STUDY ON ADSORPTION, DISSIPATION AND MOVEMENT OF ACETANILIDE HERBICIDES IN SOILS

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Dissipation and adsortion of herbicides alachlor, metolachlor and propachlor in three soils were studied (Table 1). The BAM model and GWP model were used to estimate the relative fate and the potential of contaminating groundwater. The results indicated that the dissipation rate of herbicide was increased with increasing temperature and water moisture. The dissipation rate for three herbicides followed an order of alachlor ≧ propachlor > metolachlor (Table 2). The dissipation rate in soils followed an order of : Ftl loam > St sandy loam > Sa clay loam. In non-sterilized soils the dissipation rate of herbicides was significantly slower than sterilized soils. In adsorption experiment, the equilibrium was reached within 4 hours. And the adsorption of herbicides in soil – water system was increased with increasing temperature (Table 3). The results indicated that the isotherms adsorption were well agree with the Freundlich equation. The movement rate of herbicides in St sandy loam was the faster than that of in Sa clay loam and Ftl loam (Table 4 and 5). The movement of propachlor in soil was fastest. Thus propachlor may lead to contamination of groundwater much more easily than the other two herbicides under normal condition.

Table 1. Physicochemical properties of the soils

Soil	Particle analysis			pH (1:1)	OC(%)	Field Capacity(%)
	Clay	Silt	Sand			
Sa CL	31	29	40	3.3	1.33	22.4
Ftl L	24	41	35	6.3	1.12	31.1
St SL	11	30	59	4	0.54	11.9

Table 2. The half-life of the first order kinetics model with various moistures

Moisture	Tepm.	alachlor			metolachlor			propachlor		
(% F. C.)	(℃)	clay loam	loam	sandy loam	clay loam	loam	sandy loam	clay loam	loam	sandy loam
90	10	187.3	92.4	187.3	301.4	123.8	216.6	157.5	78.8	177.7
30	25	216.6	45	182.4	433.2	105	256.7	133.3	24.6	115.5
60	25	121.6	44.7	92.4	126	57.3	150.7	80.6	25.8	71.5
90	25	61.3	29.6	68.6	70	51	93.7	54.2	23.1	48.1
90	40	17.1	8.6	13.6	43.3	22.8	35.4	20.4	9.4	17.4

Table 3. Sorption coefficients of three herbicides at various temperature and on different soils

Tepm.	alachlor			metolachlor			propachlor		
(℃)	clay loam	loam	sandy loam	clay loam	loam	sandy loam	clay loam	loam	sandy loam
25	2.27	2.26	1.98	64.09	60.55	59.16	3.18	2.9	2.84
37	5.26	4.8	4.66	736.4	417.81	728.3	6.12	4.64	4.96

Table 4. Relative fate of three herbicides in soils after 20 days simulated by using BAM

	alachlor			metolachlor			propachlor		
	clay loam	loam	sandy loam	clay loam	loam	sandy loam	clay loam	loam	sandy loam
Volatilized %	0	0	0	0	0	0	0	0	0
Degraded %	20.24	37.4	18.3	17.97	23.8	13.75	22.57	45.12	25.04
Remaining %	79.76	62.6	81.7	82.03	76.2	86.25	77.43	54.87	74.96

Table 5. Travel time and residual mass percent to 10 m or 3 m of three soils for three herbicides

deep*, m		alachlor			metolachlor			propachlor		
		clay loam	loam	sandy loam	clay loam	loam	sandy loam	clay loam	loam	sandy loam
3	time (yr)	3.16	3.51	3.23	4.32	4.41	4.57	0.73	1.19	0.44
	residual (%)	2.69	0.2	3.66	1.31	0.23	3.24	38.59	2.69	52.66
10	time (yr)	10.52	11.69	10.76	14.41	14.69	15.25	2.45	3.96	1.46
	residual (%)	2.69	0.2	3.66	1.31	0.23	3.24	38.58	2.69	52.65