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Investigation of Vertical Transmission of Pollution at Laboratory Model and It's Vitalizing for Determination of Dispersion Coefficient at Homogenous Sandy Soil

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Abstracts: In order to Quality management in foiled of underground water resource; prefect study and awareness of pollution source at aquifers models and related. Equations are necessary one of the most important stable. Conveying model at homogenous porous media of saturated; soil's model are combernous and Brigham. In this study it has been attempt; firstly one specific study and comparison between after mentioned models had been effectively done and secondly it has tried; dispersion coefficient of homogenous sandy soil have been estimated. Thus; dependency of; dispersion to soil average diameter (D_{50}) were studied. For achieving this goal; one physical circular model with P.V.C was built, beside, one mixture of sodium chloride with 9 g/lit as concentration was chosen of pollution materials. Finally, average coefficient of dispersion at coarse sand is estimated equal 1.8 coefficient medium sand and is about 2.1 times than fine As a result; it has been concluded that increased average particle diameter, value of dispersion coefficient increased gradually moreover at long transmission distance Estimated value of dispersion from fried- combernous and Brigham model is totally equal.

Key words: Pollution · Fried- combernous · Brigham · Dispersion

INTRODUCTION

Quality management in field of underground water resource is one of the essential branches of hydrogeology. Moreover studying about pollution source knowledge about aquifer, water layer and their models and aquatints are important too. Movement velocity of pollutions through water surface is depending on physical and chemistry characteristic of soil and other materials. Actually, the process have influenced by rainfall and depth of water behind the surface. Dispersion is one of the most important descriptions of porous media at pollution movement, some which have effect role on. Dispersion are as below; process; movement process; molecular diffusion, mechanical dispersion. The movement of displacement because of hydraulic gradient is case of pollution movement. Because of molecular diffusion effect of concentration gradient, mechanical dispersion at cause of velocity variation through Small space between soils particles, the pollution were moved consequently. At recent years, vast varieties of model in order to material movement were used. Generally almost models are based on one dimensional equation of movement-dispersion were used. And one stable solve liquid at saturated conditions. From of one dimensional movement-dispersion equation of stable pollution at saturated condition is as below:

$$dc\ /dt = D\frac{d^2c}{dl^2} - V\frac{dc}{dl} \qquad (1)$$

In which:

l : length of flow passing coordinate with flux direction
C : Concentration in functioned of L, t
D : dispersion Hydrodynamic coefficient at Longitude direction.
V : Average lined velocity at porous.

Darcy's velocity (q) is as following:

$$q/a = V.n \qquad (2)$$

In which:

q : Pollution flow in density
n : Porosity
a : Area of flow path cross section;(l^2)

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Hydrodynamic dispersion defined with
2 parameter (D= α V +D*)

(3)

α : Dispersion coefficient at porous media.
D* : Molecular diffusion at liquid environment. (L^2/T)

At very low speed, molecular diffusion is important process. So, hydrodynamic dispersion is equal to molecular diffusion coefficient (D= D*).

At high velocity condition of mechanical process is always at scatter condition, therefore (D=α V) [1] and D* at different velocity more than10^{-5}cm/s is so neglect able.

With using one stable racing material (without chemical action) by constant concentration C0 under one dimensional steady state from upstream of soil box: with homogenous were guide to entrance they assume that initial concentration at soil box: (before experiment) is zero. According to expunction, soil concentration has been conducted as relative concentration like C/C0; so C is exiting momentum concentration at soil box. This racing entering concentrate has been decline as stepped function. First boundary condition is as below: [2]

(*) initial condition, C(L,0)=0 L≥0
(*) upstream boundary condition C(0,t)=Co t≥0
(*) Downstream boundary condition C(∞,t)=0 t≥0;

With confederation initial for equation (1) are presented as below:

$$C/Co = \frac{1}{2}\left[erfc(\frac{x-vt}{2\sqrt{Dt}}) + \exp(\frac{xl}{D})erfc(\frac{x+Vt}{2\sqrt{Dt}})\right] \quad (4)$$

