Review article

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# Heterogeneous velocity and dispersions coefficient influence on ionic transport model in creeks

## Abstract

This paper shows the rate of ionic concentration in the creek, different station point were used to monitor their variation rates of concentration in the creek, the transport system were developed based on the investigation carried out to observed the source of contamination in the study environment, the process were applied in other to determine the significant parameters that influence the transport process of the contaminant, these generates variations of the creek velocity and dispersion coefficient, the flow rates experienced heterogeneity in its depositions through its velocity rates at different station points, such parameters were integrated in the system to generated derived simulation values, the graphical representation experience decrease with respect to increase in distance, these condition observed were due to variations of the creek flow rates through velocity of flows in different figures, such conditions were observed to pressured the system that determine the concentration rates at different figures, these figures reflects different station points that validated the predictive values through experimental data for model validation, the generated results were above the permissible limited as an acceptable standard of 0.3Mg/L, the study is imperative because the rate of ionic content in different locations has been determined, their influential parameters has be observed in the study environment, there rates of concentrations which reflects the significant parameters that pressured it transport process in the creek has been observed, these were all determined in the study environment, proofing the validation of the model for ionic concentration in the study area.

**Keywords:** heterogeneous, velocity, dispersions ionic transport and creek

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## Introduction

Surface water such as Rivers, streams and lakes, are one of the major water sources for drinking including that of agricultural uses. Drinking-water supplies relying on its proportion on surface water, it normally experiences variations regionally, but globally, predictable, surface water is cover about 50% of drinking water needs. The influences from population affect the increase in many parts of the world; these are observed through the protection of surface water sources thus preventing deterioration of its quality becomes a basic requirement. More so surface water interacts hydro chemically on its surrounding area that the flow scan be seen. The amount of should have an connections that considerably which will definitely depends on hydro-meteorological, fluvial, and anthropogenic, this should also include geological processes,[1] these conditions may influences the composition from hydro chemical of water bodies including the local and regional scales.[2-5] These has a result such as surface water quality that is subjected to hydro chemical alteration the variations definitely indicates climate and environment changes thus increased precipitation, evaporation, domestic and industrial activities, it also includes agriculture and breeding, human and animal consumption.[6]

There are conditions that shows the rate of hydro chemical characteristics, it also represents other significant factors that determining the required multi-purpose applied on water[7,8] this was carried out other to better the identify and basic processes affecting the chemical composition of the surface water. Meanwhile an understanding of some major factors in controlling ion and metal composition should be required.[8,9] The evacuations on water qualities in most developing countries should become a major issue in recent years, it also very relevant basically this area that concerns freshwater, it will be a scarce resource in future.[10,11] These conditions allowed for Permissible limits for various ions in drinking water are given by WHO[12]

## Theoretical Background

$$\frac{d\Phi}{dy}+\beta(z)\lambda=A(y) \tag{1}$$

Multiplying the equation through by $\Phi[y]$ , we have:

$$\Phi(y)\frac{d\Phi}{dy}+\Phi(y)\beta(x)\lambda=\Phi(x)A(y) \tag{2}$$

Let $$P(y)=\Phi(x)\beta(y) \tag{3}$$

Then Equation (2), we have:

$$\Phi(x)\frac{d\Phi}{dy}+\Phi(y)\beta(y)\lambda=\Phi(x)A(y) \tag{4}$$

$$\Phi(y)\frac{d\Phi}{dy}+P(y)=\Phi(y)A(y) \tag{5}$$

$$\Phi(x)P^1+P(y)\lambda=\Phi(y)A(y) \tag{6}$$

$$\Phi(x)P^1=\Phi(y)A-P(y)\lambda \tag{7}$$

Differentiate 2nd term on the left hand side of (6) with respect to y, we have

$$\lambda\frac{d\Phi}{dy}=\Phi(y)A(y)-\Phi(x)P^1 \tag{8}$$

$$\frac{d\Phi}{dy}=\frac{1}{\lambda}\left[\Phi(y)A(y)-\Phi(y)P^1\right] \tag{9}$$

$$\frac{d\Phi}{dy}=\frac{\Phi(x)}{\lambda}\left[A(y)-P^1\right] \tag{10}$$

Applying separation of variables, by dividing through by C(y) and cross multiply by dy, gives:

$$\frac{d\Phi}{C\Phi}=\frac{1}{\lambda}\left[A(y)-P^1\right]dy \tag{11}$$

$$\frac{1}{\Phi(y)}d\Phi=\frac{1}{\lambda}\left[A(y)-P^1\right]dy \tag{12}$$

$$\frac{1}{\Phi(y)}d\Phi=\left(\frac{A(y)}{\lambda}-\frac{P^1}{K}\right)dy \tag{13}$$

$$\int\frac{1}{\Phi(y)}d\Phi=\int\left(\frac{A(y)}{\lambda}-\frac{P^1}{\lambda}\right)dy+\eta \tag{14}$$

$$\ln\Phi(y)=\int A(y)dy-\int\frac{P^1}{\lambda}dy+\eta \tag{15}$$

$$\ln\Phi(y)=\frac{1}{\lambda}\left[Ay-P^1\right]y+\eta \tag{16}$$

$$\ln\Phi(y)=\left(\frac{A(y)}{\lambda}-\frac{P^1}{\lambda}\right)y+\eta \tag{17}$$

Taking exponent of the both side of the equation

$$\Phi(y)=\ell^{\left(\frac{A(y)}{\lambda}-\frac{P^1}{\lambda}+\eta\right)} \tag{18}$$

$$\Phi(y)=D\ell^{\frac{1}{\lambda}\left(Ay-P^1y\right)} \tag{19}$$

## Material and Method

Experimental procedure was set up to monitor Ionic content applying the standard techniques in carrying out experiment at various station, sample collection was carried out in sequences based on stipulated standard from those locations, this samples collected at those location generating variations at different distance producing different Ionic concentration from physiochemical analysis carried out, the experimental values was compared with theoretical values from the experiment for model validation.

