ISSN: 2641-2039
DOI: 10.33552/GJES.2019.02.000536
Global Journal of Engineering Sciences
Iris Publishers

Research Article

Porosity Influenced on Prediction of Enterobacter Transport in Heterogeneous Sand Graved Depositions

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Received Date: April 24, 2019
Published Date: May 13, 2019

Abstract

Porosity variation was observed to established high predominant heterogeneous concentration in this study, this condition was monitored on development of derived model to monitor the transport to phreatic depositions, such observed condition was found significant by applying non-homogeneous system in monitoring the rates of Enterobacter transport in sand gravel formation. Linear trend were observed on the validation of the derived model simulation values, but monitoring the rate of porosity reflection on the transport process was when the concentration were plotted against variation of porosity, the lowest soil porosity developed highest concentration, while the highest soil porosity generated lowest concentration of the contaminant, the system from the expression shows the rate at which variation of soil porosity reflect it influence on the growth rate of Enterobacter in sand gravel deposition, the study has significant detailed various rate of porosity effect on the transport process to phreatic beds, the rate of migration also explained various rate of porosity variation based on porous rocks disintegration at various soil matrix, these are structured to develop variations of porous medium in sand grave formations. Such condition has made this paper imperative to monitor the growth rate of Enterobacter transport under the influences of porosity variation in sand grave depositions.

Keywords: Porosity; Prediction Enterobacter; Transport; Sand gravel

Introduction

Quality ground water the litho structure of the formation will definitely develop reflection, that is why the transport of this contaminant are observed to influence the rate of concentration from this present study, most ground water globally are polluted due the activity of human [1-5]. it is very imperative to note that several bacteria can be removed through media even when the percentage retained is very high. Animal faces contain massive numbers of bacteria including other several enter natural water systems.

Shallow aquifer sediments interstices o can easily accommodate bacteria and probably protozoa and fungi as well. Greater microbes can be excluded from most subsurface formations, except for those formation that deposit gravelly and cavernous aquifers [6-11] pollution that contain microbiological are derived mostly from human and animal activities such as unsewered settlements; on-site sanitation; cemeteries; waste disposal; waste disposal; feedlots; etc. However, with very limited exemptions the only waterborne microbial pathogens of man are vitally human bacteria, viruses and protozoa, consideration the safety on drinking water such be adhered from the point of view of infectious diseases, because if that is ignored pollution from such sources will definitely contaminant the ground waters [12-16].

Theoretical Backgrounds

Nomenclature:

C = Shigella Concentration

A(x) = void Ratio /Permeability of Soil

B(x) = Velocity of Flow

C-n-[α1x] = Porosity of soil

x = Depth

$$\frac{dc}{dx} + A_{(x)}\ C_d + B_{(x)}\ C_d^n = 0 \quad \text{.....(1)}$$

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 = $\ell^{-\alpha x_{1x}}$ ..... **(2)**

Use I.F to Solve (2) above

Hence, the general Solution becomes:

$$C_d^{1-n} = -\frac{B}{A} + Ce^{-\alpha_1 x} \quad \text{..... (3)}$$

Materials and Method

Standard laboratory experiment where performed to monitor Enterobacter 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 Enterobacter 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 Enterobacter concentration (Tables 1-8).

Table1: Predictive and experimental values of Enterobacter concentration at different depth.

Depth [M]	Predictive Values [Conc. [Mg/L]	Experimental Values [Conc. Mg/L]
3	0.03323439	0.0333
6	0.06646878	0.0666
9	0.09970317	0.0999
12	0.13293756	0.1332
15	0.16617195	0.1665
18	0.19940634	0.1998
21	0.23264073	0.2331
24	0.26587512	0.2664
27	0.29910951	0.2997
30	0.3323439	0.333
33	0.36557829	0.3663
36	0.39881268	0.3996
39	0.43204707	0.4329
42	0.46528146	0.4662
45	0.49851585	0.4995
48	0.53175024	0.5328
51	0.56498463	0.5661
54	0.59821902	0.5994
57	0.63145341	0.6327
60	0.6646878	0.666
63	0.69792219	0.6993
66	0.73115658	0.7326
69	0.76439097	0.7659
72	0.79762536	0.7992
75	0.83085975	0.8325
78	0.86409414	0.8658
81	0.89732853	0.8991
84	0.93056292	0.9324
87	0.96379731	0.9657
90	0.9970317	0.999
93	**1.03026609**	**1.0323**
96	1.06350048	1.0656
100	1.107813	1.11

Table 2: Predictive and experimental values of Enterobacter concentration at different depth.

