides and clay edges are typically coated by organic matter (Amelung et al., 2002; Wagai et al., 2009). These minerals often form patchy coatings and interstitial aggregates on primary mineral grains (Ryan and Gschwend, 1992; Coston et al., 1995; Penn et al., 2003). Ferric and aluminum oxyhydroxides and clay edges are amphoteric minerals with relatively high points of zero charge (pHpzc). Typical groundwater pH values are below their pHpzc values; therefore, these minerals adsorb protons and acquire positive surface charge. At typical groundwater pH values, most pathogenic microbes – viruses, bacteria, protozoa – are negatively-charged. Positively- charged surfaces effectively remove negatively-charged colloids (Song et al., 1994; Johnson et al., 1996) and microbes (Scholl and Harvey, 1992; Mills et al., 1994; Zhuang and Jin, 2003b; Abudalo et al., 2005; Foppen and Schijven, 2005; Hijnen et al., 2005; Kim et al., 2008) from passing pore waters. Positively- charged surfaces also effectively adsorb organic matter (Davis, 1982; Gu et al., 1994), which is mainly anionic at typical groundwater pH values, and the adsorption of sufficient organic matter is presumed to be capable of reversing the surface charge of the ferric and aluminum oxyhydroxide coatings from positive to negative (Abudalo et al 2010).

2. Materials and methods

Column experiments were also performed using soil samples from forty (7) different borehole locations, the soil samples were collected at intervals of three metres each (3m). An E.coli solute was introduced at the top of the column and effluents from the lower end of the column were collected and analyzed for E.coli, and the effluent at the down of the column were collected at different days, analysis, velocity of the transport were monitored at different days. Finally, the results were collected to be compared with the theoretical values

3. Results and discussion

Tables and figures are presented below.

Table 1
comparison of theoretical models values at different Time

Time	Theoretical Experimental	Theoretical Analytical
3	1.31	1.1
7	2.1	2.29
14	3.39	3.48
21	4.72	4.68
28	6.03	5.87
35	7.36	7.1
42	8.68	8.26
49	10.01	9.46
56	11.33	10.65
63	12.65	11.84

Table 2
Comparisons of theoretical models values at different Time

Depth m	Theoretical Experimental	Theoretical Analytical
1.5	1.05	1.1
3	2.27	2.29
4.5	3.48	3.48
6	4.69	4.68
7.5	5.91	5.87
9	7.12	7.1
10.5	8.26	8.26
12	9.55	9.46
13.5	10.76	10.65
15	11.97	11.84

Table 3
Comparisons of theoretical models values at different time.

Time	Theoretical Experimental	Theoretical Analytical
10	5.82	4.66
20	10.85	9.33

30	15.88	14.01
40	20.91	18.67
50	25.94	23.33
60	30.97	28.01
70	36	32.68
80	41	37.35
90	46	42.01
100	51.09	46.66

Table 4
Comparisons of theoretical models values at different Time

Depth m	Theoretical Experimental	Theoretical Analytical
3	4.65	4.66
6	9.33	9.33
9	14	14.01
12	18.67	18.67
15	23.33	23.33
18	28	28.01
21	32.67	32.68
24	37.33	37.35
27	41.99	42.01
30	46.66	46.66

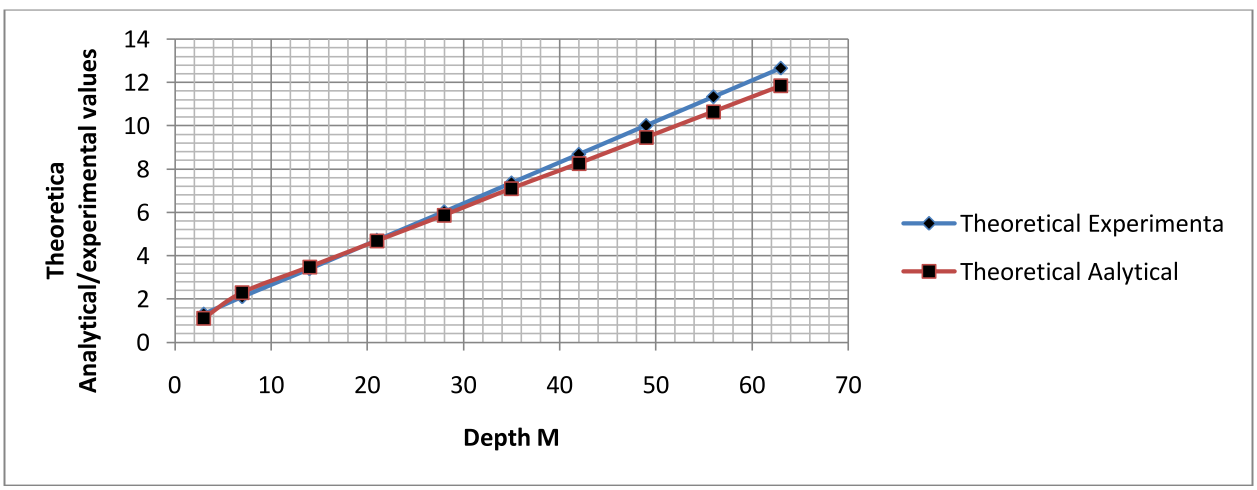

Fig. 1. comparison of both theories at different depths.

