

Accidental Contamination by Avadex BW (Triallate) Herbicide of Waxed Paper Carton Material used for Milk Containers¹

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Reports of accidental contamination of food commodities by containers or resident deposits of pesticide and herbicide formulations are scattered throughout the scientific literature. This report indicates the possibility of contamination of milk supplies by vapor phase translocation of a herbicide deposit resulting from accidental spillage on the floor of a transport truck.

Background Information. During March, 1976, a transport truck-trailer carrying a full load of Avadex BW (triallate, S-2,3,3-trichloroallyl diisopropylthiocarbamate) herbicide packaged in cartons was involved in a minor accident. Upon unloading the cargo at the point of destination, it was found that one carton at the bottom of the shipment had broken, resulting in leakage onto the truck floor. The truck flooring of the trailer compartment was then washed with an aqueous detergent solution followed by prolonged steaming with live steam in an attempt to decontaminate the flooring. The latter is evidently a standard procedure used at transport truck terminals for accidental spills of this kind.

After the flooring had been scrubbed, steamed, dried and aired, the trailer was used to transport about 6 dozen large 200-lb rolls (each approximately 2.5 ft. diam. x 6 ft. in length) of waxed, unprinted (white) carton material, later to be printed bearing special brand names and used for fabrication and machine-filling as individual 1-qt. and 2-qt. milk cartons at different commercial dairies.

After the rolls were unloaded into a central warehouse, it was perceived by the warehouse supervisor that an obnoxious odor emanated from the immediate vicinity of the rolls, and seemed to be more intense at the ends of the rolls that had been standing on end in contact with the truck floor. The warehouse manager thereupon requested the transport company to remove the rolls for fear of transmitting the odor to other commodities stored in the warehouse.

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The transport company requested the assistance of the Manitoba Environmental Research Committee (MERC) to find out the source and extent of the odor. The assignment was undertaken by B. Berck (MERC Chairman) as a practical problem in the training of a new MERC technician in fumigant and pesticide analysis by GC. It was suspected that the odor was related to the previous accidental spill outlined above, and accordingly quantitative evidence of presence of Avadex BW in the paper rolls was sought by GC/ECD.

EXPERIMENTAL

Sample Preparation. It was of interest to ascertain whether the rolls of waxed paper had become contaminated with traces of Avadex transmitted in the vapor phase, since Avadex BW is quite volatile (Smith, 1969; 1973). For this purpose, 10 samples of waxed paper and surface wax scrapings in the range 0.1-40 g were taken from the outer edges and from different points and layers leading to the core area of 5 different rolls. The samples were placed in pentane-washed, clean, dry 12-oz glass jars fitted with metal screw-caps placed over an aluminum foil liner. A wood sample from the flooring of the trailer cabin in question was also obtained by chiselling off some of the upper plywood layers of the cabin flooring.

The wax paper samples were cut into $\frac{1}{4}$ -inch squares and were left in the jars in contact with 25-100 ml of redistilled, high-purity n-pentane for 20 hours at room temperature, with occasional manual swirling to improve extraction efficiency.

Duplicate aliquots of the extracts were injected into our Fisher-Victoreen Model 4400 Gas Chromatograph fitted with a vibrating reed electrometer and Ni⁶³ electron capture detector (ECD).

GC Conditions. For preparation of a standard curve, purified, recrystallized Avadex BW supplied by Monsanto Chemical Co., St. Louis Missouri, was obtained through Dr. Allan E. Smith, Canada Agriculture Research Station, Regina, Saskatchewan. GC/ECD enabled detection of 0.05 ng (50 picograms) in pentane solution. Good linearity of response was obtained in the working range 0.1-10 ng Avadex BW.

The instrumental conditions were: detector, column and injection port temperatures, 240°, 210° and 225°C; carrier gas (nitrogen) flowrate, 45 cc/min.; the EC detector was operated at a standing current of 6.0 v. The column used was s.s., 9 ft. x 3/16 in. o.d., packed with Porapak QS, 80/100 mesh. Under the foregoing conditions the retention time of Avadex BW was 2.63 min., well behind the pentane peak.

RESULTS AND DISCUSSION

All test samples showed variable amounts of Avadex, except for two comparison samples from a "control" roll of waxed paper from which no Avadex could be detected in the extracts.

The ppm levels (μg Avadex BW per g) of the test samples ranged from 0.026 to 3.00 ppm. The mean Avadex BW concentration in the flooring surface samples was 2.80 ppm. The highest concentrations were found at the outer portions of the rolls (1st layer), with lesser amounts present on the inner edge and center portions of the 2nd and 3rd layers. No extraneous peaks were encountered that interfered with measurement of the Avadex BW peak.

Based on the results obtained, the entire shipment of paper rolls was condemned for use in packaging milk or other food or feed products.

The results show that the truck floor cleanup procedure did not completely remove or degrade the Avadex that had spilled on the flooring. In this regard, Berck and Smallman (1951; 1952) showed that DDT-oil formulations deposited on plywood surfaces were absorbed within one day after application, leaving little or no DDT as a surface deposit, but some 45 days later, large amounts of DDT had effloresced and migrated upwards to the wood surface. It is suggested that a similar phenomenon occurred in the Avadex BW spillage. Steam treatment would accelerate upward migration.

The evidence that Avadex BW (triallate) can migrate in the vapor phase (Smith, 1969; 1974) is further supported by the indications that Avadex BW migrated to the center areas of the wax paper rolls. At the same time, however, the paraffin wax surface on the paper might also act as a solvent carrier for Avadex BW in the vapor or solid state.

It should be noted that this particular contamination problem was undertaken and the data in exploratory tests were obtained only because a warehouse supervisor with a sensitive nose objected to some foreign odor perceived in the waxed paper rolls. Based on the analytical evidence that stemmed from this spot check of representative rolls, the entire shipment of waxed paper rolls (\$20,000 estimated value) was rejected. As a corollary, (a) the milk supply for an estimated 50% of Winnipeg's 500,000 citizens was spared from inadvertent contamination by Avadex BW residues translocated to the waxed paper surface of the milk cartons in the manner indicated, and (b) the transport carrier was saved costly lawsuits from dairy manufacturers and irate consumers. In the latter regard, it is assumed that residue chemists in the Winnipeg District of the Health Protection Branch, Dept. of National Health and Welfare, would have determined the Avadex BW residues in their spot sampling of milk, cream, cottage cheese, etc., in the course of their periodic surveys. The chances of this, however, are perhaps 1 in 100, since milk and hundreds of other food products used by Canadian consumers cannot be assayed daily for all of 150 different pesticide residues due to

economic constraints which limit the very large amount of staff and facilities that would be needed. Furthermore, without the advantage of knowledge of the packaging history of the samples, the correlation of the residues with prior contamination of the paper container would be difficult.

Our findings point up the need for applied research to develop practical methods of decontaminating truck and trailer flooring in the event of accidental spills of the kind abovementioned. Also, to supplement conventional quality control of packaging materials (plastic, paper, metal, cotton, jute, glass, etc.) made at the site of manufacture, the materials should be checked after delivery to and before use by the food processor to ensure that accidental uptake of some environmental toxicant had not occurred in the interval between manufacture and use.

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