Depth [M]	Predictive Values [Conc. [Mg/L]	Experimental Values [Conc. Mg/L]
3	0.03073302	0.0306
6	0.06146604	0.0612
9	0.09219906	0.0918
12	0.12293208	0.1224
15	0.1536651	0.153
18	0.18439812	0.1836
21	0.21513114	0.2142
24	0.24586416	0.2448
27	0.27659718	0.2754
30	0.3073302	0.306
33	0.33806322	0.3366
36	0.36879624	0.3672
39	0.39952926	0.3978
42	0.43026228	0.4284
45	0.4609953	0.459
48	0.49172832	0.4896
51	0.52246134	0.5202
54	0.55319436	0.5508
57	0.58392738	0.5814
60	0.6146604	0.612
63	0.64539342	0.6426
66	0.67612644	0.6732
69	0.70685946	0.7038
72	0.73759248	0.7344
75	0.7683255	0.765
78	0.79905852	0.7956
81	0.82979154	0.8262
84	0.86052456	0.8568
87	0.89125758	0.8874
90	0.9219906	0.918
93	0.95272362	0.9486
96	0.98345664	0.9792
100	1.024434	1.02

Table 3: Predictive and experimental values of Enterobacter concentration at different depth.

Depth [M]	Predictive Values [Conc. [Mg/L]	Experimental Values [Conc. Mg/L]
3	0.024621938	0.0246
6	0.049243876	0.0492
9	0.073865814	0.0738
12	0.098487752	0.0984
15	0.12310969	0.123
18	0.147731628	0.1476
21	0.172353566	0.1722
24	0.196975504	0.1968
27	0.221597442	0.2214
30	0.24621938	0.246
33	0.270841318	0.2706
36	0.295463256	0.2952
39	0.320085195	0.3198
42	0.344707133	0.3444

45	0.369329071	0.369
48	0.393951009	0.3936
51	0.418572947	0.4182
54	0.443194885	0.4428
57	0.467816823	0.4674
60	0.492438761	0.492
63	0.517060699	0.5166
66	0.541682637	0.5412
69	0.566304575	0.5658
72	0.590926513	0.5904
75	0.615548451	0.615
78	0.640170389	0.6396
81	0.664792327	0.6642
84	0.689414265	0.6888
87	0.714036203	0.7134
90	0.738658141	0.738
93	0.763280079	0.7626
96	0.787902017	0.7872
100	0.820731268	0.82

Table 4: Predictive and experimental values of Enterobacter concentration at different depth.

Depth [M]	Predictive Values [Conc. [Mg/L]	Experimental Values [Conc. Mg/L]
3	0.01493396	0.015
6	0.029867921	0.03
9	0.044801881	0.045
12	0.059735841	0.06
15	0.074669802	0.075
18	0.089603762	0.09
21	0.104537722	0.105
24	0.119471683	0.12
27	0.134405643	0.135
30	0.149339603	0.15
33	0.164273564	0.165
36	0.179207524	0.18
39	0.194141484	0.195
42	0.209075445	0.21
45	0.224009405	0.225
48	0.238943365	0.24
51	0.253877326	0.255
54	0.268811286	0.27
57	0.283745246	0.285
60	0.298679207	0.3
63	0.313613167	0.315
66	0.328547127	0.33
69	0.343481088	0.345
72	0.358415048	0.36
75	0.373349008	0.375
78	0.388282969	0.39
81	0.403216929	0.405
84	0.418150889	0.42

87	0.43308485	0.435
90	0.44801881	0.45
93	0.46295277	0.465
96	0.47788673	0.48
100	0.497798678	0.5

Table 5: Predictive and experimental values of Enterobacter concentration at different depth.

Depth [M]	Predictive Values [Conc. [Mg/L]	Experimental Values [Conc. Mg/L]
3	0.009057905	0.009
6	0.01811581	0.018
9	0.027173714	0.027
12	0.036231619	0.036
15	0.045289524	0.045
18	0.054347429	0.054
21	0.063405334	0.063
24	0.072463238	0.072
27	0.081521143	0.081
30	0.090579048	0.09
33	0.099636953	0.099
36	0.108694858	0.108
39	0.117752763	0.117
42	0.126810667	0.126
45	0.135868572	0.135
48	0.144926477	0.144
51	0.153984382	0.153
54	0.163042287	0.162
57	0.172100191	0.171
60	0.181158096	0.18
63	0.190216001	0.189
66	0.199273906	0.198
69	0.208331811	0.207
72	0.217389715	0.216
75	0.22644762	0.225
78	0.235505525	0.234
81	0.24456343	0.243
84	0.253621335	0.252
87	0.262679239	0.261
90	0.271737144	0.27
93	0.280795049	0.279
96	0.289852954	0.288
100	0.30193016	0.3

Table 6: Predictive and experimental values of Enterobacter concentration at different depth.

