

POLLUTE

(Diffusion)

(Advection)

## **The Study of Contaminant Transport Through Two-Layer Soil System by the Hydraulic Trap Effect, Using the Laboratory Models**

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### **Abstract**

In this study, using the laboratory models, the contaminant transport from a landfill to a groundwater was modeled using two-layer soil system. The models consist of a clay and a sand layers and a receptor reservoir. During the tests the concentration of chloride in source and receptor reservoirs was observed. At the end of the test, soil sample was sliced and the concentration was determined in soil depths. The observed data was accurately predicated by the computer code POLLUTE. In the three first tests water flow was downward and advection and diffusion were at one direction. At the two other tests water flow was upward and advection was opposite of diffusion. Comparison of the results at the later tests, which modeled the natural hydraulic trap system, with the results of the first three tests, showed that the hydraulic trap system has reduced the contamination in the receptor reservoirs and hence, this system could be implemented in the design of the solid waste landfills.

**Key words:** Laboratory models, Contaminant transport, Hydraulic trap, Landfill.

Rowe .[ ]

Halton

[ ]

[ ]

[ ]

[ ]

$$(\theta + \rho K_d) \frac{\partial c}{\partial t} = \theta D \frac{\partial^2 c}{\partial z^2} - \theta v \frac{\partial c}{\partial z} \quad ( )$$

$z$

$c$

( )

)

$\theta$   $t$

$v$  (

$n = \theta$

( )

$K_d$

$\rho$

$D$

(Dispersion)

)  $D_{md}$

( )  $D_e$  (Mechanical Dispersion

$$D = D_{md} + D_e \quad ( )$$

Natural )

[ ]

(hydraulic trap

( )

(Halton)

[ ]

( $v$ )

( )

( ) (v)  
 [ ]  
 /  
 ( )  
 ( ) (D<sub>e</sub>)  
 ( )

(Rowe and Badv)

[ ]

[ ]

$$\frac{D_{e(ref)}\theta}{\theta_{ref}} \quad ( ) \quad c_s(t) = c_o - \frac{I}{H_f} \int_0^t f_s d\tau - \frac{q_c}{H_f} \int_0^t c_s(\tau) d\tau \quad ( )$$

$\theta$  ,  $D_s$  ,  $c_o$  ,  $t$  ,  $c_s(t)$   
 $\theta_{ref} = n$  ,  $D_{e(ref)}$  ,  $H_f$  ,  
 $q_c$  ,  
 ( )

( )

(Mass flux)

$f_s$

[ ] Pollute

:

$$f_s = \theta v c - \theta D \frac{\partial c}{\partial z} \quad ( )$$

--

( ) (v)

)

(CL)

v

(

$$f_s = -\theta v c - \theta D \frac{\partial c}{\partial z} \quad ( )$$

(SP)

[ ] ( )

/

( )

--

( )

[ ]

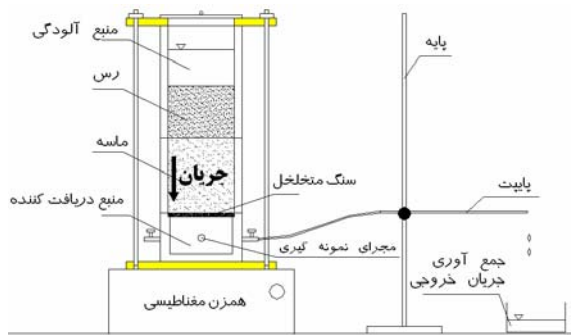
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)

AD3 AD1 AD2

( )

(Septum port)



( )	( )	
SP	CL	
-		(%)
-		(%)
/	/	
-	/	(%)
/	/	(gr/cm <sup>3</sup> )
-	/	(gr/cm <sup>3</sup> )
/ - /	/ - /	(mm)

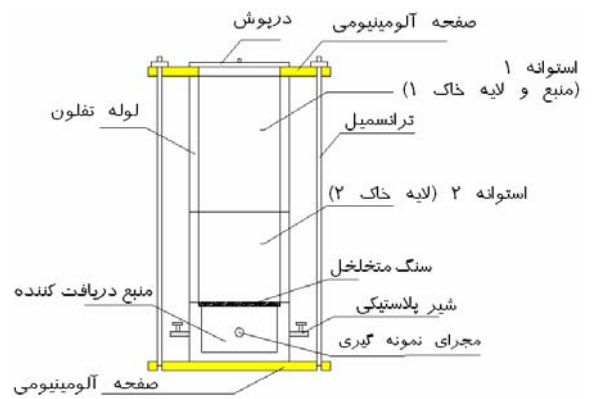
( )

(Diffusion)

(Advection)

)

( /



AD5	AD4	AD3	AD2	AD1	
CL	CL	CL	CL	CL	
					(cm)
/	/	/	/	/	
					(%)
/	/	/	/	/	(%)
/	/	/	/	/	(gr/cm <sup>3</sup> )
					(mg/L)
/	/	/	/	/	(cm <sup>2</sup> /day)

( )

AD5	AD4	AD3	AD2	AD1	
SP	SP	SP	SP	SP	
					(cm)
/	/	/	/	/	
					(%)
				/	(%)
/	/	/	/	/	(gr/cm <sup>3</sup> )
					(mg/L)
/	/	/	/	/	(cm <sup>2</sup> /day)

( )

AD5	AD4	AD3	AD2	AD1	
/	/	/	/	/	(cm)
					(mg/L)
/	/	/	/	/	
/	/	/	/	/	(cm/day)
			/		(day)

