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Modeling and simulation to monitor cryptosporidium oocyst influenced by nitrogen in heterogeneous fine sand depositiontreatment of the genitourinary syndrome of menopause

Abstract

This study monitor the behaviour of cryptosporidium oocyst depositions in heterogeneous fine sand formation, several experts has monitored the transport of microbes in the stratum, but could not identified the heterogeneity of the predominant structural influence of the depositions, but this study try to monitor the migration rate of cryptosporidium oocyst depositions on heterogeneous structure of the formation, microelement nitrogen were observed to deposit in heterogeneous structure of the stratum, this were observed to develop its influential pressure on the migration process in the deposition, the study experienced linear trend to the optimum values recorded at thirty metres at the period of hundred days, despite the observed linear trend, the concentration monitored at different location of the study environment were not homogeneous, the study experience different concentration within the predominant stratum of the formation, these condition expressed the heterogeneous influenced on the transport process of the contaminant, the study experienced pressure from latitudinal flow path within the predominant stratum as influential to the rate of migration based on velocity of flow. Nitrogen deposition also developed its pressure, all these parameters express their various influences reflected on the migration and deposited various concentration in heterogeneous setting, validation of the model were carried with experimental data, and both parameters developed best fits correlation.

Keywords: modeling cryptosporidium oocyst, nitrogen, heterogeneous, and fine sand

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Introduction

Regardless of technological developments in water decontamination as it has been established effectiveness of UV irradiation for the decontamination of C. parvum oocysts, the outbreak of disease from water born pathogen remain imperative to public health concern.[1]Tremendous challenges from water born pathogen such as C. parvum has been ubiquitous in aquatic environment, this has currently in the environmental express resilient oocyst form, it has also generate précised imperative difficulties in the protection of drinking water supply including chemical disinfection due to its resistance to conventional chemical applied. The application of Granular media filtration (GMF) is known as the conventional treatment techniques. This has developed high percentage of effective on the passage of pathogen in drinking waters for treatment. of C. parvum as reported by. Having such effectiveness GMF that a barrier on C. parvum oocyst, it has been observed that its treated passage into a drinking water is significantly impacted through design and operational factors, these are superiority of pre-treatment (coagulation), these are point between the filter cycle, hydraulic loading rate, media type, and raw water quality. Other concept that considered inorganic colloids or biocolloids such as C. parvum oocysts, the expansion of filtration theory that define colloid deposition within water-saturated porous media , these include granular media filters that has progressed considerably extend during the last several decades.[2–20]

Theoretical background

Nomenclature

C = Compressive strength

$A_{(x)}$ = Porosity of concrete

$B_{(x)}$ = Additive and cementious materials

α_{1x} = Water Cement Ratio

x = Curing Age

$$\frac{dc}{dx} + A_{(x)}\, C_d + B_{(x)}\, C_d^n = 0 \tag{1}$$

Transform the above Bernoulli's Equation to a linear first order DE gives:

$$\frac{dk}{dx} + (1-n)k = (1-n)\,B_{(x)}$$

Let I.F $= \ell^{-\alpha x_1 x}$ (2)

Use I.F to Solve (2) above

Hence, the general Solution becomes:

$$C_d^{1-n} = -\frac{B}{A} + Ce^{-\alpha_1 x} \tag{3}$$

Materials and method

Standard laboratory experiment where performed to monitor Shigallae using the standard method for the experiment at different formation, the soil deposition of the strata were collected in sequences base on the structural deposition of the lithology at different locations, this samples collected at different location generated variations at different depths producing different Shigallae concentration through column experiment, from the pressure flow at different strata, the experimental result were compared with the theoretical values for the validation of the model.

Results and discussion

Results and discussion are presented in tables including graphical representation for Shigallae concentration. Figure on to seven shows the linearization of the contaminant to the optimum values recorded at thirty metres at the period of hundred days, the study observed heterogeneous setting as the figure developed different rate of concentration at various figures. The study express growth rate of the contaminant under exponential condition, this are based on the facts that there are several factors in the transport system, this can be attributed to the microelements that are observed to deposit heterogeneous in the fine sand formation, such structured deposition in different formation of the soil express these setting in different dimensions. The growth of the contaminant in this condition determined the factor that contributes to exponential phase of the transport in depth and time. The heterogeneity of the concentration experienced this linearization in all the figures but the determined factor are on the latitudinal flow part observed to influence the growth rate with respect to time in the figures, the predictive values in such non homogeneous applied system express every influence that deposit in the litho structures of the environment, thus generate the concentration observed from the derived model simulation. Validation of the system expressed best fits correlation as the predictive and experimental values were compared.