Depth [M]	Predictive Values [Conc. [Mg/L]	Experimental Values [Conc. Mg/L]
3	0.003332217	0.0033
6	0.006664434	0.0066
9	0.009996651	0.0099
12	0.013328868	0.0132
15	0.016661085	0.0165
18	0.019993302	0.0198
21	0.023325519	0.0231
24	0.026657736	0.0264

27	0.029989953	0.0297
30	0.03332217	0.033
33	0.036654387	0.0363
36	0.039986604	0.0396
39	0.04331882	0.0429
42	0.046651037	0.0462
45	0.049983254	0.0495
48	0.053315471	0.0528
51	0.056647688	0.0561
54	0.059979905	0.0594
57	0.063312122	0.0627
60	0.066644339	0.066
63	0.069976556	0.0693
66	0.073308773	0.0726
69	0.07664099	0.0759
72	0.079973207	0.0792
75	0.083305424	0.0825
78	0.086637641	0.0858
81	0.089969858	0.0891
84	0.093302075	0.0924
87	0.096634292	0.0957
90	0.099966509	0.099
93	0.103298726	0.1023
96	0.106630943	0.1056
100	0.111073899	0.11

Table 7: Predictive and experimental values of Enterobacter concentration at different depth.

Depth [M]	Predictive Values [Conc. [Mg/L]	Experimental Values [Conc. Mg/L]
3	0.009996509	0.0099
6	0.019993018	0.0198
9	0.029989526	0.0297
12	0.039986035	0.0396
15	0.049982544	0.0495
18	0.059979053	0.0594
21	0.069975562	0.0693
24	0.07997207	0.0792
27	0.089968579	0.0891
30	0.099965088	0.099
33	0.109961597	0.1089
36	0.119958106	0.1188
39	0.129954614	0.1287
42	0.139951123	0.1386
45	0.149947632	0.1485
48	0.159944141	0.1584
51	0.16994065	0.1683
54	0.179937158	0.1782
57	0.189933667	0.1881
60	0.199930176	0.198
63	0.209926685	0.2079
66	0.219923194	0.2178
69	0.229919702	0.2277

72	0.239916211	0.2376
75	0.24991272	0.2475
78	0.259909229	0.2574
81	0.269905738	0.2673
84	0.279902246	0.2772
87	0.289898755	0.2871
90	0.299895264	0.297
93	0.309891773	0.3069
96	0.319888282	0.3168
100	0.33321696	0.33

Table 8: Variation predictive values of Enterobacter concentration at different depth.

Porosity of Soil	0.22	0.23	0.25	0.3	0.35	0.4	0.45
3m	0.03323439	0.03073302	0.024621938	0.01493396	0.009057905	0.003332217	0.009996509
6m	0.06646878	0.06146604	0.049243876	0.029867921	0.01811581	0.006664434	0.019993018
9m	0.09970317	0.09219906	0.073865814	0.044801881	0.027173714	0.009996651	0.029989526
12m	0.13293756	0.12293208	0.098487752	0.059735841	0.036231619	0.013328868	0.039986035
15m	0.16617195	0.1536651	0.12310969	0.074669802	0.045289524	0.016661085	0.049982544
18m	0.19940634	0.18439812	0.147731628	0.089603762	0.054347429	0.019993302	0.059979053
21m	0.23264073	0.21513114	0.172353566	0.104537722	0.063405334	0.023325519	0.069975562
24m	0.26587512	0.24586416	0.196975504	0.119471683	0.072463238	0.026657736	0.07997207
27m	0.29910951	0.27659718	0.221597442	0.134405643	0.081521143	0.029989953	0.089968579
30m	0.3323439	0.3073302	0.24621938	0.149339603	0.090579048	0.03332217	0.099965088
33m	0.36557829	0.33806322	0.270841318	0.164273564	0.099636953	0.036654387	0.109961597
36m	0.39881268	0.36879624	0.295463256	0.179207524	0.108694858	0.039986604	0.119958106
39m	0.43204707	0.39952926	0.320085195	0.194141484	0.117752763	0.04331882	0.129954614
42m	0.46528146	0.43026228	0.344707133	0.209075445	0.126810667	0.046651037	0.139951123
45m	0.49851585	0.4609953	0.369329071	0.224009405	0.135868572	0.049983254	0.149947632
48m	0.53175024	0.49172832	0.393951009	0.238943365	0.144926477	0.053315471	0.159944141
51m	0.56498463	0.52246134	0.418572947	0.253877326	0.153984382	0.056647688	0.16994065
54m	0.59821902	0.55319436	0.443194885	0.268811286	0.163042287	0.059979905	0.179937158
57m	0.63145341	0.58392738	0.467816823	0.283745246	0.172100191	0.063312122	0.189933667
60m	0.6646878	0.6146604	0.492438761	0.298679207	0.181158096	0.066644339	0.199930176
63m	0.69792219	0.64539342	0.517060699	0.313613167	0.190216001	0.069976556	0.209926685
66m	0.73115658	0.67612644	0.541682637	0.328547127	0.199273906	0.073308773	0.219923194
69m	0.76439097	0.70685946	0.566304575	0.343481088	0.208331811	0.07664099	0.229919702
72m	0.79762536	0.73759248	0.590926513	0.358415048	0.217389715	0.079973207	0.239916211
75m	0.83085975	0.7683255	0.615548451	0.373349008	0.22644762	0.083305424	0.24991272
78m	0.86409414	0.79905852	0.640170389	0.388282969	0.235505525	0.086637641	0.259909229
81m	0.89732853	0.82979154	0.664792327	0.403216929	0.24456343	0.089969858	0.269905738
84m	0.93056292	0.86052456	0.689414265	0.418150889	0.253621335	0.093302075	0.279902246
87m	0.96379731	0.89125758	0.714036203	0.43308485	0.262679239	0.096634292	0.289898755
90m	0.9970317	0.9219906	0.738658141	0.44801881	0.271737144	0.099966509	0.299895264
93m	1.03026609	0.95272362	0.763280079	0.46295277	0.280795049	0.103298726	0.309891773
96m	1.06350048	0.98345664	0.787902017	0.47788673	0.289852954	0.106630943	0.319888282
100m	1.107813	1.024434	0.820731268	0.497798678	0.30193016	0.111073899	0.33321696