## Result and discussion

Figure one to ten explained the graphical representation of the study on ionic transport in creek, these surface water were observed to exhibits several content based on the investigation and other required analysis in the environment, several environmental factors were observed in the creek during a comprehensive survey that was carry out, the content of ion deposition were basically from the industrial activity that generate pollution in the environment, the deposition ionic content are from this industrial activities from human, the study were able to monitor the activities of man in the environment, such conditions from investigations were comprehensively considered in development of model applied to generate the graphical presentation results, the presentation expressed various behaviour of the contaminant in terms of their rates of concentration at different locations that were applied for model validation, the study has expressed various rates of concentration based on the observed factors that influence the deposition of ionic content in the creek, the contaminant has also displayed the effect of velocity of flows at different station points that generated different concentration, these are based on velocity influence in the creek, the velocity of flows were monitor in the creek, the reflection of their impact in transport of ionic concentration shows the fluctuation of the flow rates that affect their rate of concentration at different locations. the dispersion of the contaminant were also observed as a significant factor that increase the concentration at various area of the creek, the human activity were observed not to have one source of discharge, the rate of ionic content were affected from this factor thus their point source in the creek were out of control, the system from the graphical representation observed decrease in concentration with respect to increase in distance, these are based on their rates of waste discharge at different point sources, the velocity where investigation was carried out during these process were to monitor the transport process of the ionic content in the discharge point sources, these were integrated in the simulation, whereby the generated predictive values were compared with experimental values, both parameters developed beast fits correlation (Figures 1-10), (Tables 1-10).

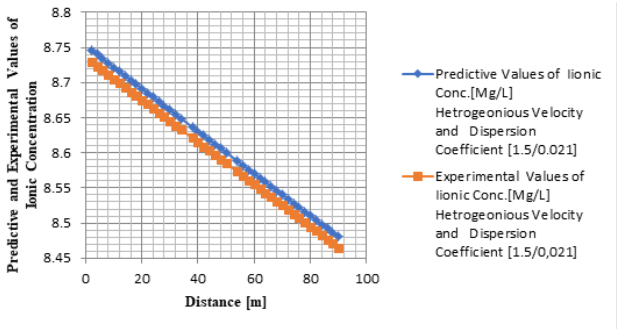


**Figure 1** Experimental and predictive values of ionic concentration at different distance.

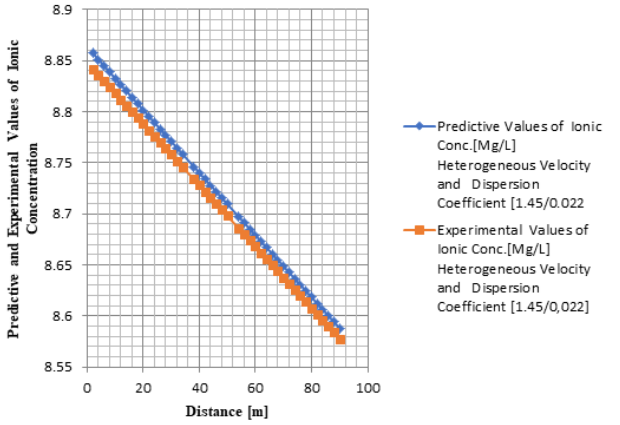


**Figure 2** Experimental and predictive values of ionic concentration at different distance.

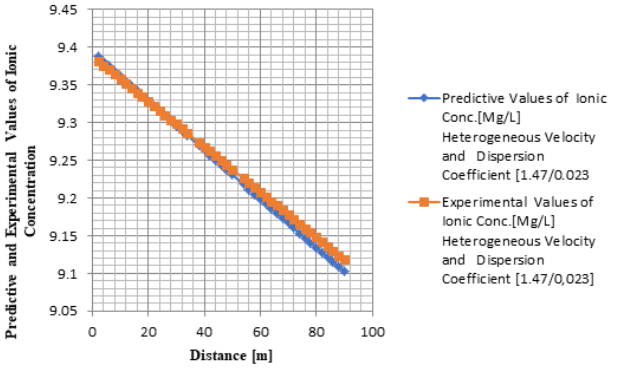


**Figure 3** Experimental and predictive values of ionic concentration at different distance.

**Citation:** Eluozo SN, Ikebude CF. Heterogeneous velocity and dispersions coefficient influence on ionic transport model in creeks. *Material Sci & Eng.* 2022;6(3):101–109. DOI: 10.15406/mseij.2022.06.00186