If values dispersion at porous media is too high or if L or t are going to high value; then equation right side is to small and conclusion the following equation were deducted:

$$C/Co = \frac{1}{2}\left[erfc(\frac{x-vt}{2\sqrt{Dt}})\right] \quad (5)$$

If relation of C/Co have been plotted against time (t); at existing section break trough curve: will achieve (B t c) and sometimes, relation c/co has been plotted against pore volume (U) ; thus U is equal to exiting fluid volume per total volume space between soil particles exiting value of flows concentration. Exiting fluid concentration breakthrough curve is used to evaluate dispersion coefficient more over models of fried –combernous and Brigham have been investigated perfectly.

Fried-Combernous model: For solving equation (1), C/Co as parameter was written is below

$$C/Co = (2\pi)^{-\frac{1}{2}} \int_{L-VL/(2Dt)^{1/2}} \exp(-x^2/2)dx \quad (6)$$

This equation is one normal equation and mathematics hope is m=Vt and standard error are L, $\delta = (Dt)^{\frac{1}{2}}$ is variable function through time. Two characteristic of normal distribution is as below:

$$N(1) = 0.841 \cong 0.84 \quad (7)$$

$$N(-1) = 0.1587 \cong 0.16 \quad (8)$$

To sum up all equations (6, 7, 8) the following equation

$$L_1 = (L - Vt_i)/(2Dt_1)^{\frac{1}{2}} \quad (9)$$

$$(L - Vt_{0.16})/(2Dt_{0.16})^{\frac{1}{2}} - (L - Vt_{0.84})/(2Dt_{0.84})^{\frac{1}{2}} = 2 \quad (10)$$

Finally (D) has been calculated by fried-combernous [3].

$$D = \frac{1}{8}[(L - vt_{0.16})/(t_{0.16})^{1/2} - (L - vt_{0.84})/(t_{0.84})^{1/2}]^2 \quad (11)$$

At this experiment (v) or water relate have B.T.C are determined

$$v = \frac{L}{t_{.5}} \quad (12)$$

At this equation (12): L= Length of soil tank.

To $t_{0.16}$, $t_{0.5}$, $t_{0.84}$, Are relative concentration of (0.16, 0.5, 0.84) which were pioneered from (B.T.C).

Brigham Model: Pickens and Grisak used implicit solution of equation (1) by Rofay. And with utilizing this member of: water volumetric porous (U): have been calculated as below: [4].

$$C/Co = \frac{1}{2}\left[erfc(\frac{1-U}{2(UD/Vl)^{\frac{1}{2}}}\right] \quad (13)$$

$$U = \frac{Vnat}{aLn} = \frac{vt}{l} \quad (14)$$

U= number of total pore volume. Actually Fried-combernous models is one direct solution from classic equation of movement—Dispersion which has been proposed for Lang term: convey. However, Brigham model were optimized one: important different of pollution movement between. Break through polluting movement at conveying one term is defined as below: at different shut conveying length, is because of concentration Gradient and pollute. Movement is quicker than flow rate. So reaching time to relation concentration ….Will not happens after exiting but else will happen to low. Value will be soon. Parameter B= Vl/D For determination short conveying distance and long length were proposed a value of B between 125 to 500 is reported for insurance of long length.

METHODS AND MATERIALS

Physical model which has been used is one P.V.C pipe with (10 cm is diameter and high is about 100 cm). Model is consisting of 3 different entrances, porous media and one exiting option. On the body surface and length from bottom (30cm, 60 cm, 90 cm) some drain way small space has been installed for sampling. at up of each sampling box, one exiting optional space were been considered (for each 5 cm) for water resource and pollution resource) in order to provide necessary pressure were put on be and through water conveying path one control value and vacuum value were used using soil at model is demined from my fine soil to coarse size.

Determined: actual Velocity at porous media Fried- Combernous use Velocity of pollution particle and Break through curve were produced finally, but Brigham Used modified factor of fried-combernous model coefficient at short term parameters. (He used:actual flow velocity at porous media) thus, Due to long length.