The Figure from 1-7 express linear trend of the Enterobacter migration in sand grave formation, the graphical representation express linear trend under exponential condition, this shows that the contaminant are under increase to the optimum depth recorded at 100m, such condition were observed in all the figures, validation were carried where all the predictive valued were compared with

experiment data, and both parameters developed favorable fits, the study shows linear trend but the concentration deposition at different figure are not on linear condition, this experienced are observed in figure [8] where the variations of porosity were monitored at different depth, the deposited of porosity were plotted against concentration at different depth, the figure shows how porosity influence are reelected on the concentration applying non-homogeneous system, the figure express the rate of concentration from [3-100m] of the formation, this condition explained the litho structure of the deposition in heterogeneous setting, these factors were monitored through the predominant formation characteristics monitored to influence the system in heterogeneous sand grave depositions, the concentration of the contaminant in sand gravel express several litho structure in study environment, it has display its rate of depositional variations of porosity in different depth, high to low concentration from the last figure explained extensively the detailed transport influence of the contaminant, the derived simulation values were compared with experimental values and both parameters express best fit correlation.

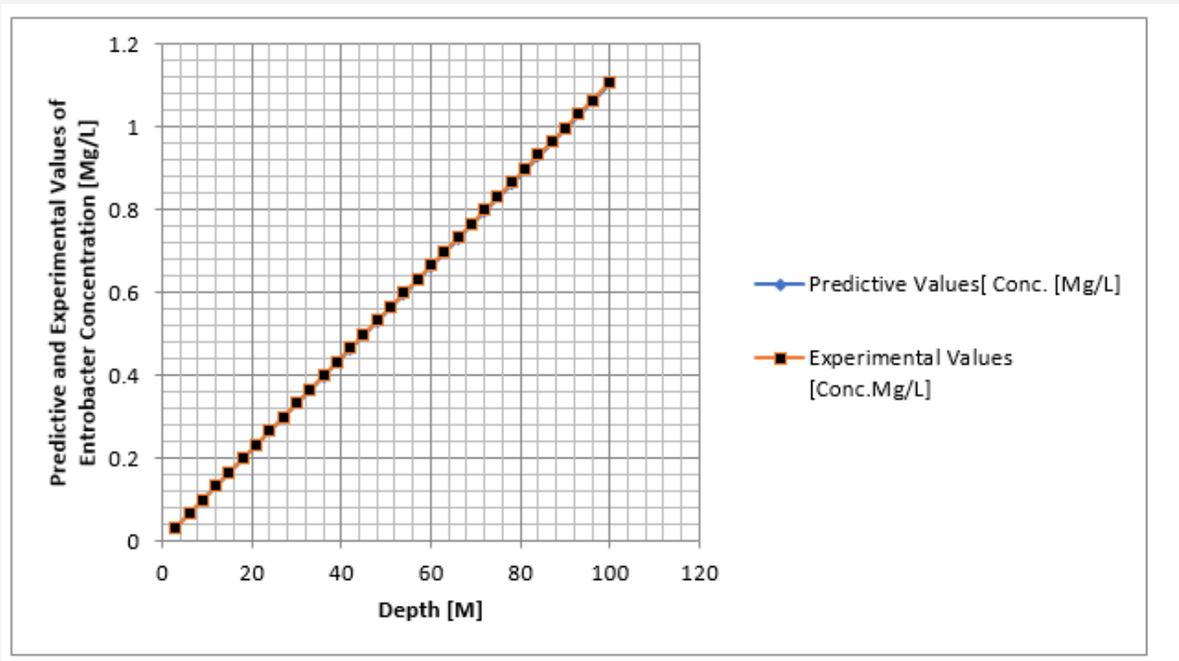

Figure 1: Predictive and experimental values of Enterobacter concentration at different depth.

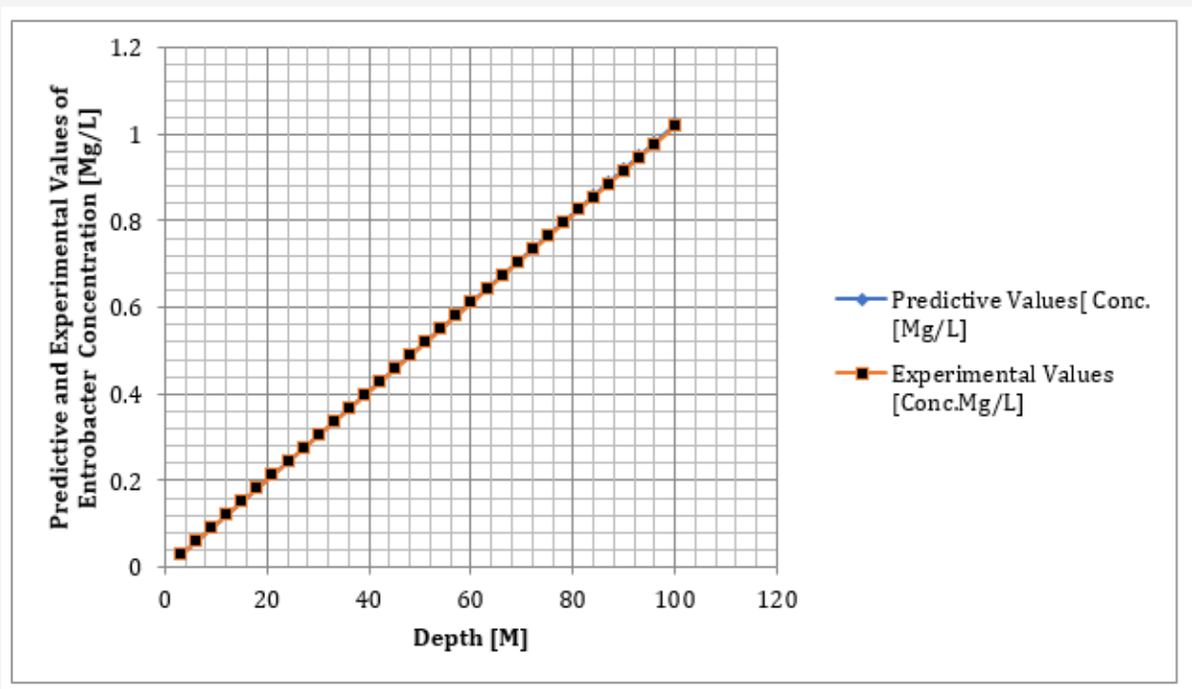

Figure 2: Predictive and experimental values of Enterobacter concentration at different depth.

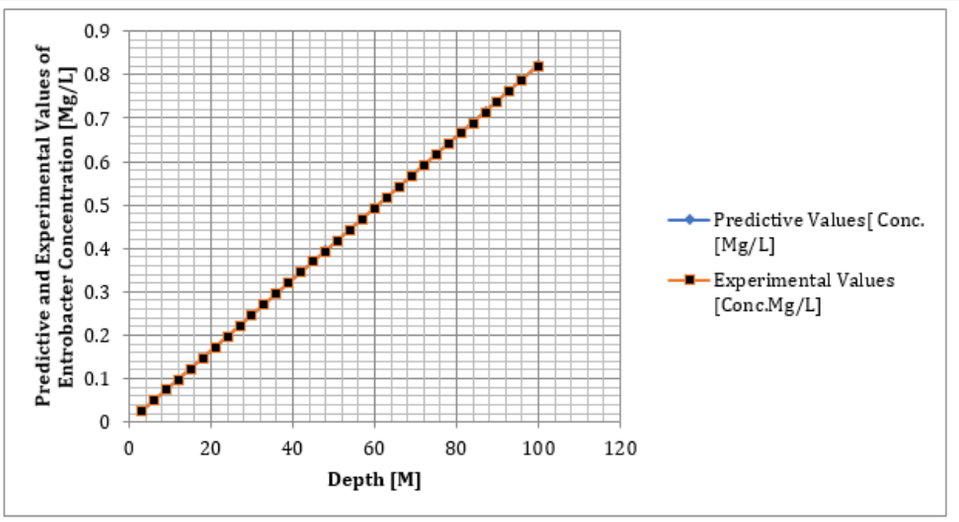

Figure 3: Predictive and experimental values of Enterobacter concentration at different depth.