Table 1 predictive and Experimental Values of Cryptosporidium Concentration at Different Depth

Depth [m]	Predictive Values	Experimental Values
3	0.9	0.92
6	1.8	1.82
9	2.7	2.71
12	3.6	3.62
15	4.5	4.53
18	5.4	5.42
21	6.3	6.32
24	7.2	7.22
27	8.1	8.12
30	9	9.22

Table 2 predictive and Experimental Values of Cryptosporidium Concentration at Different Depth

Time [T]	Predictive Values	Experimental Values
10	0.17	0.108
20	0.34	0.283
30	0.52	0.458
40	0.69	0.633
50	0.87	0.808
60	1.04	0.983
70	1.22	1.158
80	1.39	1.333
90	1.57	1.508
100	1.74	1.683

Table 3 predictive and Experimental Values of Cryptosporidium Concentration at Different Depth

Time [T]	Predictive Values	Experimental Values
10	1.83E-03	0.00201
20	3.68E-03	0.00401
30	5.52E-03	0.00601
40	7.36E-03	0.00801
50	9.21E-03	0.01001
60	1.11E-02	0.01201
70	1.29E-02	0.01401
80	1.47E-02	0.01601
90	1.65E-02	0.01801
100	1.84E-02	0.02001

Table 4 predictive and Experimental Values of Cryptosporidium Concentration at Different Depth

Time [T]	Predictive Values	Experimental Values
10	1.74E-04	0.00019993
20	3.48E-04	0.00039993
30	5.23E-04	0.00059993
40	6.97E-04	0.00079993
50	8.71E-04	0.00099993
60	1.04E-03	0.00119993
70	1.22E-03	0.00139993
80	1.39E-03	0.00159993
90	1.57E-03	0.00179993
100	1.74E-03	0.00199993

Table 5 predictive and Experimental Values of Cryptosporidium Concentration at Different Depth

Depth [m]	Predictive Values	Experimental Values
3	2.83E-03	0.00272
6	5.65E-03	0.00542
9	8.48E-03	0.00812
12	1.13E-02	0.01082
15	1.41E-02	0.01352
18	1.73E-02	0.01622
21	1.98E-02	0.01892
24	2.26E-02	0.02162
27	2.54E-02	0.02432
30	2.83E-02	0.02702

Table 6 predictive and Experimental Values of Cryptosporidium Concentration at Different Depth

Depth [m]	Predictive Values	Experimental Values
3	5.19E-04	0.0003
6	1.04E-04	0.0009
9	1.55E-03	0.0015
12	2.10E-03	0.0021
15	2.59E-03	0.0027
18	3.11E-03	0.0033
21	3.63E-03	0.0039
24	4.15E-03	0.0045
27	4.66E-03	0.0051
30	5.19E-03	0.0057

Table 6 predictive and Experimental Values of Cryptosporidium Concentration at Different Depth

Depth [m]	Predictive Values	Experimental Values
3	5.19E-04	0.0003
6	1.04E-04	0.0009
9	1.55E-03	0.0015
12	2.10E-03	0.0021
15	2.59E-03	0.0027
18	3.11E-03	0.0033
21	3.63E-03	0.0039
24	4.15E-03	0.0045
27	4.66E-03	0.0051
30	5.19E-03	0.0057

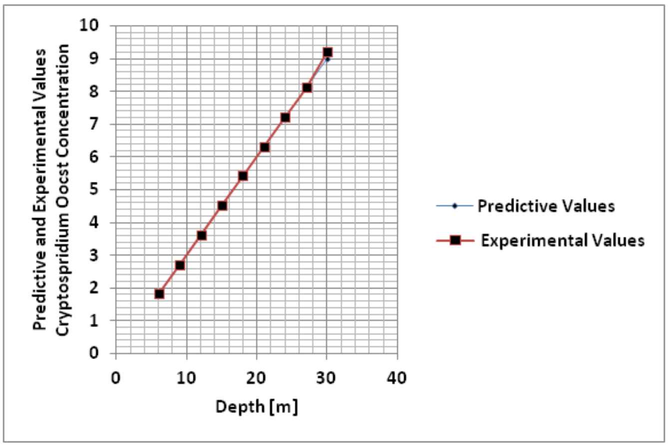

Figure 1 predictive and Experimental Values of Cryptosporidium Concentration at Different Depth.

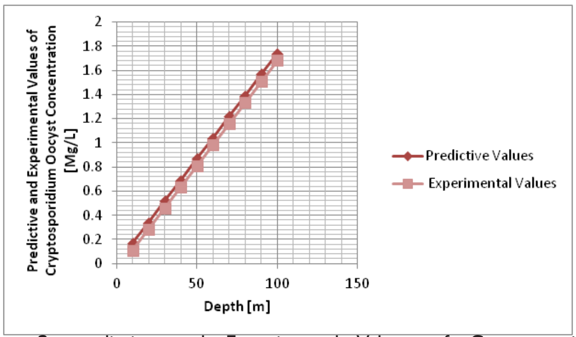

Figure 2 predictive and Experimental Values of Cryptosporidium Concentration at Different Depth.