Table 1: Physical characteristics of sand use in experimental

discussion	*Large sand*	*sand*	*Fine sand*
# of mesh	10	30	60
# of mesh	20	50	80
(D_{50}) (mm)	1.42	0.45	0.21
$(g/cm^3)(\rho_b)$	1.61	1.59	1.53
(n) (porosity)	39	40	42
$(cm/s) K \times 10^{-3}$	85	25	6

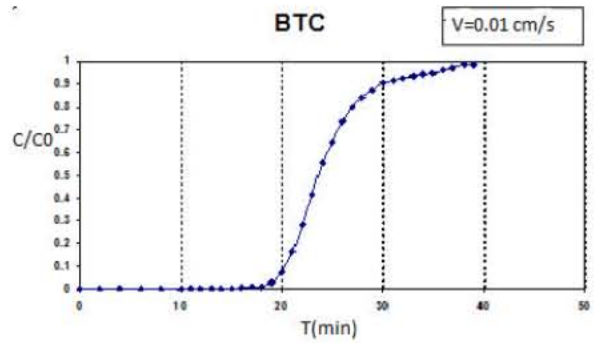

Fig. 1: Break through curve for coarse sand at 30 cm Different of conveying length

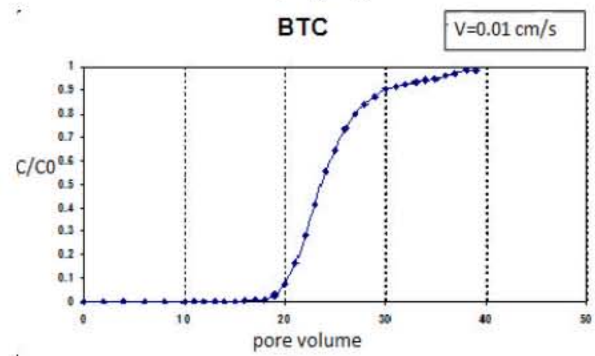

Fig. 2: Pore volume curve for coarse sand: at 30 cm conveying length

Table 2: Value of determinate Dispersion coefficient (α) based on Fried-combernous Model

Soil type	Fluid velocity $10^{-5}\times$(m/s)	Conveying length (cm) 30	60	90
Coarse sand	6	0.47	0.83	0.66
	10	0.31	0.53	1.29
	13	0.55	0.69	0.85
	19	0.64	0.88	1
	26	1.24	1.33	1.1
Medium sand	6	0.12	0.34	0.55
	10	0.17	0.54	0.60
	13	0.20	0.47	0.83
	19	0.21	0.35	0.73
	26	0.19	0.44	0.88
Fine sand	6	0.08	0.47	0.34
	10	0.09	0.53	0.42
	13	0.12	0.36	0.45
	19	0.11	0.24	0.90
	26	0.14	0.23	1.33

Procedure of Runs and similarity of two models dedretimes. It could be send that, Result for two models are similar at long period Experiments.In order Studying Relation between average Dispersion coefficient and

Table 3: Value of determinate Dispersion coefficient (α) based on Brigham Model

Soil type	Fluid velocity $10^{-5}\times$(m/s)	Conveying length (cm) 30	60	90
Coarse sand	6	0.46	0.87	0.76
	10	0.32	0.55	1.38
	13	0.54	0.68	1.01
	19	0.63	0.85	1.08
	26	1.26	1.39	1.15
Medium sand	6	0.17	0.36	0.54
	10	0.22	0.56	0.60
	13	0.22	0.49	0.82
	19	0.25	0.38	0.70
	26	0.25	0.47	0.95
Fine sand	6	0.10	0.47	0.33
	10	0.10	0.55	0.45
	13	0.14	0.34	0.50
	19	0.14	0.22	1.01
	26	0.20	0.25	1.46