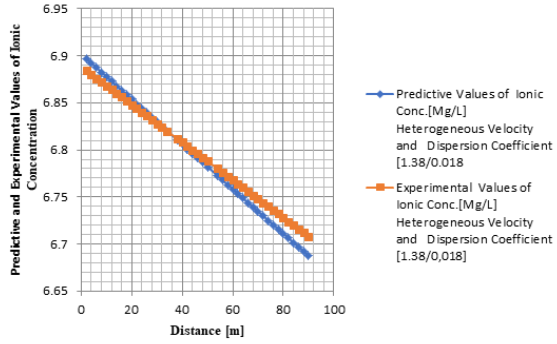


**Figure 4** Experimental and predictive values of ionic concentration at different distance.

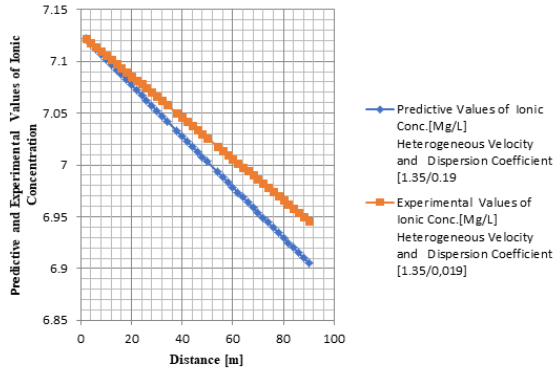


**Figure 5** Experimental and predictive values of ionic concentration at different distance.

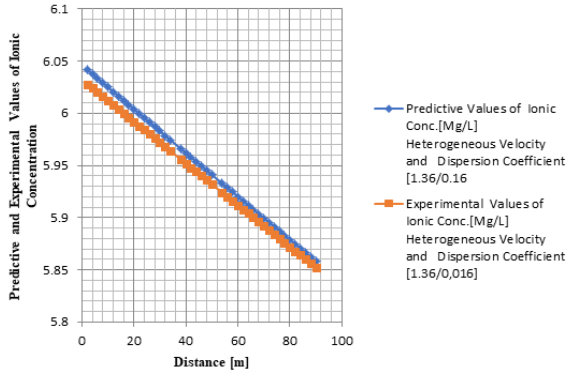


**Figure 6** Experimental and predictive values of ionic concentration at different distance.

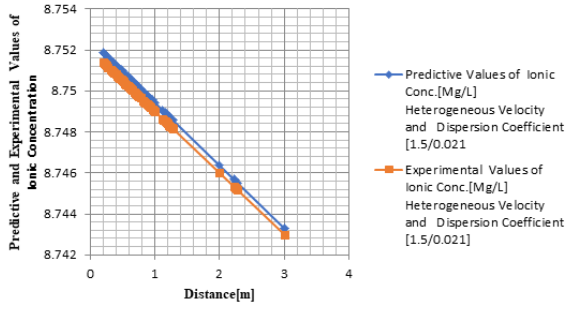


**Figure 7** Experimental and predictive values of ionic concentration at different distance.

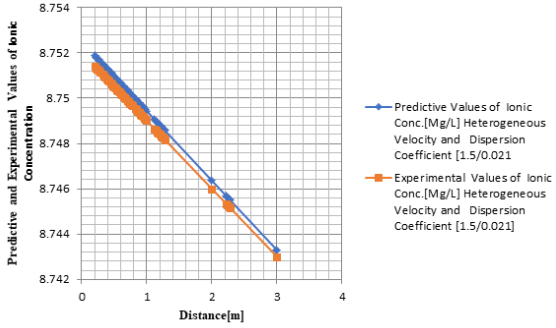


**Figure 8** Experimental and predictive values of ionic concentration at different distance.

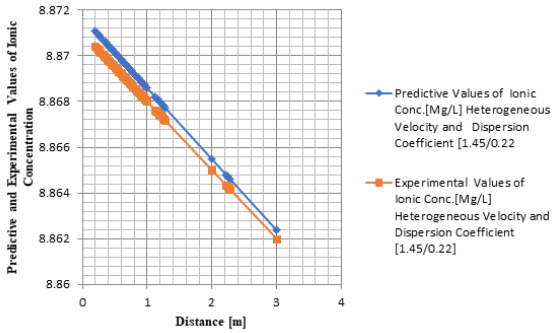


**Figure 9** Experimental and predictive values of ionic concentration at different distance.

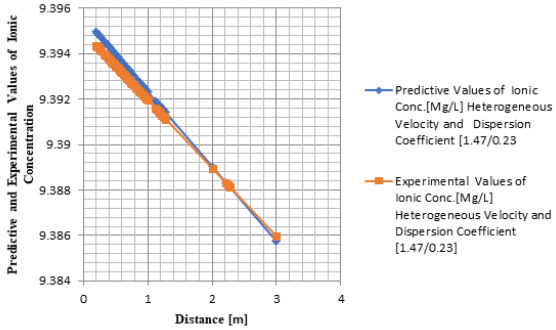


**Figure 10** Experimental and predictive values of ionic concentration at different distance.

**Table 1** Experimental and Predictive Values of Ionic Concentration at Different Distance

| Distance [x] | Predictive Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.5/0.021] | Experimental Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.5/0,021] |
|---|---|---|
| 2 | 8.746358687 | 8.729 |
| 4 | 8.740226177 | 8.723 |
| 6 | 8.734097966 | 8.717 |
| 8 | 8.727974053 | 8.711 |
| 10 | 8.721854433 | 8.705 |
| 12 | 8.715739104 | 8.699 |
| 14 | 8.709628063 | 8.693 |
| 16 | 8.703521306 | 8.687 |
| 18 | 8.697418831 | 8.681 |

**Citation:** Eluozo SN, Ikebude CF. Heterogeneous velocity and dispersions coefficient influence on ionic transport model in creeks. *Material Sci & Eng.* 2022;6(3):101–109. DOI: 10.15406/mseij.2022.06.00186

Table Continued...

| Distance [x] | Predictive Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.5/0.021] | Experimental Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.5/0,021] |
|---|---|---|
| 20 | 8.691320635 | 8.675 |
| 22 | 8.685226715 | 8.669 |
| 24 | 8.679137068 | 8.663 |
| 26 | 8.67305169 | 8.657 |
| 28 | 8.666970579 | 8.651 |
| 30 | 8.660893732 | 8.645 |
| 32 | 8.654821145 | 8.639 |
| 34 | 8.648752816 | 8.633 |
| 38 | 8.636628921 | 8.621 |
| 40 | 8.630573347 | 8.615 |
| 42 | 8.62452202 | 8.609 |
| 44 | 8.618474936 | 8.603 |
| 46 | 8.612432091 | 8.597 |
| 48 | 8.606393484 | 8.591 |
| 50 | 8.60035911 | 8.585 |
| 54 | 8.588303053 | 8.573 |
| 56 | 8.582281364 | 8.567 |
| 58 | 8.576263896 | 8.561 |
| 60 | 8.570250648 | 8.555 |
| 62 | 8.564241616 | 8.549 |
| 64 | 8.558236797 | 8.543 |
| 66 | 8.552236189 | 8.537 |
| 68 | 8.546239787 | 8.531 |
| 70 | 8.540247591 | 8.525 |
| 72 | 8.534259595 | 8.519 |
| 74 | 8.528275798 | 8.513 |
| 76 | 8.522296197 | 8.507 |
| 78 | 8.516320788 | 8.501 |
| 80 | 8.510349569 | 8.495 |
| 82 | 8.504382537 | 8.489 |
| 84 | 8.498419688 | 8.483 |
| 86 | 8.49246102 | 8.477 |
| 88 | 8.48650653 | 8.471 |
| 90 | 8.480556216 | 8.465 |