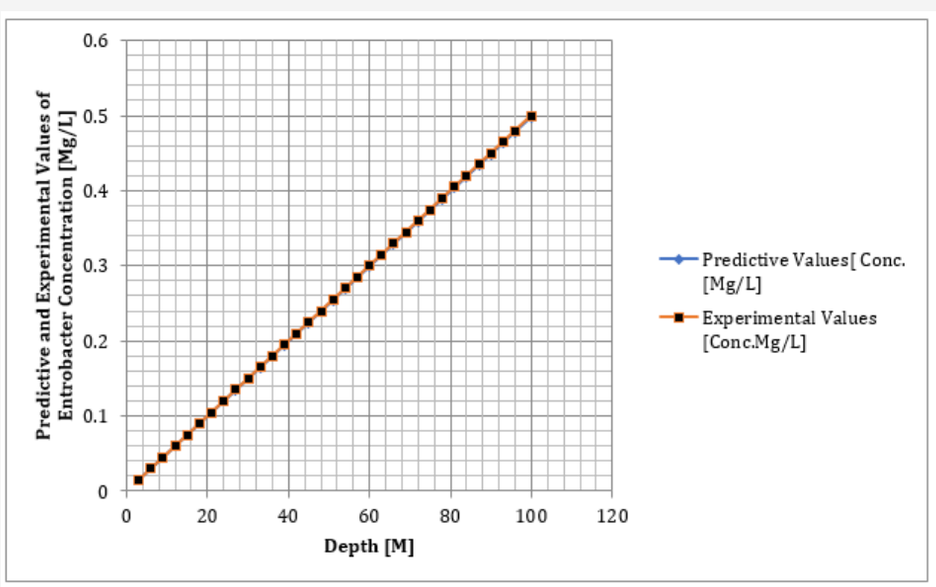

Figure 4: Predictive and experimental values of Enterobacter concentration at different depth.

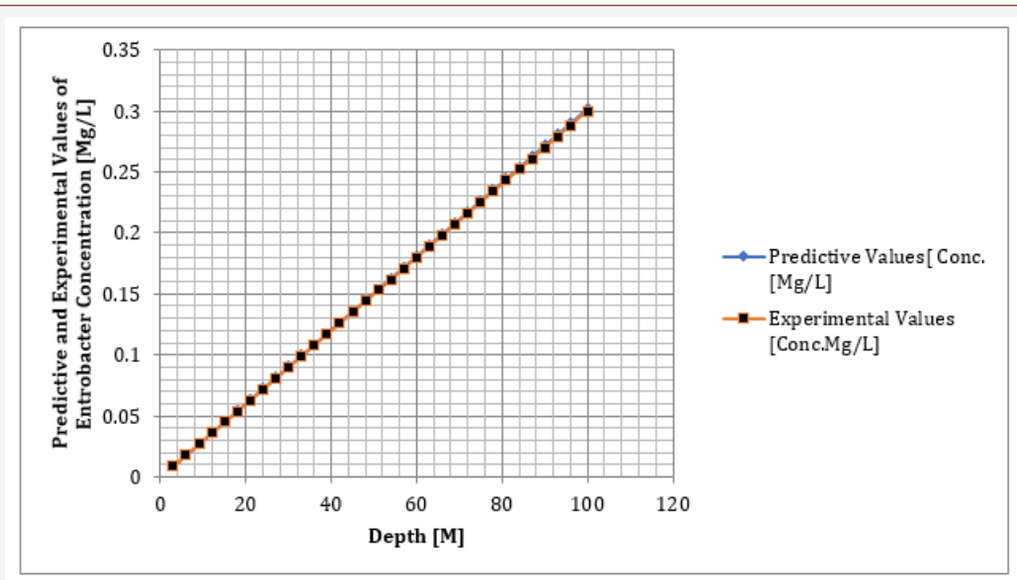

Figure 5: Predictive and experimental values of Enterobacter concentration at different depth.

