A Feeding Study with Captan Fungicide in the Dairy Cow

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Captan (N-(trichloromethylthio)-4-cyclohexane-1,2-dicarboximide) is a fungicide in common use for controlling diseases in fruit trees, vegetables and ornamentals. Compounds used on such plants when adjacent to pastures or forage crops may result in contamination of them by drift. A feeding study was therefore conducted with the fungicide in a dairy cow in an attempt to learn its excretion pattern in milk and excreta.

Experimental

A Holstein cow weighing 543 kg and having an average daily milk production of 23.0 kg was fed the pure fungicide at the 5 ppm level (based on a daily ration of 22.7 kg) for 4 days. This amounted to a total dose of 0.454 gram of Captan ingested during the 4-day period. The compound dissolved in acetone was thoroughly mixed with the evening grain.

Morning and evening samples of the totally mixed milk were taken 1 day prior to feeding the fungicide (control sample) daily throughout the feeding period and for 6 days thereafter. the morning and evening milk samples were combined each day prior to analysis. Total urine was collected by catheter and manure samples were collected in specially constructed gutter trays. All samples were frozen prior to analysis.

Analysis of Captan in Milk, Body Fluids and Excreta

One hundred grams of milk was blended with 200 ml of acetone. The mixture was filtered and concentrated by rotary evaporation to about 60 ml. Five grams of sodium sulfate and 2 ml of benzene were added. The solution was made to a volume of 100 ml with 5% sodium sulfate and shaken vigorously. The benzene was separated by centrifugation and chromatographed on a column containing 10 grams of Florisil prewashed with 100 ml of n-hexane and 50 ml of 1% methanol in methylene chloride. The column was eluted with 150 ml of the methanol-methylene chloride solution. The eluate was

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evaporated, the residue dissolved in 10 ml of benzene and analyzed by electron affinity gas chromatography.

Urine was analyzed as follows: To twenty grams of urine was added 5 grams of sodium sulfate, 5 ml of benzene and 75 ml of 5% sodium sulfate. The mixture was shaken vigorously for 2 minutes. The benzene, separated by centrifugation, was analyzed by electron affinity gas chromatography.

Gas Chromatographic Analysis

Final analysis was made using a Barber-Colman Model 10 gas chromatograph equipped with an electron affinity detector. The detector was a battery-operated No. A-4071, of 6 cm^3 volume and containing 56 µCi of radium-226. The recorder was a Wheelco, 0 to 50 mV, equipped with 10-in. chart paper, running 10 in. per hr. The electrometer gain was 10,000. The columns were U-shaped, made of borosilicate glass, 6 mm i.d., 1.83 m long and containing a mixture of 10% DC-200 on 80 to 100 mesh Gas Chrom Q. The operating temperatures for the column, flash heater and detector were 180, 250 and 235° C, respectively, and nitrogen was the carrier gas. The retention time for Captan was 8.0 min.

Results

Residues of intact Captan were not detected in any of the milk or urine samples. The recoveries and estimated detection limits for the fungicide in milk and urine are listed in Table 1. Repeated attempts to analytically recover Captan from fortified control manure samples were unsuccessful and therefore possible excretion of the compound in feces could not be determined.

Few studies of the matabolism of Captan have been reported. The fungicide is of low toxicity. The oral LD_{50} of Captan in rats is 480 mg/kg (CHRISTENSEN et al., 1975) and its tolerance in fruit is 100 ppm. The compound was found to be nonteratogenic in rabbits (KENNEDY et al., 1968). Folpet (N-(trichloromethylthio)phthalimide), a fungicide closely related in structure to Captan, was rapidly decomposed in cell cultures of Saccharomyces pastorianus with the sulfur-containing moieties of the compound binding to ethanol-insoluble protein components of the cells (SIEGEL and SISLER, 1968a, 1968b).

While residues of intact Captan were not found in milk or urine in this study it is possible that metabolites of the fungicide were present or that the compound was retained in body tissues or excreted in the manure as a metabolite or intact. Further studies in the bovine with the isotopically labelled compound would facilitate analysis of Captan and possible metabolites.

Table 1

Recovery of Captan from Control Samples

Sample	Added, ppm	Recovery, per cent	Estimated Limit of detection, ppm
milk	0.02	70	0.01
	0.05	77, 100, 60, 72	
urine	0.5	91, 86, 114, 105, 108	0.1

References

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