**Table 2** Experimental and Predictive Values of Ionic Concentration at Different Distance

| Distance [x] | Predictive Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.45/0.022] | Experimental Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.45/0,022] |
|---|---|---|
| 2 | 8.857423559 | 8.842 |
| 4 | 8.851213176 | 8.836 |
| 6 | 8.845007147 | 8.83 |
| 8 | 8.838805469 | 8.824 |
| 10 | 8.83260814 | 8.818 |
| 12 | 8.826415156 | 8.812 |
| 14 | 8.820226514 | 8.806 |
| 16 | 8.814042212 | 8.8 |
| 18 | 8.807862245 | 8.794 |
| 20 | 8.801686612 | 8.788 |
| 22 | 8.795515308 | 8.782 |
| 24 | 8.789348332 | 8.776 |
| 26 | 8.78318568 | 8.77 |
| 28 | 8.777027348 | 8.764 |

Table Continued...

| Distance [x] | Predictive Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.45/0.022] | Experimental Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.45/0,022] |
|---|---|---|
| 30 | 8.770873335 | 8.758 |
| 32 | 8.764723636 | 8.752 |
| 34 | 8.758578249 | 8.746 |
| 38 | 8.746300399 | 8.734 |
| 40 | 8.74016793 | 8.728 |
| 42 | 8.73403976 | 8.722 |
| 44 | 8.727915887 | 8.716 |
| 46 | 8.721796308 | 8.71 |
| 48 | 8.71568102 | 8.704 |
| 50 | 8.709570019 | 8.698 |
| 54 | 8.69736087 | 8.686 |
| 56 | 8.691262714 | 8.68 |
| 58 | 8.685168835 | 8.674 |
| 60 | 8.679079228 | 8.668 |
| 62 | 8.67299389 | 8.662 |
| 64 | 8.66691282 | 8.656 |
| 66 | 8.660836013 | 8.65 |
| 68 | 8.654763467 | 8.644 |
| 70 | 8.648695179 | 8.638 |
| 72 | 8.642631146 | 8.632 |
| 74 | 8.636571364 | 8.626 |
| 76 | 8.630515831 | 8.62 |
| 78 | 8.624464544 | 8.614 |
| 80 | 8.6184175 | 8.608 |
| 82 | 8.612374696 | 8.602 |
| 84 | 8.606336129 | 8.596 |
| 86 | 8.600301795 | 8.59 |
| 88 | 8.594271693 | 8.584 |
| 90 | 8.588245818 | 8.578 |

**Table 3** Experimental and Predictive Values of Ionic Concentration at Different Distance

| Distance [x] | Predictive Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.47/0.023] | Experimental Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.47/0,023] |
|---|---|---|
| 2 | 9.387758324 | 9.382 |
| 4 | 9.381176096 | 9.376 |
| 6 | 9.374598484 | 9.37 |
| 8 | 9.368025483 | 9.364 |
| 10 | 9.361457091 | 9.358 |
| 12 | 9.354893305 | 9.352 |
| 14 | 9.348334121 | 9.346 |
| 16 | 9.341779535 | 9.34 |
| 18 | 9.335229546 | 9.334 |
| 20 | 9.328684149 | 9.328 |
| 22 | 9.322143341 | 9.322 |
| 24 | 9.315607119 | 9.316 |
| 26 | 9.30907548 | 9.31 |
| 28 | 9.302548421 | 9.304 |
| 30 | 9.296025939 | 9.298 |
| 32 | 9.289508029 | 9.292 |
| 34 | 9.28299469 | 9.286 |
| 38 | 9.269981708 | 9.274 |
| 40 | 9.26348206 | 9.268 |

**Citation:** Eluozo SN, Ikebude CF. Heterogeneous velocity and dispersions coefficient influence on ionic transport model in creeks. *Material Sci & Eng.* 2022;6(3):101–109. DOI: 10.15406/mseij.2022.06.00186

Table Continued...

| Distance [x] | Predictive Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.47/0.023] | Experimental Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.47/0,023] |
|---|---|---|
| 42 | 9.256986968 | 9.262 |
| 44 | 9.250496431 | 9.256 |
| 46 | 9.244010445 | 9.25 |
| 48 | 9.237529006 | 9.244 |
| 50 | 9.231052112 | 9.238 |
| 54 | 9.218111944 | 9.226 |
| 56 | 9.211648664 | 9.22 |
| 58 | 9.205189915 | 9.214 |
| 60 | 9.198735695 | 9.208 |
| 62 | 9.192286001 | 9.202 |
| 64 | 9.185840829 | 9.196 |
| 66 | 9.179400176 | 9.19 |
| 68 | 9.172964038 | 9.184 |
| 70 | 9.166532414 | 9.178 |
| 72 | 9.160105299 | 9.172 |
| 74 | 9.15368269 | 9.166 |
| 76 | 9.147264585 | 9.16 |
| 78 | 9.140850979 | 9.154 |
| 80 | 9.134441871 | 9.148 |
| 82 | 9.128037256 | 9.142 |
| 84 | 9.121637132 | 9.136 |
| 86 | 9.115241495 | 9.13 |
| 88 | 9.108850343 | 9.124 |
| 90 | 9.102463671 | 9.118 |

