

Dynamics of novel insecticide HNPC-A9908 residue in vegetable-field ecosystem

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Abstract: HNPC-A9908 (*o*-(3-phenoxybenzyl)-2-methylthio-1-(4-chlorophenyl) propyl ketone oxime), a novel oxime insecticide, is a highly effective and broad-spectrum insecticide which can be widely used to control many species of foliar insects on various crops. A study was conducted to evaluate the fate of HNPC-A9908 and study the degradation dynamics of HNPC-A9908 residue in vegetable field ecosystem. The results showed that degradation of HNPC-A9908 was much faster in vegetable pakchoi than in soil, and its half-life in pakchoi and soil was 1.32 and 3.75 d, respectively. The final residue of HNPC-A9908 in pakchoi was at the undetectable level to 0.122 mg/kg. As a conclusion, a dosage of 90 g/hm² was suggested and considered to be safe to human beings and animals.

Keywords: oxime insecticide; HNPC-A9908; residue; degradation; pakchoi; soil

HNPC-A9908 (*o*-(3-phenoxybenzyl)-2-methylthio-1-(4-chlorophenyl) propyl ketone oxime) is a novel oxime insecticide developed by Hunan Research Institute of Chemical Industry, Changsha, China. It can be widely used to control many species of foliar insects on various crops such as rice, vegetables and teas (Liu *et al.*, 2000; Ou *et al.*, 2003a, b, 2004). HNPC-A9908 was launched into market in 2004 because of its excellent effects on control of pests. It has been used largely on vegetables and teas as an effective pesticide (Ou *et al.*, 2003a), and can provide efficient protective effect against vegetable pests such as imported cabbageworm and beet armyworm. Since organophosphate insecticides are gradually limited in agricultural practices because of their high toxicity threatening human health and long-term residue in vegetables, it seems that organophosphate insecticides would be replaced by some insecticides with low toxicity in future. Some studies demonstrated that HNPC-A9908 was one of good candidate insecticides for replacing organophosphates and could be easily degraded to non-toxic substances in environments (Ou *et al.*, 2004). However, the fate of HNPC-A9908 in pakchoi (*Brassica chinensis* L.) field was not clear yet. Therefore, the residue dissipation of formulation 10% HNPC-A9908 EW in the vegetable-field ecosystem was investigated in this paper using high performance liquid chromatography to evaluate its degradation kinetics and to provide basic information for developing regulations to guard a safe application of the insecticide.

The dissipation dynamics of HNPC-A9908 residue in pakchoi and soil over the testing period are indicated in Fig.1. The initial residue concentration of HNPC-A9908 in pakchoi was 0.559 mg/kg, and it was at the undetectable level 14 d after application with its

corresponding degradation of almost 100%. The initial concentration of HNPC-A9908 in soil was as low as 0.175 mg/kg, and the residue at 21 d after application was less than the limit of quantification (0.012 mg/kg) with degradation rate of nearly 100%, which might be due to the low dosage of HNPC-A9908 in application. The degradation kinetics of HNPC-A9908 in pakchoi and soil could be described by the pseudo-first-order equation (Table 1), and the half-life of HNPC-A9908 in pakchoi and soil was 1.32 d and 3.75 d, respectively, indicating that degradation of HNPC-A9908

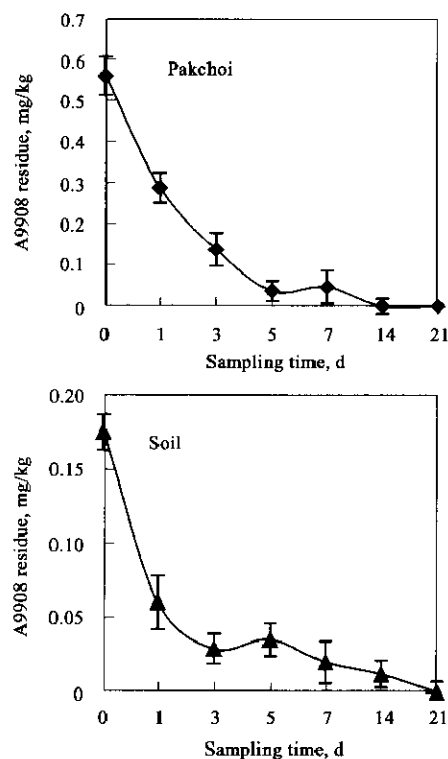


Fig.1 Dynamics of insecticide HNPC-A9908 degradation in soil and pakchoi

Table 1 Degradation kinetic equation of HNPC-A9908 in pakchoi and soil

Sample	$t_{1/2}$, d	Kinetics equation $C_t = C_0 \exp(-kt)$	Correlation coefficient	Determination factor, %	F value	Significant level (P)
Soil	3.75	$C_t = 0.1868 \exp(-0.1845t)$	0.9639	92.90	5.24×10^2	1.94×10^{-3}
Pakchoi	1.32	$C_t = 0.5444 \exp(-0.5256t)$	0.9921	98.43	2.51×10^2	9.20×10^{-5}

Table 2 Final residues of HNPC-A9908 in pakchoi and soil

Dosage, g a. i./hm ²	Application times	Time interval, d	Final residue \pm SD, mg/kg	
			Pakchoi	Soil
Recommended (90)	2	3	<0.020	<0.012
		7	<0.020	<0.012
	3	3	0.033 \pm 0.011	<0.012
		7	<0.020	<0.012
Doubled (180)	2	3	0.061 \pm 0.015	<0.012
		7	<0.020	<0.012
	3	3	0.122 \pm 0.017	<0.012
		7	0.047 \pm 0.012	<0.012

residue was much faster in pakchoi than in soil.

The final levels of HNPC-A9908 residue in pakchoi and soil are presented in Table 2. The final residue of HNPC-A9908 in soil was at the undetectable level at the concentration of the recommended dosage and doubled dosage. The final residue of HNPC-A9908 in pakchoi was ranging from the undetectable level to 0.033 mg/kg at the recommended dosage, and from the undetectable level to 0.122 mg/kg at the doubled dosage. The final residue levels of HNPC-A9908 in pakchoi and soil were much lower than USA's maximum residue limits (MRL) of 0.2 mg/kg of HNPC-A9908 analogues such

as bifenthrin and etofenprox in vegetable crops (ICAMA, 2001). Therefore, a dosage of 90 g a. i. /hm² was suggested, which could be considered as safe to human beings and animals. However, no MRL criteria of insecticide HNPC-A9908 in pakchoi have been worked out since it is a new insecticide that has been registered temporarily by ICAMA. Further works must be done with the respect to the different experimental plots and times. Combined with the toxicological profile, MRL for HNPC-A9908 should be set up by China legislation.

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