

# SINGLE PHOTOTUBE LIQUID SCINTILLATION COUNTING OF $C^{14}$ \*

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By means of good optical coupling between sample vial and phototube (see Fig. 1) and the use of quartz instead of glass sample vials to lower the back-

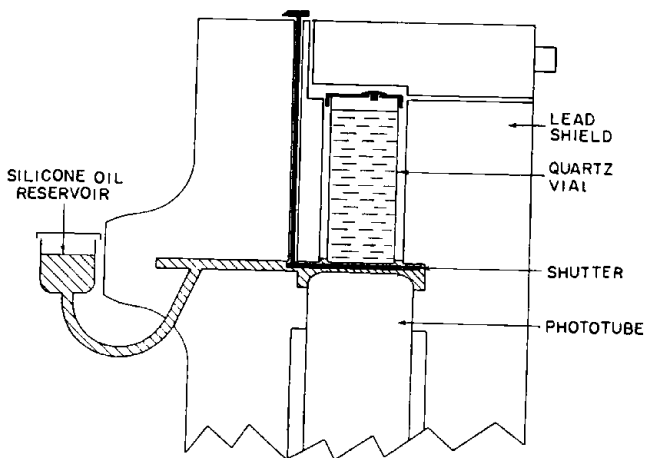


Fig. 1. Lead pig arranged for securing optical coupling between sample vial and phototube. The light shutter permits sample changes while the high voltage is still applied to the phototube.

ground counting rate (Fig. 2, Table 1),  $C^{14}$  can be counted using a single phototube by the liquid scintillation method at about 80% efficiency with a background counting rate of 80–90 counts/min.<sup>1</sup>

The amplifier (Fig. 3), scaler, and power supply are the same as those used for gas-phase proportional counting of  $C^{14}O_2$  admixed with 9:1 argon-methane.<sup>2</sup> Gas-phase counting of  $C^{14}O_2$  subsequent to wet combustion<sup>3</sup> of the organic sample is a useful adjunct to scintillation counting, in that it is a quite general method applicable to biological samples which are colored, insoluble in fat solvents or which strongly quench phosphor scintillations.

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Individual photomultiplier tubes (Du Mont 6291 or RCA 6199) usually have sufficiently good signal to noise ratios for liquid scintillation counting as described above at temperatures between  $0^{\circ}$  and  $-15^{\circ}C$ ; an occasional tube will be found which operates satisfactorily at room temperature. A tube

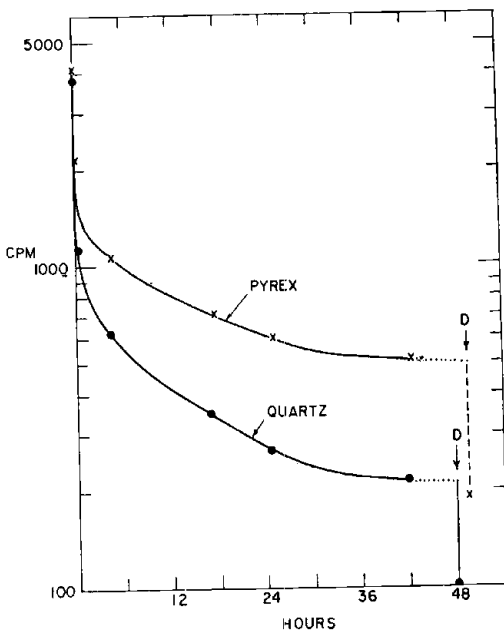


Fig. 2. Decay curves at  $-20^{\circ}C$  for phosphorescence induced in quartz (17.1 g) and Pyrex (20.7 g) counting vials by 3 min exposure at room temperature to unfiltered light from an 85 W ultraviolet lamp (General Electric C-H3). At the times indicated by the D's the remaining induced phosphorescence was discharged by heating the vials for 30 sec in the outer blue flame of a Meker burner. Vials were counted empty and with no paper reflectors at a voltmeter setting of 2150 (see Table 1).

should be rejected only after being kept under operating conditions (cold, dark, high voltage applied) for a week or more.

Four liquid scintillation counters of this type have now performed satisfactorily in four separate laboratories for over a year. Counting of  $C^{14}$  has been routine;  $Cl^{36}$  and  $C^{11}$  also have been counted successfully. The counting of  $H^3$  is limited to samples of high activity because no non-phosphorescent vial material has been found (see Table 1).

#### REFERENCES

- <sup>1</sup> R. STEELE, W. BERNSTEIN and CLARA BJERKNES, *J. Appl. Physiol.* **10**, 319-326 (1957).
- <sup>2</sup> F. M. SINEX, J. PLAZIN, D. CLAREUS, W. BERNSTEIN, D. D. VAN SLYKE and R. CHASE, *J. Biol. Chem.* **213**, 673-680 (1955).
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TABLE 1  
Contributions of Quartz and Pyrex Vials to Background Counting Rates

Sample	Dark noise, (counts/min)	Rate less dark noise	
		Quartz (counts/min)	Pyrex (counts/min)
Voltmeter set at 2150*			
(1) Bare empty vial; de-activated†	151 ± 5	83 ± 8	168 ± 11
(2) Same; 2 days (at -20°C) after u.v.‡	158 ± 3	215 ± 7	509 ± 10
(3) Same; again de-activated†	150 ± 5	99 ± 6	174 ± 8
(4) De-activated† vial (with reflector applied) filled with 25 ml 4:1 xylene-ethanol	151 ± 5	378 ± 9	517 ± 10
Voltmeter set at 1850**			
(5) De-activated† vial (with reflector applied) filled with 25 ml of 0.24% PBD in 4:1 xylene-ethanol	34 ± 1	45 ± 3	74 ± 3

\* This is the voltmeter setting required to count H<sup>3</sup> at about 10% efficiency in the system 0.24% PBD in 4:1 xylene-ethanol. Voltage across phototube is a little less than half the voltmeter setting.

† Heat treated (see legend for Fig. 2). Quartz vial weighed 17.1 g; Pyrex vial, 20.7 g.

‡ See legend for Fig. 2.

\*\* Voltmeter setting required to count C<sup>14</sup> at 68% efficiency under conditions described in \* above.