**Table 4** Experimental and Predictive Values of Ionic Concentration at Different Distance

| Distance [x] | Predictive Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.38/0.018] | Experimental Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.38/0,018] |
|---|---|---|
| 2 | 6.897128565 | 6.884 |
| 4 | 6.892292642 | 6.88 |
| 6 | 6.887460111 | 6.876 |
| 8 | 6.882630967 | 6.872 |
| 10 | 6.87780521 | 6.868 |
| 12 | 6.872982836 | 6.864 |
| 14 | 6.868163844 | 6.86 |
| 16 | 6.86334823 | 6.856 |
| 18 | 6.858535993 | 6.852 |
| 20 | 6.85372713 | 6.848 |
| 22 | 6.848921638 | 6.844 |
| 24 | 6.844119516 | 6.84 |
| 26 | 6.839320761 | 6.836 |
| 28 | 6.834525371 | 6.832 |
| 30 | 6.829733343 | 6.828 |
| 32 | 6.824944674 | 6.824 |
| 34 | 6.820159364 | 6.82 |
| 38 | 6.810598806 | 6.812 |
| 40 | 6.805823554 | 6.808 |
| 42 | 6.80105165 | 6.804 |
| 44 | 6.796283092 | 6.8 |
| 46 | 6.791517878 | 6.796 |
| 48 | 6.786756004 | 6.792 |
| 50 | 6.78199747 | 6.788 |

Table Continued...

| Distance [x] | Predictive Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.38/0.018] | Experimental Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.38/0,018] |
|---|---|---|
| 54 | 6.772490408 | 6.78 |
| 56 | 6.767741875 | 6.776 |
| 58 | 6.762996672 | 6.772 |
| 60 | 6.758254797 | 6.768 |
| 62 | 6.753516246 | 6.764 |
| 64 | 6.748781017 | 6.76 |
| 66 | 6.744049109 | 6.756 |
| 68 | 6.739320518 | 6.752 |
| 70 | 6.734595243 | 6.748 |
| 72 | 6.729873281 | 6.744 |
| 74 | 6.725154629 | 6.74 |
| 76 | 6.720439287 | 6.736 |
| 78 | 6.71572725 | 6.732 |
| 80 | 6.711018517 | 6.728 |
| 82 | 6.706313086 | 6.724 |
| 84 | 6.701610954 | 6.72 |
| 86 | 6.696912119 | 6.716 |
| 88 | 6.692216578 | 6.712 |
| 90 | 6.68752433 | 6.708 |

**Table 5** Experimental and Predictive Values of Ionic Concentration at Different Distance

| Distance [x] | Predictive Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.35/0.19] | Experimental Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.35/0,019] |
|---|---|---|
| 2 | 7.122034931 | 7.122 |
| 4 | 7.117041315 | 7.118 |
| 6 | 7.112051201 | 7.114 |
| 8 | 7.107064586 | 7.11 |
| 10 | 7.102081467 | 7.106 |
| 12 | 7.097101842 | 7.102 |
| 14 | 7.092125708 | 7.098 |
| 16 | 7.087153064 | 7.094 |
| 18 | 7.082183906 | 7.09 |
| 20 | 7.077218232 | 7.086 |
| 22 | 7.072256039 | 7.082 |
| 24 | 7.067297326 | 7.078 |
| 26 | 7.06234209 | 7.074 |
| 28 | 7.057390328 | 7.07 |
| 30 | 7.052442039 | 7.066 |
| 32 | 7.047497218 | 7.062 |
| 34 | 7.042555865 | 7.058 |
| 38 | 7.03268355 | 7.05 |
| 40 | 7.027752583 | 7.046 |
| 42 | 7.022825074 | 7.042 |
| 44 | 7.017901019 | 7.038 |
| 46 | 7.012980417 | 7.034 |
| 48 | 7.008063265 | 7.03 |
| 50 | 7.003149561 | 7.026 |
| 54 | 6.993332486 | 7.018 |
| 56 | 6.98842911 | 7.014 |
| 58 | 6.983529173 | 7.01 |
| 60 | 6.97863267 | 7.006 |

**Citation:** Eluozo SN, Ikebude CF. Heterogeneous velocity and dispersions coefficient influence on ionic transport model in creeks. *Material Sci & Eng.* 2022;6(3):101–109. DOI: 10.15406/mseij.2022.06.00186

Table Continued...

| Distance [x] | Predictive Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.35/0.19] | Experimental Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.35/0,019] |
|---|---|---|
| 62 | 6.973739602 | 7.002 |
| 64 | 6.968849963 | 6.998 |
| 66 | 6.963963754 | 6.994 |
| 68 | 6.95908097 | 6.99 |
| 70 | 6.954201609 | 6.986 |
| 72 | 6.94932567 | 6.982 |
| 74 | 6.94445315 | 6.978 |
| 76 | 6.939584046 | 6.974 |
| 78 | 6.934718356 | 6.97 |
| 80 | 6.929856078 | 6.966 |
| 82 | 6.924997208 | 6.962 |
| 84 | 6.920141746 | 6.958 |
| 86 | 6.915289688 | 6.954 |
| 88 | 6.910441032 | 6.95 |
| 90 | 6.905595776 | 6.946 |