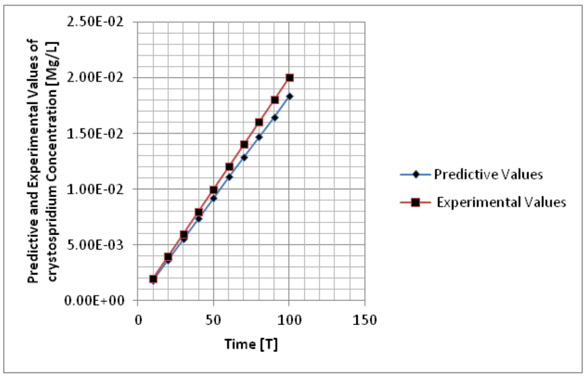

Figure 3 predictive and Experimental Values of Cryptosporidium Concentration at Different Time .

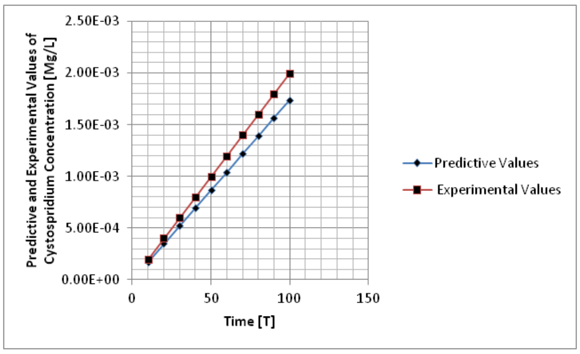

Figure 4 predictive and Experimental Values of Cryptosporidium Concentration at Different Time.

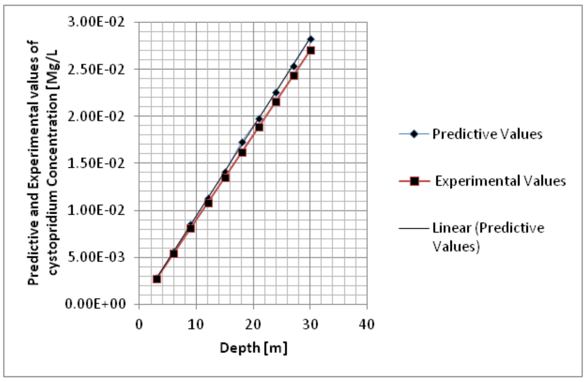

Figure 5 predictive and Experimental Values of Cryptosporidium Concentration at Different Depth.

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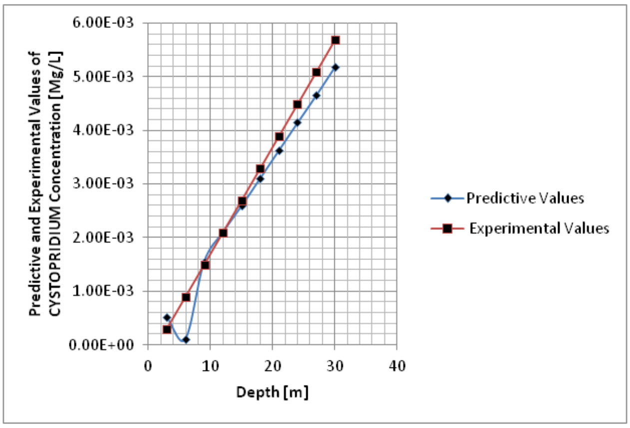

Figure 6 predictive and Experimental Values of Cryptosporidium Concentration at Different Depth.

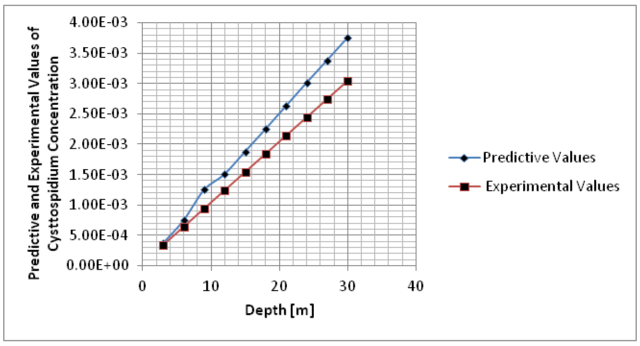

Figure 7 predictive and Experimental Values of Cryptosporidium Concentration at Different Depth.

Conclusion

The study has express the behaviour of Cryptosporidium oocyst in fines and deposition, such condition expressed the migration in heterogeneity at different figures, linear trend was observed but the concentration were heterogeneous in different depositions, such observed condition implies that the system are pressure by other factors that should influence the transport system to unconfined bed, based on this factors, the development of nonhomogeneous system to monitor the behaviour of the formation were appropriate, the developed system express the relationship between the heterogeneity of the formation and that of the migration level of the contaminant. These conditions have tremendously expressed other influential factors that may have caused the rate of concentration to generate exponential phase all the figures based on time and depth. These conditions observed variations on the flow path between intercedes of the strata. The litho structure of the formation experienced heterogeneous in slight condition but predominantly influenced by microelement nitrogen and flow path under latitudinal setting in the depositions, the derived model simulation from non-homogeneous system has definitely express the required pressured from these variables as an influential factors for the growth rates of the contaminant.

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None.

Conflicts of interest

The authors declare no conflicts of interest.

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