《Research Note》

Effect of Insecticide-impregnated Insulation Board on Growth of Chicks and Vaporizing Rate of the Insecticide

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We¹⁾ reported that the micro-encapsulated diazinon used for impregnation of heat insulation board decreased insect damages, which was caused by *Alphitobius diaperinus*. In order to confirm safety of diazinon-impregnated board of poultry houses, we conducted 2 experiments; the first was a feeding test of ground materials of diazinon-impregnated board and of dead bodies of *Alphitobius diaperinus* which was killed by diazinon, and the second was estimating of the vaporization rate of diazinon from the impregnated board.

Materials and methods

Urethane board (3 cm thickness), which was made by mixing 0.14% micro-encapsulated diazinon as previously reported¹⁾, was used for this study. For the feeding test of the diazinon impregnated board, 30 male chicks of 10-day-old White Leghorn were used. They were divided into 3 groups, and each group subdivided into 2 replicates of 5 chicks. The test was carried out for 10 days in July 1983. Two groups of chicks fed a commercial chick diet mixed with 1 or 10 vol. % of the ground diazinon-impregnated board respectively (hereinafter called 1% group and 10% group respectively). The other group of chicks (control group) fed the commercial chick diet in which diazinon-impregnated board was not contained. Feed and water were given *ad libitum*. Body weight gain and feed intake were measured. Choline esterase activity in blood was also measured at the end of the test period by the DTNB colorimetric method²⁾.

At the same time of the feeding test of the diazinon-impregnated board, another 10 chicks were designed to feed dead bodies of *Alphitobius diaperinus* caused from eating diazinon-impregnated board for 10 days to know effects of the drug accumulated in the body of the worm on body weight gain and choline esterase activity. Ten chicks were divided two groups of five each; one was administered 1 dead body and the other 5 dead bodies daily which were fed with a commercial chick diet (1-dead-body group and 5-dead-body group, respectively). They were kept individually in the rearing cage (20×45×23 cm). Body weight gain and choline esterase activity were measured at the end of the experiment. The about thousand dead bodies of *Alphitobius diaperinus* were prepared by treating them with diazinon-impregnated board in an incubator, and the diazinon content in the dead body of

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雛の発育に対する防虫加工断熱材給与の影響と空気中への殺虫剤の蒸散

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Alphitobius diaperinus was measured by the gas chromatographical method.

To estimate the vaporization rate of diazinon from the diazinon-impregnated board, a closed box with a net capacity of 1 m³ (88.7×88.7×127.1 cm) was made of the diazinon-impregnated board. The board was covered with aluminum foil on one side and with craft paper on the other, and the inside of the box was covered with the aluminum foil to simulate the practical usage of the board in poultry houses. A trap (17×170 mm) for vapoured diazinon was made of a glass tube 100 mm of which was filled with Wako Gel G (Wako Junyaku Co Ltd., Osaka), and was placed at the center in the box. Six hundred liters of air in the box was sucked with a pump for 2 hours at a rate of 5 l/min. via the trap. Estimation of the vapoured diazinon was made under the following 4 alternative conditions; 1) suction of the air from the outside of the box for the control, 2) suction of air from the inside of the box immediately after placing of the trap, 3) suction of the air from the inside of the box 1.5 hours after placing the trap tube, and 4) suction of the air from the inside of the box with a piece of uncovered diazinon-impregnated board (50×50×2.5 cm). The concentration of the trapped diazinon was measured by extracting from the gel with acetone and then subjecting it to gas chromatography (Shimadzu GC-3 BF with FPD, Shimadzu Co. Ltd., Kyoto).

Results and discussion

The diazinon concentration of the insecticide-impregnated board was 0.14%, and those in the diets were 0.46 and 4.6 ppm for 1% group and 10% group respectively. Body weight gain, feed intake, feed conversion rate and choline esterase activity was shown in Table 1. Both body weight gain and feed intake were not significant different between groups. Feed conversion rate in 1% group, however, was somewhat lower than the other two groups, but there was no statistical difference. Choline esterase activity of 10% group was the highest in the 3 groups, but no statistical difference was shown. In the poultry house the insulation board was usually covered with the wooden board up to some 50 cm high from the floor

Table 1. Effect of feeding of diazinon-impregnated board and of dead bodies caused from eating diazinon-impregnated board on growth and choline esterase activity of chicks

	Number of chicks	Body weight gain (g)	Feed intake	Feed conversion* rate	Choline esterase activity umol (SH)/min. ml.
Feeding test of ground diazinon-impregnated board					
Control group	10	83	209	2.54	1.18
1% group	10	86	197	2.28	1.17
10% group	10	85	207	2.43	1.31
Standard error of mean		3.3	9.3	0.06	0.18**
Feeding test of dead bodies of <i>Alphitobius diaperinus</i>					
1 dead body group	5	75	—	—	1.28
5 dead bodies group	5	80	—	—	1.46
Standard error of mean					0.25**

*: Feed intake (g)/Body weight gain (g)

**: Based on individual data

Table 2. Diazinon vaporization rate from insecticide-impregnated board

	Diazinon concentration*
	$\mu\text{g/l}$
Outside of the box	<0.0003
Inside of the box	<0.0003
Immediately after the placing of the trap	
Inside of the box	<0.0003
1.5 hrs after the placing of the trap	
Inside of the box	0.0003
Containing a piece of insulation board	

*: Detectable limit; 0.0003 $\mu\text{g/l}$

for prevention from being picked. Furthermore, the insulation board was unlikely picked by chicks 10% by volume of the diet. Therefore, it was suggested that chicks did not decrease their performance, even if they fed the diazinon-impregnated board.

The diazinon content in the dead bodies of *Alphitobius diaperinus* was 22.6 ppm/g, or 147 ng per dead body. The body weight gain of chicks fed 1 or 5 dead bodies were 75 g and 80 g, respectively. These values were less than that of the control group. This, however, may be supposed to the fact that the chicks in the groups fed dead bodies of *Alphitobius diaperinus* were 10 days old and were kept in individual cages; chicks in control were kept in groups of 5 in one pen. The former chicks may be cool in the cages. No significant difference was seen between groups in choline esterase activity, although values of chicks fed dead bodies were rather higher than that of the control. This showed negligible ill effect of eating dead bodies of *Alphitobius diaperinus*.

The vaporization rate of diazinon from its impregnated board was shown in Table 2. The diazinon concentration in the box was invariably less than the detectable limit of 0.0003 $\mu\text{g/l}$. Even when a piece of diazinon impregnated board which was removed the covers of aluminum foil and craft paper were put in the box, concentration of vaped diazinon was as low as 0.0003 $\mu\text{g/l}$. Hence there appears to be negligible influences on chicks of diazinon vaporized from the insecticide-impregnated board. Furthermore, the effect of diazinon-impregnated board against *Alphitobius diaperinus* may be not attributable to vaporization of the insecticide, but to contact of the insect with the insecticide-impregnated board.

From the present study of the feeding tests of ground insecticide-impregnated board and of dead bodies of *Alphitobius diaperinus* in the impregnated board and the estimation of vaporization rate of the insecticide, no problem was shown in using diazinon for insulation board of poultry house.

References

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