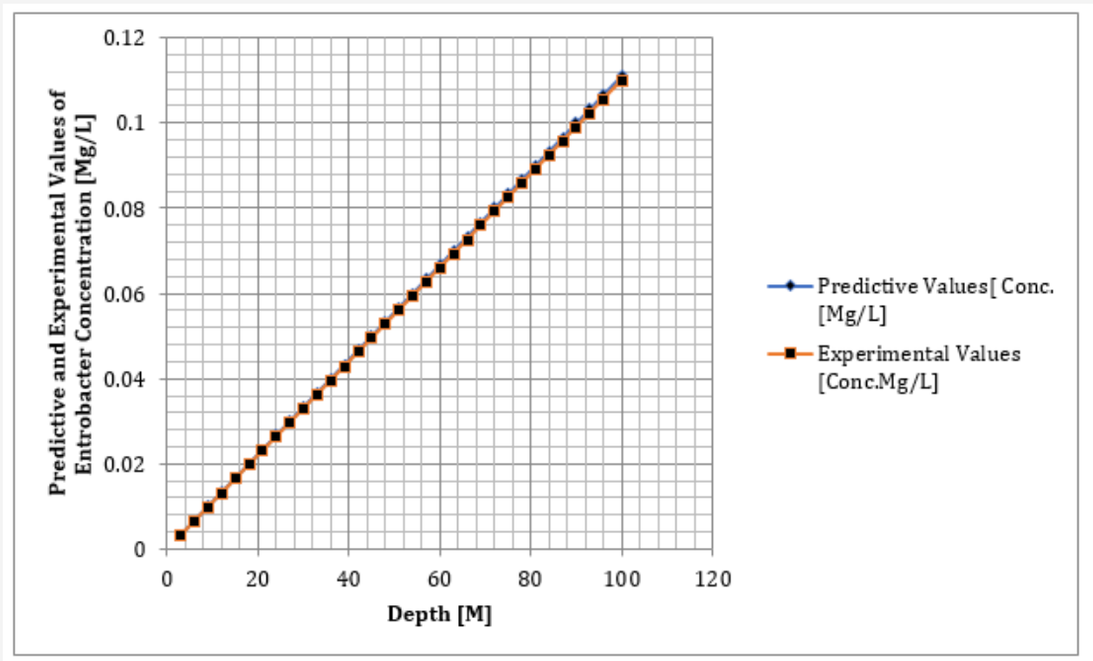

Figure 6: Predictive and experimental values of Enterobacter concentration at different depth.

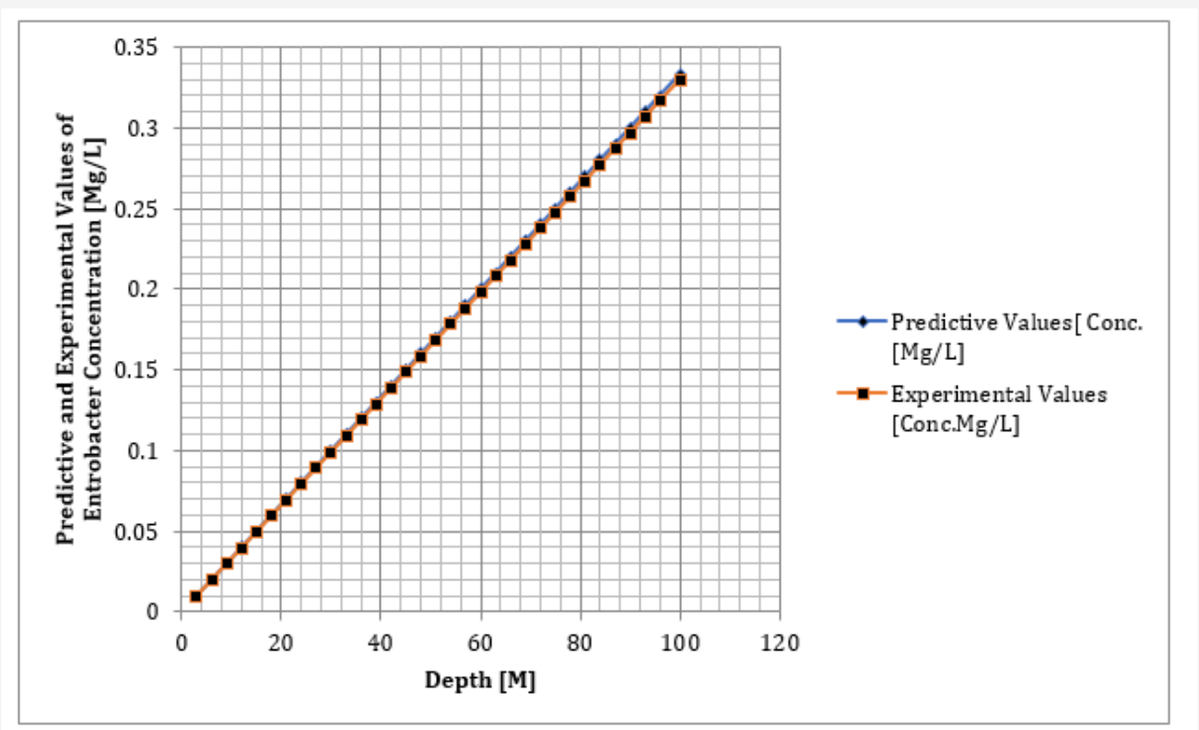

Figure 7: Predictive and experimental values of Enterobacter concentration at different depth.