**Table 6** Experimental and Predictive Values of Ionic Concentration at Different Distance

| Distance [x] | Predictive Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.36/0.16] | Experimental Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.36/0,016] |
|---|---|---|
| 2 | 6.041929049 | 6.028 |
| 4 | 6.037692749 | 6.024 |
| 6 | 6.033459421 | 6.02 |
| 8 | 6.02922906 | 6.016 |
| 10 | 6.025001665 | 6.012 |
| 12 | 6.020777235 | 6.008 |
| 14 | 6.016555766 | 6.004 |
| 16 | 6.012337258 | 6 |
| 18 | 6.008121707 | 5.996 |
| 20 | 6.003909112 | 5.992 |
| 22 | 5.99969947 | 5.988 |
| 24 | 5.995492781 | 5.984 |
| 26 | 5.99128904 | 5.98 |
| 28 | 5.987088247 | 5.976 |
| 30 | 5.9828904 | 5.972 |
| 32 | 5.978695496 | 5.968 |
| 34 | 5.974503533 | 5.964 |
| 38 | 5.966128423 | 5.956 |
| 40 | 5.961945271 | 5.952 |
| 42 | 5.957765053 | 5.948 |
| 44 | 5.953587765 | 5.944 |
| 46 | 5.949413407 | 5.94 |
| 48 | 5.945241975 | 5.936 |
| 50 | 5.941073468 | 5.932 |
| 54 | 5.93274522 | 5.924 |
| 56 | 5.928585475 | 5.92 |
| 58 | 5.924428647 | 5.916 |
| 60 | 5.920274733 | 5.912 |
| 62 | 5.916123732 | 5.908 |
| 64 | 5.91197564l | 5.904 |
| 66 | 5.907830459 | 5.9 |
| 68 | 5.903688183 | 5.896 |
| 70 | 5.899548812 | 5.892 |

Table Continued...

| Distance [x] | Predictive Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.36/0.16] | Experimental Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.36/0,016] |
|---|---|---|
| 72 | 5.895412343 | 5.888 |
| 74 | 5.891278774 | 5.884 |
| 76 | 5.887148103 | 5.88 |
| 78 | 5.883020329 | 5.876 |
| 80 | 5.878895448 | 5.872 |
| 82 | 5.87477346 | 5.868 |
| 84 | 5.870654362 | 5.864 |
| 86 | 5.866538152 | 5.86 |
| 88 | 5.862424829 | 5.856 |
| 90 | 5.858314389 | 5.852 |

**Table 7** Experimental and Predictive Values of Ionic Concentration at Different Distance

| Distance [m] | Predictive Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.5/0.021] | Experimental Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.5/0.021] |
|---|---|---|
| 0.2 | 8.751881625 | 8.7514 |
| 0.22 | 8.75182024 | 8.75134 |
| 0.24 | 8.751758855 | 8.75128 |
| 0.26 | 8.751697471 | 8.75122 |
| 0.28 | 8.751636087 | 8.75116 |
| 3 | 8.743291894 | 8.743 |
| 0.32 | 8.751513321 | 8.75104 |
| 0.34 | 8.751451938 | 8.75098 |
| 0.36 | 8.751390556 | 8.75092 |
| 0.38 | 8.751329174 | 8.75086 |
| 0.4 | 8.751267793 | 8.7508 |
| 0.42 | 8.751206412 | 8.75074 |
| 0.44 | 8.751145032 | 8.75068 |
| 0.46 | 8.751083652 | 8.75062 |
| 0.48 | 8.751022272 | 8.75056 |
| 0.5 | 8.750960893 | 8.7505 |
| 0.52 | 8.750899515 | 8.75044 |
| 0.54 | 8.750838136 | 8.75038 |
| 0.56 | 8.750776758 | 8.75032 |
| 0.58 | 8.750715381 | 8.75026 |
| 0.6 | 8.750654004 | 8.7502 |
| 0.62 | 8.750592628 | 8.75014 |
| 0.64 | 8.750531251 | 8.75008 |
| 0.66 | 8.750469876 | 8.75002 |
| 0.68 | 8.750408501 | 8.74996 |
| 0.7 | 8.750347126 | 8.7499 |
| 0.72 | 8.750285751 | 8.74984 |
| 0.74 | 8.750224377 | 8.74978 |
| 0.76 | 8.750163004 | 8.74972 |
| 0.78 | 8.750101631 | 8.74966 |
| 0.82 | 8.749978886 | 8.74954 |
| 0.84 | 8.749917514 | 8.74948 |
| 0.86 | 8.749856143 | 8.74942 |
| 0.88 | 8.749794772 | 8.74936 |
| 0.9 | 8.749733401 | 8.7493 |

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Table Continued...

| Distance [m] | Predictive Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.5/0.021] | Experimental Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.5/0.021] |
|---|---|---|
| 0.92 | 8.749672031 | 8.74924 |
| 0.94 | 8.749610662 | 8.74918 |
| 0.96 | 8.749549293 | 8.74912 |
| 0.98 | 8.749487924 | 8.74906 |
| 1 | 8.749426555 | 8.749 |
| 1.12 | 8.749058354 | 8.74864 |
| 1.14 | 8.748996989 | 8.74858 |
| 1.16 | 8.748935624 | 8.74852 |
| 1.18 | 8.74887426 | 8.74846 |
| 1.2 | 8.748812896 | 8.7484 |
| 1.22 | 8.748751532 | 8.74834 |
| 1.24 | 8.748690169 | 8.74828 |
| 1.26 | 8.748628806 | 8.74822 |
| 1.28 | 8.748567444 | 8.74816 |
| 2 | 8.746358687 | 8.746 |
| 2.22 | 8.7456839 | 8.74534 |
| 2.24 | 8.745622559 | 8.74528 |
| 2.26 | 8.745561217 | 8.74522 |
| 2.28 | 8.745499877 | 8.74516 |
| 3 | 8.743291894 | 8.743 |

