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Direct In-Vial Collection for Liquid-Scintillation Assay of Carbon-14 and Tritium

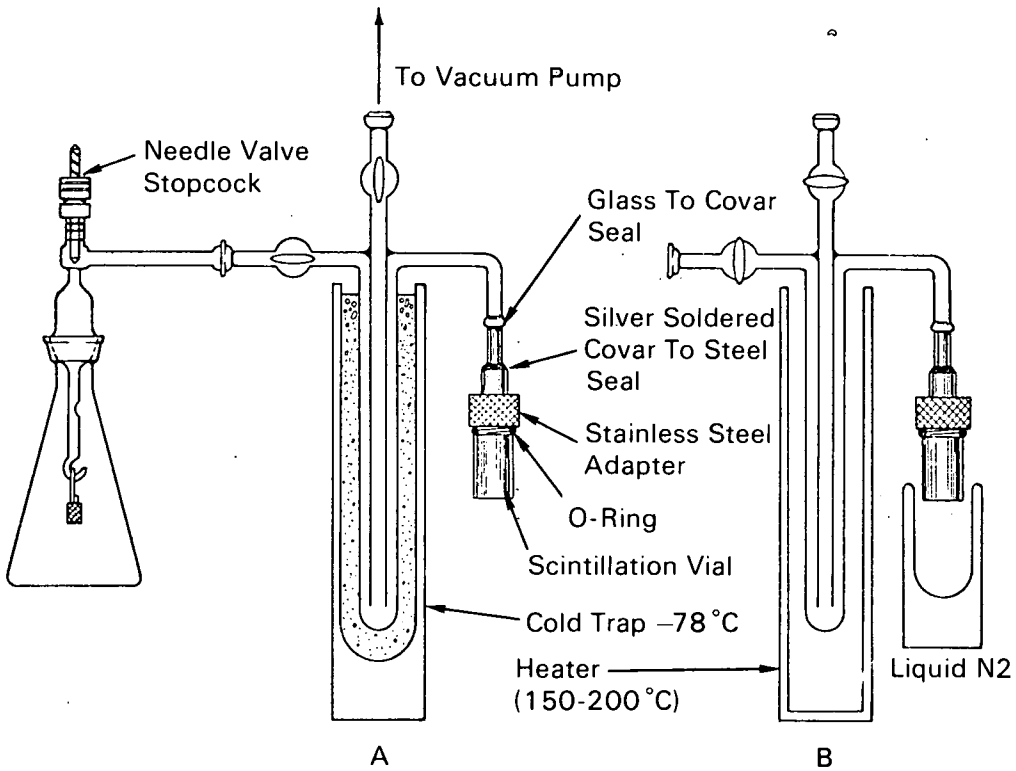

Fig. 1. Diagram of the apparatus: A, combustion flask, cold trap, and adapter for the scintillation-vial assembly; B, sublimation assembly.

The problem:

To develop a better technique for dissolution of biological materials for liquid-scintillation studies. Earlier methods include dissolution of the materials in an organic base such as hyamine hydroxide or Nuclear Chicago solvent, the oxygen-flask combustion method, the vacuum-line or sealed-tube combustion method, and the in-vial combustion method; all have certain limitations and have to be modified to fit particular requirements.

The solution:

A technique for dissolution of biological materials that combines the simplicity and facility of the oxygen-flask combustion with the reproducibility, efficiency, purity of the final product, and convenience of direct in-vial collection of the sample by

(continued overleaf)

the sealed-tube method. The method has these advantages:

1. The final product of combustion (H_2O for tritium, and CO_2 for ^{14}C is collected directly into the scintillation vial used for counting, with elimination of dilution of the sample and of losses due to transferral.
2. The final combustion products are pure enough for direct gravimetric or volumetric assay.
3. It eliminates quenching effects due to impurities or formation of color.
4. It assures quantitative and reproducible recoveries.
5. Larger samples, weighing 10 to 100 mg dry, can be combusted.
6. Double tracers can be separated with slight modification of the apparatus.
7. It lends itself to rapid routine handling so that a reasonable number of samples can be processed in 1 day.

With this method various tissues, including blood, liver, and eyes, can be combusted quantitatively. Samples of nonvolatile organic compounds, such as amino acids, carbohydrates, and phosphate derivatives, also have been successfully determined.

How it's done:

The apparatus (Fig. 1) consists of a 500-ml flask fitted with a needle valve, a cold trap with a side arm to which a scintillation vial is attached by way of a specially constructed connector and Covar seal, and a vacuum pump. Approximately 20 to 30 mg of dried tissue is weighed into a gelatin capsule, wrapped in black filter paper, and burned in an atmosphere of oxygen. The flask is attached to the cold trap, immersed in a mixture of dry ice and alcohol, and exhausted slowly through the trap. Water vapor is separated from other gases and condensed in the trap.

After 5 minutes stopcocks are closed, the flask is disconnected, and the trap is removed from the bath of dry ice and alcohol. The bottom of the scintillation vial is immersed in liquid nitrogen, and water is sublimed into the scintillation vial. In order to facilitate the transfer of water from the trap into the vial, a heater is placed around the trap. Sublimation takes no longer than 10 minutes before the vial is removed, proper scintillation solution is added, and the sample is counted in a liquid-scintillation counter.

By use of four to five trap-vial combinations, the process is made continuous, and between 40 and 50 samples can be processed in 8 hours. The memory effect in the trap is less than 0.01%; in the trap-flask combination, 0.03%. Thus a flask can be reused for several samples.

Reference:

1. L. G. Huebner and W. E. Kisieleski, in *ANL-7278* (Argonne National Laboratory, Dec. 1968), p. 245.

Notes:

1. This information may interest medical or biological laboratories, or drug or food companies.
2. Inquiries may be directed to:

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Patent status:

Inquiries concerning rights for commercial use of this innovation may be made to:

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