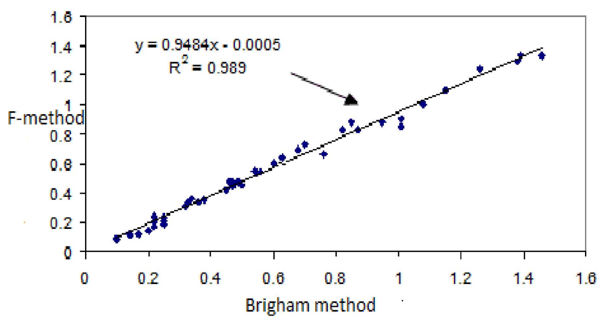

Fig. 3: Comparison of fried- combernous and Brigham model for all experiment at homogenous sand soil

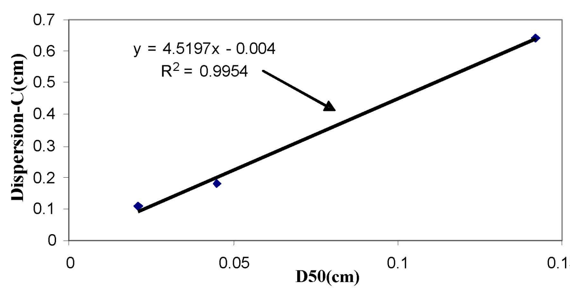

Fig. 4: Relation between sand average diameter and average Dispersion at sample of sand soil with 30 cm length.

Sand Particles Diameter (D_{50}). One resergional graph: for different Distance were plotted based on 3 Different Soils [5].

For Distance of conveying length at each 30 cm, average Dispersion coefficient for their Different sand soil are 0.64, 0.17, 0.1 cm(respectively) three value for soil with 60 cm length are 0.85, 0.42, 0.36 cm and Beside three value for soil with 90 cm length are 0.98, 0.71, 0.68 cm.

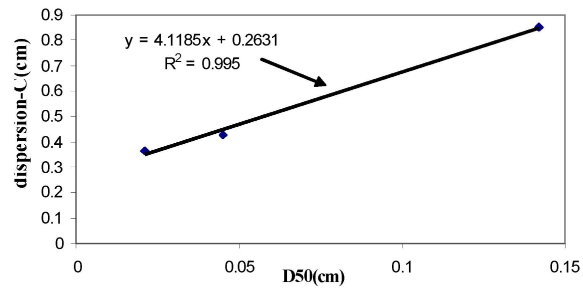

Fig. 5: Relation between sand average diameter and average Dispersion at sample of sand soil with 60 cm length.

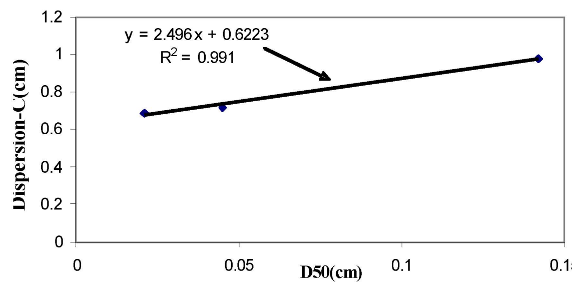

Fig. 6: Relation between sand average diameter and average Dispersion at sample of sand soil with 90 cm length.

As a Result, by increasing Particle size Dispersion are increased directly average value for soil with 60 cm length are 0.85, 0.42, 0.36 and Beside their value for soil with 90 cm length are 0.98, 0.71, 0.68 cm. As a Result, by increasing Particle size Dispersion are increased directly. Average value for Dispersion coefficient for coarse sand is 1.8 and for average size sand 2.1, bigger than fine sand parameters in addition in this study, values of Hydraulic conductivity were calculated, too. Hydraulic Conductivity for coarse sand is 3.4bigger than medium sand soil coefficient and 14 times more than. Fine coarse, sand, conclusion it has been observed that, increasing size of sand is directly related to Hydraulic conductivity Variations [6].

CONCLUSION

In this research and study Dispersion for 3 Homogenous sand soil types according two models were product. Domain of Variation is from 0.08 to 1.46 cm. It has been conducted that at long length of Experiment Run Dispersion are equal more over average value of dispersion for coarse sand is 1.8 times more than average sand size and finally it is observed Increasing average size of sand particle is case of Increase Hydraulic conductivity

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