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DETECTION OF TRITIATED COMPOUNDS IN PAPER CHROMATOGRAPHY

Irving Gray, Saburo Ikeda, A. A. Benson, and David Kritchevsky

June 5, 1950

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DETECTION OF TRITIATED COMPOUNDS IN PAPER CHROMATOGRAPHY

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ABSTRACT

June 5, 1950

A windowless tube has been developed which can be used to detect tritium radiations on paper, glass and alumina. The detection of tritiated compounds in paper chromatography is greatly simplified by the use of this device.

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(1) Major, Medical Service Corps, U. S. Army. Present address: Brooke Army Medical Center, Fort Sam Houston, Texas.

(2) The work described in this paper was sponsored by the Atomic Energy Commission.

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Location of tritiated compounds in paper chromatography has posed a problem because of the difficulties involved in the detection of the active spots. Because of the low energy of its emitted β-rays, the assay of tritium has usually been done in the gaseous phase; this procedure does not lend itself to the location of tritiated compounds on paper. A possible method, which has been tried in this laboratory, involves cutting of the paper into squares and counting each square in a windowless counter such as the "Nucleometer." This method is disadvantageous since it renders the paper useless for further work. A counting tube has been developed which will measure the radiation from the spots in question easily and accurately.

The counting apparatus consists of a windowless Scott tube [3], a gas flow regulator and a source of helium saturated with alcohol at 0° C. The

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(3) A bell-shaped glass tube, lined internally with an electrode consisting of copper sulfide coated copper foil, the open end which has a diameter of 7/8 inch covered with a thin mica window, ca. 1.5 mg./cm^2 and having a nichrome electrode extending through the center of the tube. The center electrode is tipped with a glass bead. This tube was developed by Dr. Kenneth G. Scott of this laboratory.

tube is wrapped in lead foil to minimize background radiation and to add ballast, so that a constant resistance to gas flow through the paper is maintained.

A rate of gas flow of 300 ml./min. was maintained. This rate insured a reproducible counting rate. At this pressure the system showed the following characteristics:

Starting voltage	1125 volts
Threshold voltage	1200 volts
Plateau	200 volts
Optimum operating voltage	1350 volts

For scanning, the tube is allowed to rest on the paper and is slowly moved over the paper in a definite pattern. The location of activity is recorded on a scaler. Where a particular area is to be counted, the tube is flushed for at least thirty seconds, after which the scaler is turned on and the activity determined.

This apparatus has been used to scan and count papers holding either C^{14} or tritium containing compounds. Table I summarizes the results obtained using various types of counters. For counting in the "Nucleometer", papers were cut into appropriately sized pieces.

Table I

Comparison of the values obtained by counting the same sample by various counting devices. All data given as counts per minute x 64.

Sample	Scott Tube	Windowless Tube	Nucleometer
*T (on paper)	a	191;193;193	173;201;133[b]
T (on glass plate)	a	118;119;115	210;191;172[b]
T (on aluminum plate)	a	47;47;48	93;94;93
**C (on paper)	60;64;66	95;93;97	164;168;173

* Denotes tritium-containing compound (tritiated cholesterol)

** Denotes C^{14}-containing compound (stearic-1-C^{14})

a No measureable activity

b Very erratic and unsteady counting

Once the active spots have been located on the paper, it is desirable to make a radiogram of the paper in order to have an accurate outline of the active area (4). Here again, the low energy of tritium radiation (0.015 mev) and the high self-absorption indicated the necessity of altering the usual procedure. We have found, however, that a satisfactory image of an area containing a tritiated compound is obtained on Eastman "No-Screen" X-ray film in twenty-four hours, if the area has an activity of 15,000 counts/min/cm^2. as recorded by the windowless tube. (C^{14}, 0.16 mev, requires a recorded activity of about

(4) A. A. Benson, et. al., J. Am. Chem. Soc., 72, 1710 (1950).

200 counts/min/cm^2 in order to give a satisfactory image in twenty-four hours.

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SUMMARY

A windowless tube has been developed which can be used to detect tritium radiations on paper, glass and alumina. The detection of tritiated compounds in paper chromatography is greatly simplified by the use of this device.