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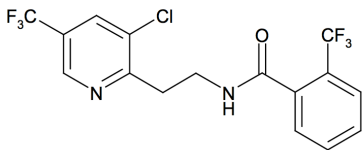
Flow rate dependent transport of Fluopyram in saturated sandy soil

Introduction

- Velum[®] is a novel contact nematicide with Fluopyram (FL) as active ingredient.
- Knowledge on FL adsorption and transport characteristics in soils is essential for both agricultural and environmental considerations.

Objective

To quantify the transport characteristics of FL in a sandy soil from a non-cultivated area in the Arava region, Southern Israel.



Material and Methods

Flow through soil column under saturated water flow conditions

Factors examined:

- (i) Pulse concentration
- (ii) Water flux
- (iii) Pulse size
- (iv) Continuous\Interrupted flow

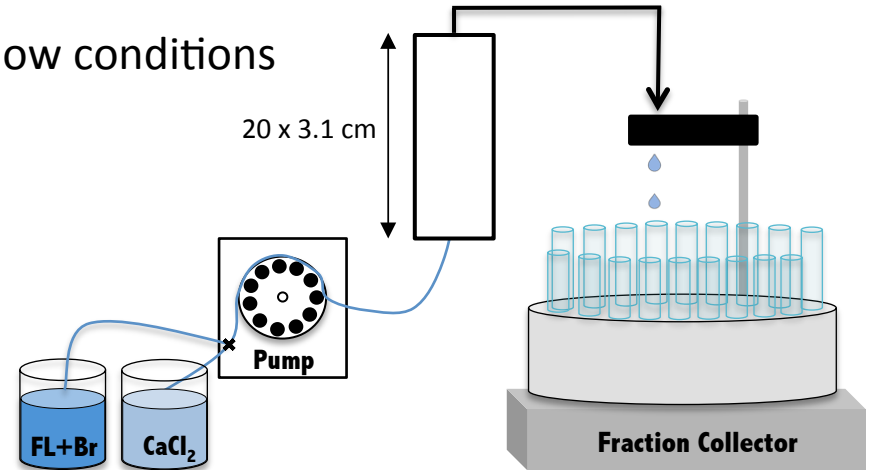


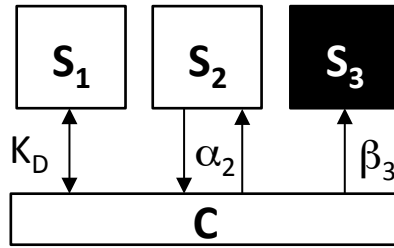
Table 1. Experimental conditions for the different soil columns experiments

Treatments	Q ml min ⁻¹	Pulse duration PV	Input conc. mg L ⁻¹	Applied Mass mg	ρ_b g cm ⁻³
A	1	1	4	0.26	1.51
B	1	1	8	0.51	1.50
C	1	1	15	0.96	1.50
D	0.3	3	8	1.55	1.51
E	1	3	8	1.54	1.55
F	4	3	8	1.54	1.52