**Table 8** Experimental and Predictive Values of Ionic Concentration at Different Distance

| Distance [m] | Predictive Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.45/0.22] | Experimental Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.45/0.22] |
|---|---|---|
| 0.2 | 8.86301663 | 8.8624 |
| 0.22 | 8.862954465 | 8.86234 |
| 0.24 | 8.862892301 | 8.86228 |
| 0.26 | 8.862830137 | 8.86222 |
| 0.28 | 8.862767974 | 8.86216 |
| 3 | 8.854317823 | 8.854 |
| 0.32 | 8.862643649 | 8.86204 |
| 0.34 | 8.862581487 | 8.86198 |
| 0.36 | 8.862519325 | 8.86192 |
| 0.38 | 8.862457164 | 8.86186 |
| 0.4 | 8.862395003 | 8.8618 |
| 0.42 | 8.862332843 | 8.86174 |
| 0.44 | 8.862270683 | 8.86168 |
| 0.46 | 8.862208524 | 8.86162 |
| 0.48 | 8.862146365 | 8.86156 |
| 0.5 | 8.862084206 | 8.8615 |
| 0.52 | 8.862022048 | 8.86144 |
| 0.54 | 8.86195989 | 8.86138 |
| 0.56 | 8.861897733 | 8.86132 |
| 0.58 | 8.861835576 | 8.86126 |
| 0.6 | 8.86177342 | 8.8612 |
| 0.62 | 8.861711264 | 8.86114 |
| 0.64 | 8.861649109 | 8.86108 |
| 0.66 | 8.861586954 | 8.86102 |
| 0.68 | 8.861524799 | 8.86096 |
| 0.7 | 8.861462645 | 8.8609 |
| 0.72 | 8.861400491 | 8.86084 |

Table Continued...

| Distance [m] | Predictive Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.45/0.22] | Experimental Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.45/0.22] |
|---|---|---|
| 0.74 | 8.861338338 | 8.86078 |
| 0.76 | 8.861276185 | 8.86072 |
| 0.78 | 8.861214033 | 8.86066 |
| 0.82 | 8.861089729 | 8.86054 |
| 0.84 | 8.861027578 | 8.86048 |
| 0.86 | 8.860965427 | 8.86042 |
| 0.88 | 8.860903277 | 8.86036 |
| 0.9 | 8.860841127 | 8.8603 |
| 0.92 | 8.860778978 | 8.86024 |
| 0.94 | 8.860716829 | 8.86018 |
| 0.96 | 8.86065468 | 8.86012 |
| 0.98 | 8.860592532 | 8.86006 |
| 1 | 8.860530385 | 8.86 |
| 1.12 | 8.860157508 | 8.85964 |
| 1.14 | 8.860095364 | 8.85958 |
| 1.16 | 8.860033219 | 8.85952 |
| 1.18 | 8.859971076 | 8.85946 |
| 1.2 | 8.859908932 | 8.8594 |
| 1.22 | 8.85984679 | 8.85934 |
| 1.24 | 8.859784647 | 8.85928 |
| 1.26 | 8.859722505 | 8.85922 |
| 1.28 | 8.859660364 | 8.85916 |
| 2 | 8.857423559 | 8.857 |
| 2.22 | 8.856740204 | 8.85634 |
| 2.24 | 8.856678083 | 8.85628 |
| 2.26 | 8.856615963 | 8.85622 |
| 2.28 | 8.856553843 | 8.85616 |
| 3 | 8.854317823 | 8.854 |

**Table 9** Experimental and Predictive Values of Ionic Concentration at Different Distance

| Distance [m] | Predictive Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.45/0.22] | Experimental Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.45/0.22] |
|---|---|---|
| 0.2 | 8.871073918 | 8.8704 |
| 0.22 | 8.871011696 | 8.87034 |
| 0.24 | 8.870949476 | 8.87028 |
| 0.26 | 8.870887255 | 8.87022 |
| 0.28 | 8.870825036 | 8.87016 |
| 3 | 8.862367203 | 8.862 |
| 0.32 | 8.870700597 | 8.87004 |
| 0.34 | 8.870638379 | 8.86998 |
| 0.36 | 8.870576161 | 8.86992 |
| 0.38 | 8.870513943 | 8.86986 |
| 0.4 | 8.870451726 | 8.8698 |
| 0.42 | 8.870389509 | 8.86974 |
| 0.44 | 8.870327293 | 8.86968 |
| 0.46 | 8.870265077 | 8.86962 |
| 0.48 | 8.870202861 | 8.86956 |
| 0.5 | 8.870140646 | 8.8695 |
| 0.52 | 8.870078432 | 8.86944 |
| 0.54 | 8.870016218 | 8.86938 |
| 0.56 | 8.869954004 | 8.86932 |
| 0.58 | 8.869891791 | 8.86926 |
| 0.6 | 8.869829578 | 8.8692 |

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Table Continued...

| Distance [m] | Predictive Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.45/0.22] | Experimental Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.45/0.22] |
|---|---|---|
| 0.62 | 8.869767365 | 8.86914 |
| 0.64 | 8.869705153 | 8.86908 |
| 0.66 | 8.869642942 | 8.86902 |
| 0.68 | 8.869580731 | 8.86896 |
| 0.7 | 8.86951852 | 8.8689 |
| 0.72 | 8.86945631 | 8.86884 |
| 0.74 | 8.8693941 | 8.86878 |
| 0.76 | 8.869331891 | 8.86872 |
| 0.78 | 8.869269682 | 8.86866 |
| 0.82 | 8.869145265 | 8.86854 |
| 0.84 | 8.869083058 | 8.86848 |
| 0.86 | 8.86902085 | 8.86842 |
| 0.88 | 8.868958644 | 8.86836 |
| 0.9 | 8.868896437 | 8.8683 |
| 0.92 | 8.868834231 | 8.86824 |
| 0.94 | 8.868772026 | 8.86818 |
| 0.96 | 8.868709821 | 8.86812 |
| 0.98 | 8.868647616 | 8.86806 |
| 1 | 8.868585412 | 8.868 |
| 1.12 | 8.868212197 | 8.86764 |
| 1.14 | 8.868149996 | 8.86758 |
| 1.16 | 8.868087795 | 8.86752 |
| 1.18 | 8.868025595 | 8.86746 |
| 1.2 | 8.867963395 | 8.8674 |
| 1.22 | 8.867901196 | 8.86734 |
| 1.24 | 8.867838997 | 8.86728 |
| 1.26 | 8.867776798 | 8.86722 |
| 1.28 | 8.8677146 | 8.86716 |
| 2 | 8.865475762 | 8.865 |
| 2.22 | 8.864791786 | 8.86434 |
| 2.24 | 8.864729609 | 8.86428 |
| 2.26 | 8.864667432 | 8.86422 |
| 2.28 | 8.864605256 | 8.86416 |
| 3 | 8.862367203 | 8.862 |