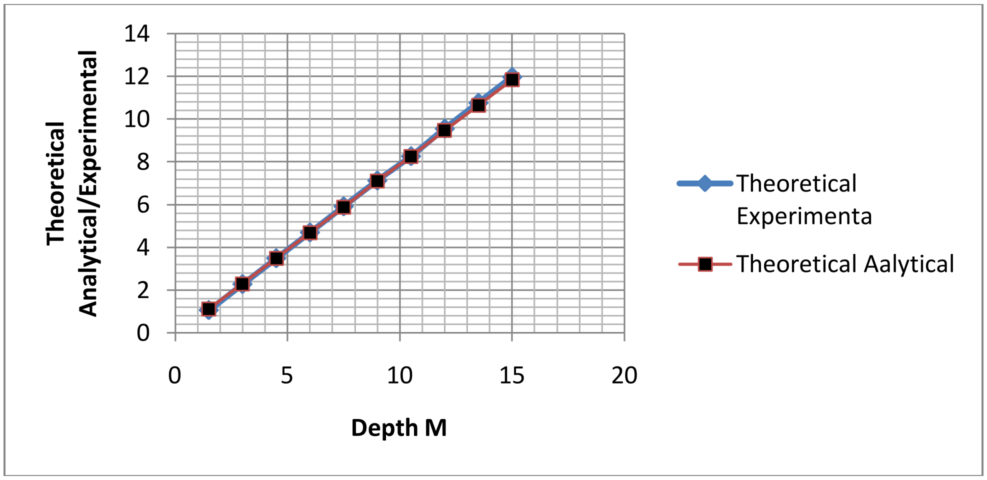

Fig. 2. comparisons of both theories at different Depths.

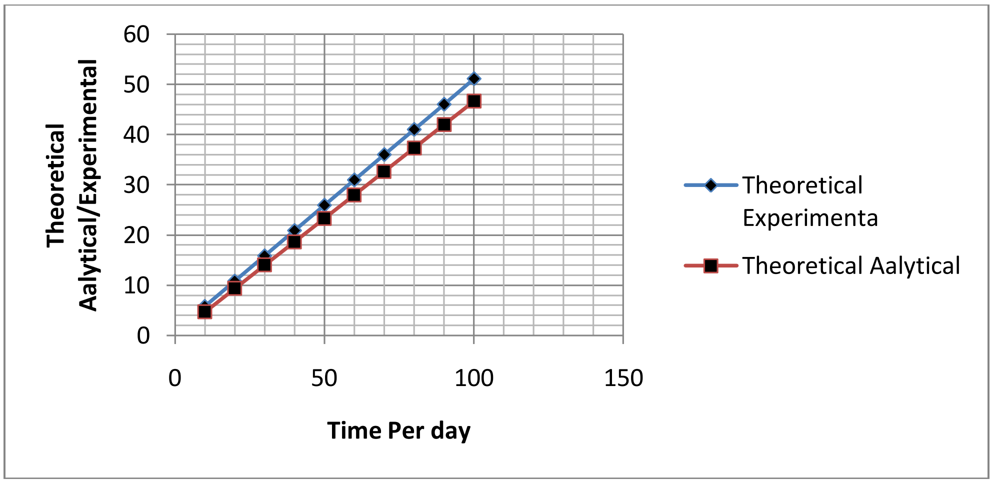

Fig.3. comparisons of both theories at different Depths.