Modeling approaches

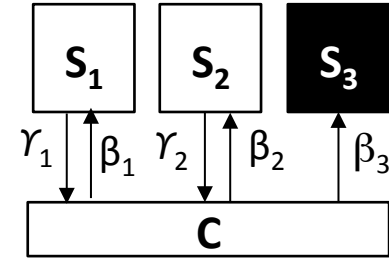
Reversible

Two-sites model



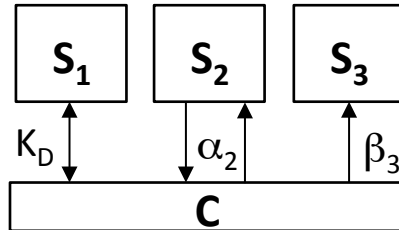
2 sites 2 rates-rev

Two-kinetic sites model

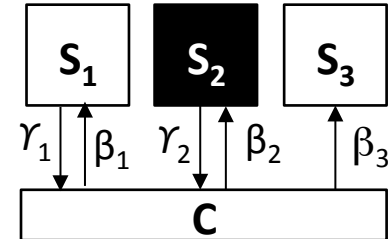


2 sites 4 rates-rev

Irreversible



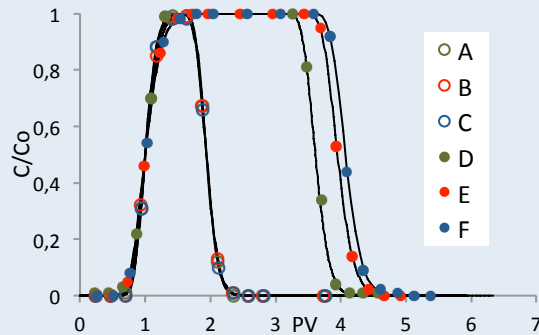
3 sites 2 rates-irr



2 sites 3 rates-irr

Results and discussion

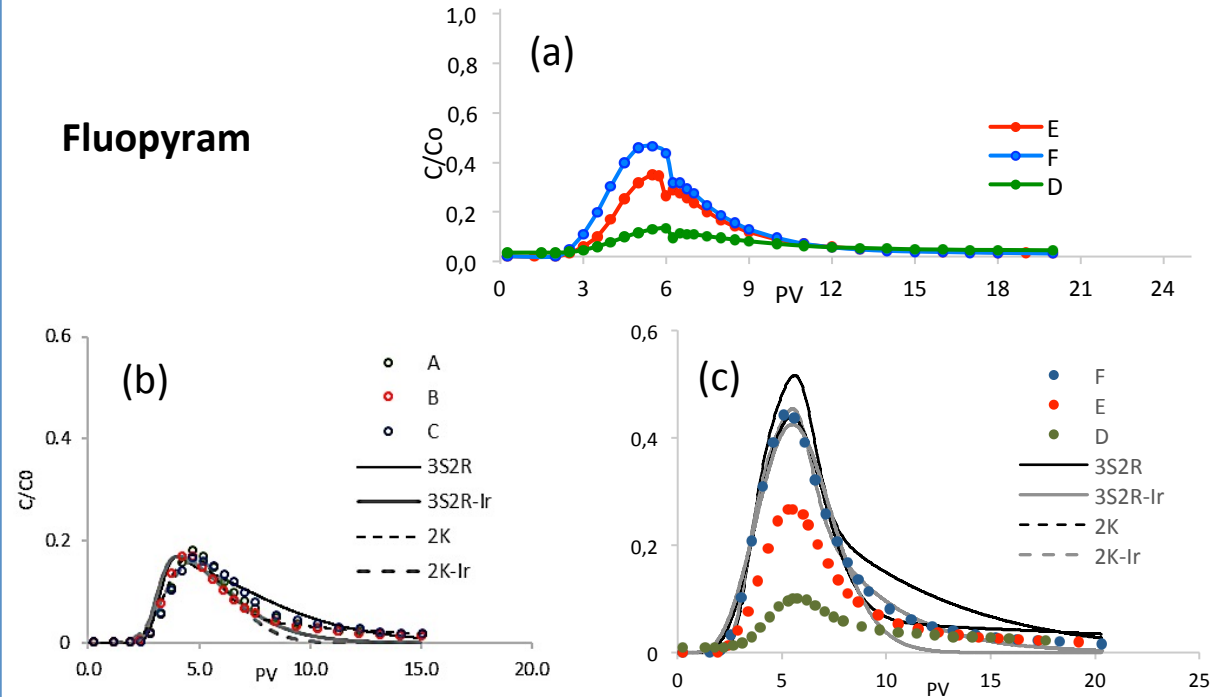
Conservative tracer (Br)



Bromide

Symmetrical pattern, regardless of the applied concentration of Fluopyram or flow rate; therefore, physical equilibrium can be assumed

Fluopyram



(a) Effect of flow perturbation: the decrease in FL concentration after flow perturbation, implied on low kinetics desorption.

(b) Effect of concentration and pulse duration: No difference in the transport behavior were observed among concentrations. However, the short pulse resulted in lower peak concentration.

(c) Effect of flow rate: The decrease in flux increased retention time, lowered peak concentration and enhanced tailing during leaching phase.

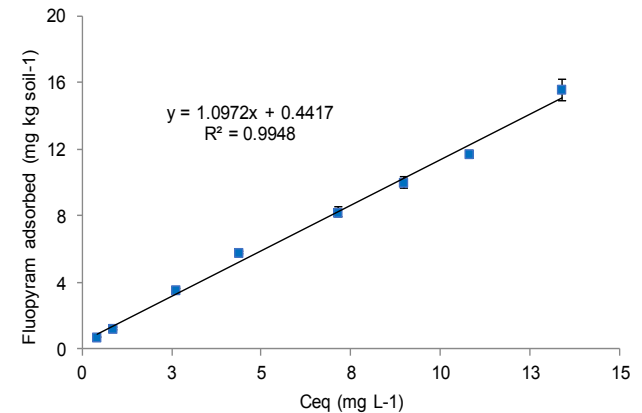
Results and discussion

Table 2. Optimized parameters of the 2 Kinetic sites model, using 2 reversible sorption (S1, S2) sites and 4 rates

Treat.	AttS2 MM ⁻¹	DetS2 MM ⁻¹	AttS1 MM ⁻¹	DetS1 MM ⁻²	R ² (-)	RMSE (-)
A	0,49	0,10	0,01	0,003	0,99	0,02
B	0,038*	0,008	0,001	0,001		
	0,49	0,11	0,01	0,002	0,99	0,03
C	0,048	0,011	0,001	0,000		
	0,46	0,09	0,02	0,004	1,00	0,01
D	0,030	0,007	0,001	0,000		
	0,09	0,02	0,01	0,000	0,98	0,03
E	0,026	0,006	0,000	0,000		
	0,46	0,10	0,02	0,001	0,99	0,02
F	0,061	0,013	0,001	0,000		
	1,53	0,39	0,05	0,004	0,99	0,02
	0,199	0,053	0,003	0,001		

* Standard error

Equilibrium adsorption Isotherm
K_D = 1.1 (L/kg)



Conclusions

- For the sandy soil examined, the transport of Fluopyram is affected by the flow rate and pulse duration but not by the input concentration below FL solubility (16 mg/l)
- Flow perturbation and not full recovery of FL, may indicates on low kinetics desorption mechanism
- Breakthrough curves could be fitted better with the Two kinetic site model, using 2 reversible sorption sites and 4 rates (2K)

Acknowledgments

The financial support for this study by Bayer is gratefully acknowledged



06 May 2020