Conclusion

The study monitoring the reflection influence from porosity depositions in sand grave formation, the study observed linear trend in the figure compared with experimental values, these parameter developed best fits correlation, but the reflection of porosity on Enterobacter migration to phreatic deposition were observed through comparison between concentration at different depth and variation of soil porosity. The study experienced high to low concentration; different from exponential rate in other figures, this expression examined the rate of influence from soil porosity on Enterobacter transport in deltaic depositions, the rate of concentration has applied porosity depositions at different locations as a determine factor on migration rate of the contaminant. The derived solution generated this non-homogeneous system to monitor the concentration under such predominant reflection in the study area. The study has detailed the behavior of porosity heterogeneity in the transport system of Enterobacter in sand gravel depositions (Figure 8).

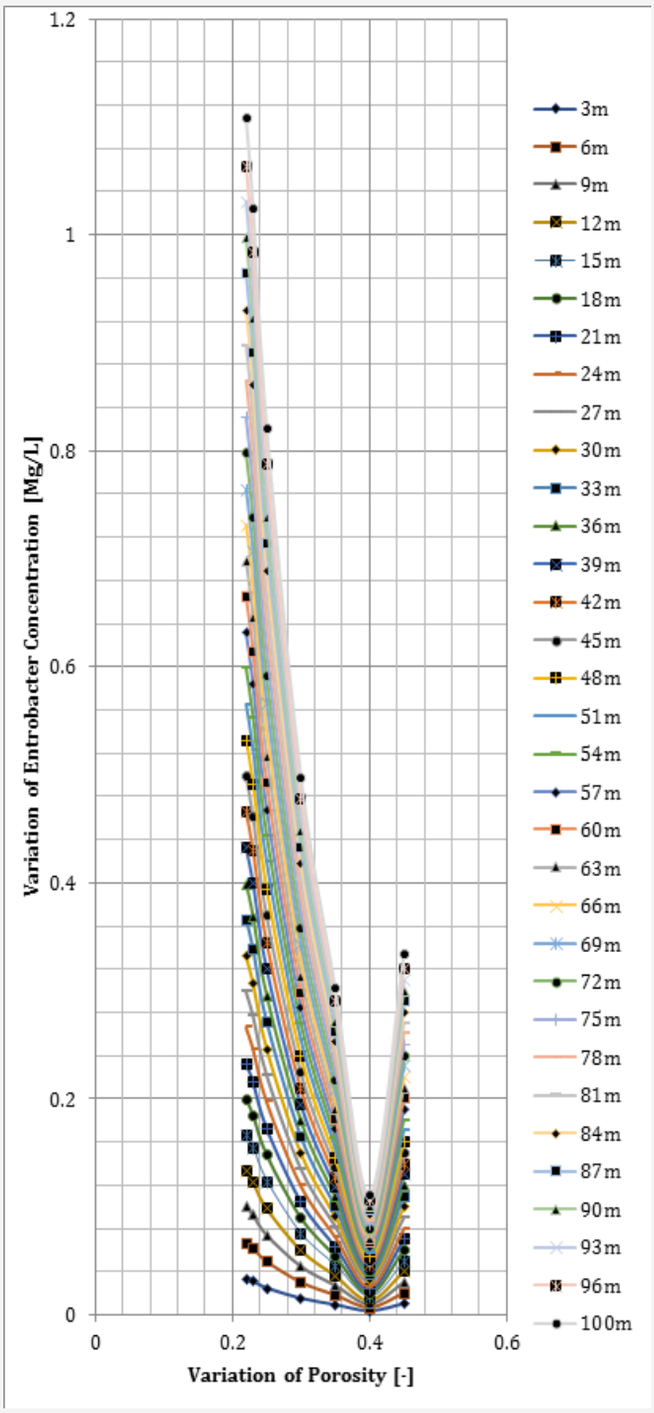

Figure 8: Variation predictive values of Enterobacter concentration at different depth.

Acknowledgement

None.

Conflict of Interest

No conflict of interest.

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