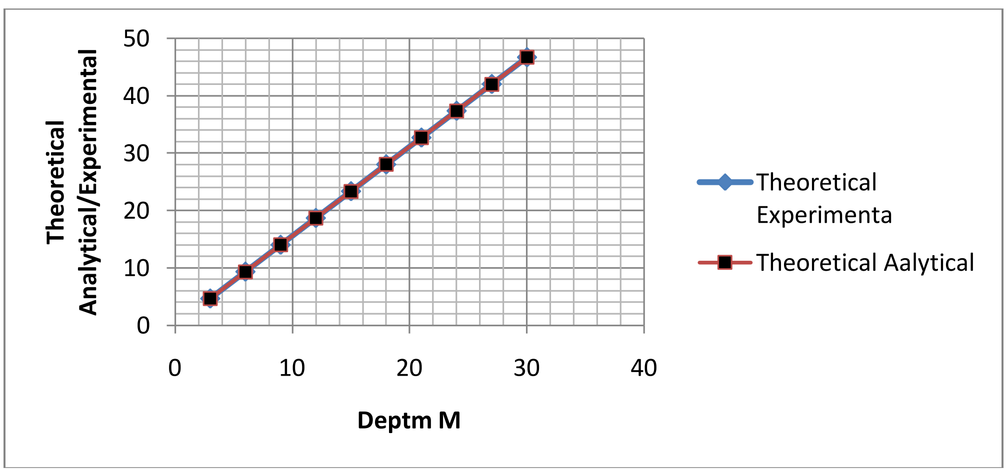

Fig. 4. comparisons of both theories at different Depths.

Figure 1 shows that the microbes gradually increase to a point where the optimum values were recorded, these conditions explained the rate of microbial population in the study location, in most instances; it can be attribute to the rate of microelements deposition in the soil formation. More so the microbes may have experiential exponential phase, base on the structural stratification in the formation, the concentration varies in period as presented in the figure, showing the present of micronutrients that cause increase in microbial population. Figure 2 experience similar conditions, both theories experience exponential processes on the migration of Thermotolerant, the microbes gradually increase on the transport process to where the optimum values where recorded at the aquiferious zone, the microbes are also influenced by the degree of porosity in the formation, these influence fast migration of the contaminants. Figure three in the same vein maintained the same exponential condition, the microbes where found to rapidly increase with change in concentration, at various depths to the optimum value at thirty metres, this exponential conditions that experience development in these figures implies that the soil stratum are in high degree of permeability, and with high rate of micro poles of the soil deposition in the study location, finally, figure four confound the rate of substrate utilization to have influence rapid growth rate of the microbes, the concentration increase at every depth, it implies that the geological formation of the study area are influenced by alluvium deposition, as a deltaic environment, high rate of pollution from microbial contaminant in ground water aquifers are influenced by the these condition, the models were compared to see there fit with experimental theories, the model compare faviourably well with these experimental theories from other study location, the model will serve as a baseline for design and development of ground water system in the study area.

4. Conclusion

The transport of the Thermotolerant is from the fecal family that cause allots pollution in ground water in the study location. This source of pollution transport is a serious threat to the people of the study location, models developed from experimental results at the study location were compared with theoretical values from analytical method, both parameters compared faviourably well, the comparative model where to evaluate the positivity of the both model integration, as a baseline for design of quality assurance and quality control of water pollution in the study area. The results where found to have experience high degree of microbial population, this implies that there is high rates of Thermotolerant contaminants in the aquiferious zone, in these condition there is need for thorough assessments of ground water pollution emanating from Thermotolerant, this can only be solved through the application of these model that has been simulate and compared which has proof a successful results, as presented from in the figures, these that has models compared faviourably well should be applied in design and construction of ground water system to improve water quality in the study area.

Reference

Abudalo, R.A., Bogatsu, Y.G., Ryan, J.N., Harvey, R.W., Metge, D.W., Elimelech, M., 2005. Effect of ferric oxyhydroxide grain coatings on the transport of bacteriophage PRD1 and Cryptosporidium parvum oocysts in saturated porous media. Environ. Sci. Tech. 39, 6412–6419.

Foppen, J.W.A., Schijven, J.F., 2005. Transport of E. coli in columns of geochemically heterogeneous sediment. Water Res. 39, 3082–3088

Hijnen, W.A.M., Brouwer-Hanzens, A.J., Charles, K.J., Medema, G.J., 2005. Transport of MS2 phage, Escherichia coli, Clostridium perfringens, Cryptosporidium parvum, and Giardia intestinalis in a gravel and a sandy soil. Environ. Sci. Tech. 39, 7860–7868

Davis, J.A., 1982. Adsorption of natural dissolved organic matter at the oxide/water interface. Geochimica et Cosmochimica Acta 46, 2381–2393

Gu, B., Schmitt, J., Chen, Z., Liang, L., McCarthy, J.F., 1994. Adsorption and desorption of natural organic matter on iron oxide: mechanisms and models. Environ. Sci. Tech. 28, 38–46.