( )

porewater squeeze apparatus)

[ ]

( )

[NaCl]

/

[Cl<sup>-</sup>]

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( )

(

(Tracer)

(Conservative)

(

)

(K<sub>d</sub>)

[ ]

( )

[ ]

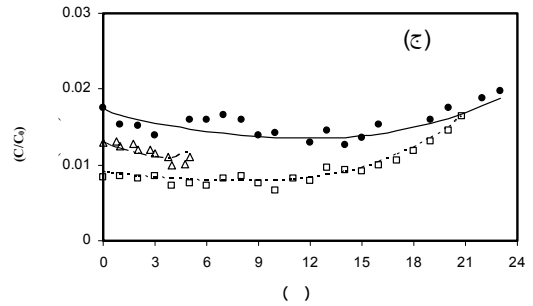
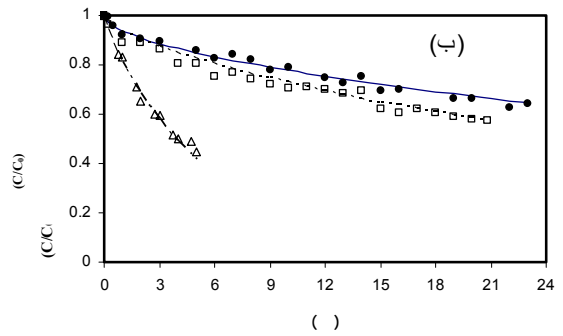
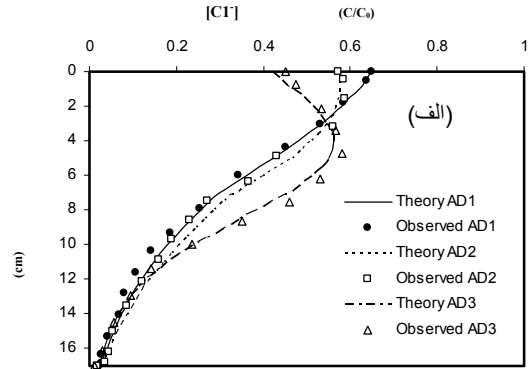
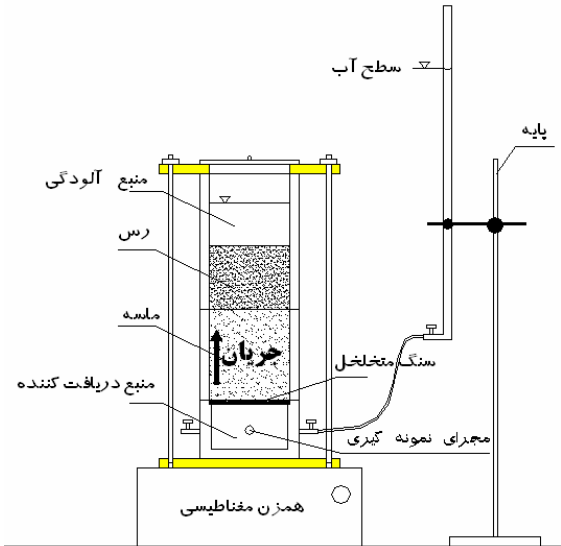
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POLLUTE

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( ) ( )

(Pneumatic



AD5 AD4

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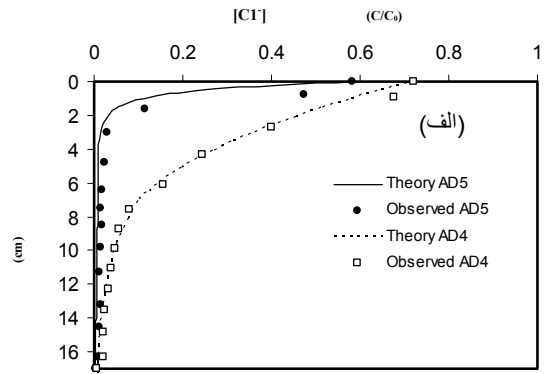
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POLLUTE

POLLUTE

( )

( ) AD5 AD4



( )

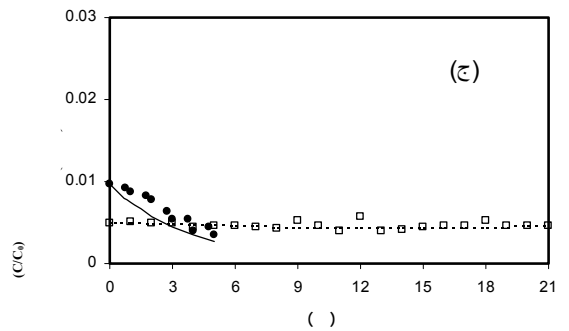
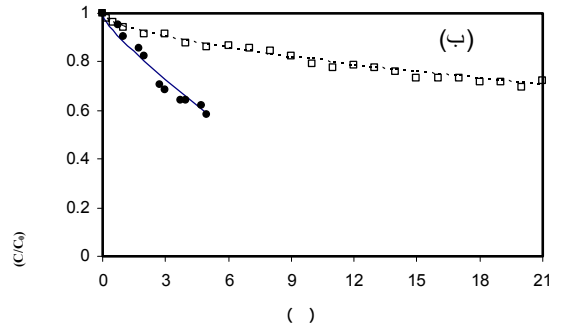
POLLUTE

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( )

AD5 AD4

POLLUTE



/ (cm/day) / (cm/day) / (cm/day)

)

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(

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/ (cm/day) / (cm/day)

)

/ (cm/day)



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