An Electron Capture Detector Bypass System

by D. L. STRUBLE
Crop Entomology Section
Research Station, Canada Department of Agriculture
Lethbridge, Alberta

Gas-liquid chromatography (GLC) with a tritium electron capture detector is used extensively for the analysis of chlorinated hydrocarbon insecticide residues. The tritium electron source limits the detector operating temperature to a maximum of 225°C, as above this temperature the tritium is rapidly lost from the detector foil (1). The temperature limitation is a serious drawback because in residue extracts from plants, soils, and animal tissues some high-boiling components invariably are not removed in the clean-up procedures normally used before the GLC analysis (2). The high-boiling components gradually pass through the GLC column and collect on the detector, thus progressively reducing its sensitivity. This necessitates frequent cleaning of the detector, which not only removes some of the radioactive material, but decreases the available operating time of the instrument. This is particularly a problem with some of the older-model gas chromatographs where the column and the detector must be operated at or near the same temperature. This report describes an inexpensive detector bypass system that allows the column effluent to be vented directly to the atmosphere while purging the column during the overnight or standby periods.

The bypass was installed on a Varian Model 600-D gas chromatograph. A hole (0.317 cm. D.) was drilled through the fitting at the base of the detector into the carrier-gas flow system, and a length (12 cm.) of stainless steel tubing (0.317 cm. O.D.) was silver soldered into place as illustrated in Figure 1. The bypass tube was placed through the wall of the chromatograph and a valve (A) was fixed to the outer end of the tubing. The detector base of this instrument was designed for electron capture or flame ionization detectors. The manufacturer installed air and hydrogen lines that are necessary for use with the latter detector, but these lines are normally blocked when the electron capture detector is in use. In the present system the hydrogen line was connected to a cylinder of nitrogen via valve B.

Bulletin of Environmental Contamination & Toxicology,
Vol. 5, No. 5, 1970, published by Springer-Verlag New York Inc.

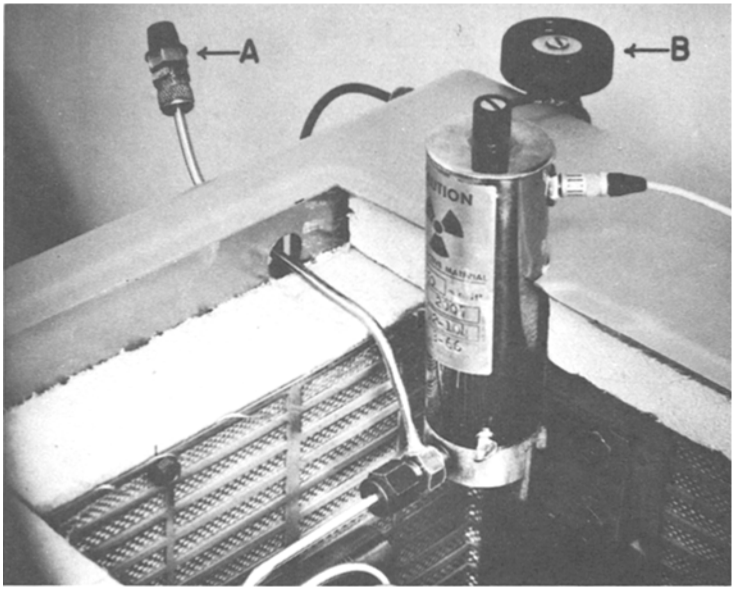

Figure 1. Gas chromatograph with electron capture detector bypass system.

The bypass was used by opening valves A and B. Nitrogen at a flow rate of 40 ml./min. was allowed to enter the system via valve B and flow through the detector or valve A. Due to the flow-restrictions in the detector, the main flow pathway was via valve A.

To establish that the carrier-gas did not pass through the detector while the bypass system was functioning, a standard solution of aldrin and dieldrin at a concentration of 1 p.p.m. was injected into the GLC with the detector power on. The insecticides were not detected; therefore, the carrier-gas and column effluent were forced to by-pass the detector via valve A. For normal operation of the GLC, valves A and B were tightly closed.

This system was used during the analysis for aldrin and dieldrin residues in potatoes and the bypass line did not cause any detectable peak broadening or loss of sensitivity. When the instrument was operated 8 hours per day and the column was purged using the bypass system during the overnight and standby periods, it was necessary to clean the detector about every 15 days. When the bypass was not used, the detector had to be cleaned about every 5 days. This system could be easily installed on any gas chromatograph.

References

1. WESTLAKE, W. E., AND GUNTHER, F. A., Residue Rev. 18, 175 (1967).

2. GASTON, L. K., Residue Rev. 5, 21 (1964).