Kim, S.B., Park, S.J., Lee, C.G., Kim, H.C., 2008. Transport and retention of Escherichia coli in a mixture of quartz, Al-coated and Fe-coated sands. Hydrol. Proces. 22 (18), 3856–3863

Van der Kooij D, Hijnen WAM. 1998. Nutritional versatility and growth kinetics of an *Aeromonas hydrophila* strain isolated from drinking water. Appl. Environ. Microbiol. 54(11), 2842.51.

Rippey, S.R., Cabelli, V.J., 1980. Occurrence of *Aeromonas hydrophila* in limnetic environments: relationship of the organism to trophic state. Microb. Ecol. 6, 45.

Thomas, J., Casadevall, 1998. Acting Director ground Water and surface water a single resource U.S. Geolog. Surv/ey Circular 1139pp

Abudalo, R.A., Ryan, J.N., Harvey, R.W., Metge, D.W., Landkamer, L., 2010. Influence of organic matter on the transport of Cryptosporidium parvum oocysts in a ferric oxyhydroxide-coated quartz sand saturated porous medium. Water Res. 44 1104-1113.

Carey, C.M., Lee, H., Trevors, J.T., 2004. Biology, persistence and detection of Cryptosporidium parvum and Cryptosporidium hominis oocysts. Water Research 38, 818–862.

Cosovic, B., Hrsak, D., Vojvodic, V., Krznaric, D., 1996. Transformation of organic matter and bank filtration from a polluted stream. Water Res. 30, 2921–2928.

Coston, J.A., Fuller, C.C., Davis, J.A., 1995. Pb2þ and Zn2þ adsorption by a natural aluminum- and iron-bearing surface coating on an aquifer sand. Geochimica et Cosmochimica Acta 59, 3535–3547.

Ryan, J.N., Gschwend, P.M., 1992. Effect of iron diagenesis on the transport of colloidal clay in an unconfined sand aquifer. Geochimica et Cosmochimica Acta 56, 1507–1521

Scholl, M.A., Harvey, R.W., 1992. Laboratory investigations on the role of sediment surface and groundwater chemistry in transport of bacteria through a contaminated sandy aquifer. Environ. Sci. Tech. 26, 1410–1417

Song, L., Johnson, P.R., Elimelech, M., 1994. Kinetics of colloid deposition onto heterogeneously charged surfaces in porous media. Environ. Sci. Tech. 28, 1164–1171

Tufenkji, N., Ryan, J.N., Elimelech, M., 2002. The promise of bank filtration. Environ. Sci. Tech. 36, A422–A428.

Wagai, R., Mayer, L.M., Kitayama, K., 2009. Extent and nature of organic coverage of soil mineral surfaces assessed by a gas sorption approach. Geoderma 149 (1–2), 152–160

Zhuang, J., Jin, Y., 2003a. Virus retention and transport as influenced by different forms of soil organic matter. Journal of Environmental Quality 32, 816–823

Miettinen, I.T., Martikainen, P.J., Vartiainen, T., 1994. Humus transformation at the bank filtration water-plant. Water Science and Technology 30, 179–187.

MacKenzie, W.R., Hoxie, N.J., Proctor, M.E., Gradus, M.S., Blair, K.A., Peterson, D.E., Kazmierczak, J.J., Addiss, D.G., Fox, K.R., Rose, J.B., Davis, J.P., 1994. A massive outbreak in Milwaukee of Cryptosporidium infection transmitted through the public water supply. New England Journal of Medicine 331, 161–167.

Amelung, W., Kaiser, K., Kammerer, G., Sauer, G., 2002. Organic carbon at soil particle surfaces – evidence from X-ray photoelectron spectroscopy and surface abrasion. Soil Science Society of America Journal 66, 1526–1530

Penn, R.L., Zhu, C., Xu, H., Veblen, D.R., 2003. Iron oxide coatings on sand grains from the Atlantic coastal plain: high-resolution transmission electron microscopy characterization. Geology
29, 843–946.

Johnson, W.P., Logan, B.E., 1996. Enhanced transport of bacteria in porous media by sediment-phase and aqueous-phase organic matter. Water Research 30, 923–931

Mills, A.L., Herman, J.S., Hornberger, G.M., DeJesus, T.H., 1994. Effect of solution ionic strength and iron coatings on minerals grains on the sorption of bacterial cells to quartz sand. Applied and Environmental Microbiology 60, 3300–3306.

Gru¨ nheid, S., Amy, G., Jekel, M., 2005. Removal of bulk dissolved organic carbon (DOC) and trace organic compounds by bank filtration and artificial recharge. Water Research 39, 3219–3228

Gollnitz, W.D., Clancy, J.L., Whitteberry, B.L., Vogt, J.A., 2003. RBF as a microbial treatment process. J. Amer. Water Works Associ. 95, 56–66