**Table 10** Experimental and Predictive Values of Ionic Concentration at Different Distance

| Distance [m] | Predictive Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.47/0.23] | Experimental Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.47/0.23] |
|---|---|---|
| 0.2 | 9.39496433 | 9.39436433 |
| 0.22 | 9.394898434 | 9.39430433 |
| 0.24 | 9.394832539 | 9.39424433 |
| 0.26 | 9.394766644 | 9.39418433 |
| 0.28 | 9.39470075 | 9.39412433 |
| 3 | 9.385743431 | 9.38596433 |
| 0.32 | 9.394568963 | 9.39400433 |
| 0.34 | 9.39450307 | 9.39394433 |
| 0.36 | 9.394437178 | 9.39388433 |
| 0.38 | 9.394371286 | 9.39382433 |
| 0.4 | 9.394305394 | 9.39376433 |
| 0.42 | 9.394239503 | 9.39370433 |
| 0.44 | 9.394173612 | 9.39364433 |
| 0.46 | 9.394107722 | 9.39358433 |

Table Continued...

| Distance [m] | Predictive Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.47/0.23] | Experimental Values of Ionic Conc.[Mg/L] Heterogeneous Velocity and Dispersion Coefficient [1.47/0.23] |
|---|---|---|
| 0.48 | 9.394041833 | 9.39352433 |
| 0.5 | 9.393975943 | 9.39346433 |
| 0.52 | 9.393910055 | 9.39340433 |
| 0.54 | 9.393844166 | 9.39334433 |
| 0.56 | 9.393778279 | 9.39328433 |
| 0.58 | 9.393712391 | 9.39322433 |
| 0.6 | 9.393646504 | 9.39316433 |
| 0.62 | 9.393580618 | 9.39310433 |
| 0.64 | 9.393514732 | 9.39304433 |
| 0.66 | 9.393448846 | 9.39298433 |
| 0.68 | 9.393382961 | 9.39292433 |
| 0.7 | 9.393317077 | 9.39286433 |
| 0.72 | 9.393251193 | 9.39280433 |
| 0.74 | 9.393185309 | 9.39274433 |
| 0.76 | 9.393119426 | 9.39268433 |
| 0.78 | 9.393053543 | 9.39262433 |
| 0.82 | 9.392921779 | 9.39250433 |
| 0.84 | 9.392855898 | 9.39244433 |
| 0.86 | 9.392790017 | 9.39238433 |
| 0.88 | 9.392724136 | 9.39232433 |
| 0.9 | 9.392658256 | 9.39226433 |
| 0.92 | 9.392592377 | 9.39220433 |
| 0.94 | 9.392526498 | 9.39214433 |
| 0.96 | 9.392460619 | 9.39208433 |
| 0.98 | 9.392394741 | 9.39202433 |
| 1 | 9.392328864 | 9.39196433 |
| 1.12 | 9.391933607 | 9.39160433 |
| 1.14 | 9.391867733 | 9.39154433 |
| 1.16 | 9.391801859 | 9.39148433 |
| 1.18 | 9.391735985 | 9.39142433 |
| 1.2 | 9.391670112 | 9.39136433 |
| 1.22 | 9.39160424 | 9.39130433 |
| 1.24 | 9.391538368 | 9.39124433 |
| 1.26 | 9.391472496 | 9.39118433 |
| 1.28 | 9.391406625 | 9.39112433 |
| 2 | 9.38903557 | 9.38896433 |
| 2.22 | 9.3883112 | 9.38830433 |
| 2.24 | 9.388245351 | 9.38824433 |
| 2.26 | 9.388179503 | 9.38818433 |
| 2.28 | 9.388113655 | 9.38812433 |
| 3 | 9.385743431 | 9.38596433 |

## Conclusion

The transport of ionic concentration in creek were investigated to generate several influential parameters that influenced the system, the creek were monitored through application of physiochemical investigation at different point sources of waste discharge in the creek, this type of surface water experiences variation rates of concentration at different location, these were also mentored and some parameters were noted, these variable were observed to pressure the rates of ionic content at different station point. The distance of the creek were measure and there was variation of distance in different stations point was determined, these concept were applied to determine the variation of concentration at different locations, the simulation carried out generated lots of significant parameters that reflected the transport process of the contaminants in the creek, the dispersion of

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the contaminant due to non point discharge affect the creek as the contaminant trace were at most locations of the creek, the study expressed their rates under the influences of heterogeneous velocities of the creek, while that of the dispersion reflected the concentration at other area, the generated waste were discharged outside the stipulated regulations causing serious hazards, the investigation were to generate the experimental values and its analysis in all the station points, the derive model for ionic transport integrated all the observed parameters to generate the predictive values for the study, the predictive simulation values were compared with experimental Data, both parameters generated best fits correlation. Basically, on general acceptable standard that Point of reference: Water with an iron level above 0.3 milligrams per liter (mg/L) is usually considered objectionable. Iron levels are usually below 10 mg/L in water.

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## Conflicts of interest

The author hereby declares of having not conflict of interest in this article.

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