TRIATHLER APPLICATIONS AND TECHNICAL FEATURES

Tritium Wipe Tests with Wad Sticks and Filter Discs in Triathler.

1. WAD STICKS

Wad sticks are useful for wiping cavities and small spots. The sticks can be measured in microtubes (like Eppendorf®) with minimal amount of cocktail, thus minimising background, costs and liquid waste. An illustrative procedure:

- Wipe the target either 1) with a dry stick or 2) with a moistened stick and dry it,
- Break it so that it fits in a microtube,
- Pipette 100 - 200 μl of scintillation cocktail in a microtube and drop the stick in it,
- Count with Triathler in the microtube adapter.

A lipophilic non-evaporating safe cocktail is recommended. The figure shows the stick in a microtube. Naturally, the cocktail can be pipetted in the tubes already prior the actual assay. It is also possible to pipette the cocktail directly in the wad and insert the cocktail-wet stick into the Eppendorf tube for counting.

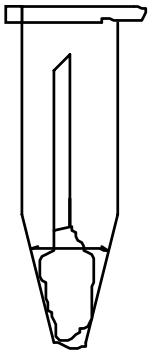

Fig. 1. *A broken wad stick in a microtube with 150 μl of liquid scintillant.*

As an experimental verification of the test, 100 μl of H3-sucrose solution (activity about 80 000 DPM) was spread over about 3 cm x 3 cm area on a wooden laminate and let dry. A wipe test was performed as above. The stick was counted in an Eppendorf® tube (1.5 ml) with 150 μl of liquid scintillation cocktail OptiScint HiSafe (Wallac).

Results: The measurement for the tube gave 2720 CPM (counting time 300 s). A rough estimation for activity in the wad was made by assuming 7 % counting efficiency (see below). This would give ~2720/.07 = 38900 DPM in the wad. Consequently, recovery of wipe would be ~38900/80000 = 48 %.

1.1 Further studies with wad sticks: A. Window setting and B. Comparison between liquid and meltable scintillant

A. Window Setting

The same H-3 wad stick as above was measured in two counting windows: one was the preset MCA window 35 - 120 (linear MCA), the other was 25 - 120 . Higher counting efficiency is obtained with 25 as the lower limit of discrimination (lower pulses are counted). The results are in the table below. "Act." denotes gross CPM for the active stick, "Bkg" for the background stick (no activity), respectively.

Window	Act.(CPM)	Bkg(CPM)
35-120	2153	50

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25-120	4558	90

Conclusion: It is possible to lower the window setting, and thus increase counting efficiency while maintaining acceptably low background. It may be risky to set the window low limit below 20 because low-amplitude luminescence and noise pulses may interfere there.

B. Liquid vs. Meltable Scintillant

MeltiLex™ is a meltable scintillant wax. For comparison, the same activity (appr. 40 000 DPM) was pipetted in two wad sticks. One was added with 150 µl of liquid scintillator OptiScint HiSafe as above, the other was dipped into molten MeltiLex on a hot plate with a heat resistant foil acting as a support.

window	OptiScint (CPM)	MeltiLex (CPM)
35-120	1422	772
25-120	2489	1661

Conclusion: As known, OptiScint has greater light output, and consequently higher counting efficiency than MeltiLex. However, the latter doesn't produce liquid waste. It is convenient to handle and carry with.

2. FILTER DISCS

Filter discs can be used for flat surfaces. Typical disc diameters range 25 - 50 mm. Filter materials can be paper, glass fiber, cellulose, cloth and plastic. Due to its many advantages we recommend the use of glass fiber filter discs. The procedure:

- Wipe the target either 1) with a dry disc or 2) with a moistened disc and dry it,
- By bending the disc, insert it vertically in a counting vial. A minivial suits.
- Add cocktail (0.5 ml for 25 mm discs and 1.5 ml for 50 mm discs) and tilt the vial so that the cocktail wets the filter.
- Insert the vial in the counting adapter so that the disc faces towards the detector (PM-tube) and count.

Recommendations: a glass fiber filter (see below) and a lipophilic non-evaporating safe cocktail.

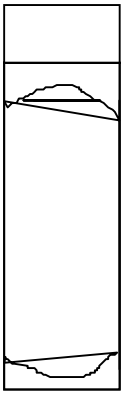

Fig. 2. *A bent filter disc in a minivial.*

3. SWAB MATERIAL AND COUNTING EFFICIENCY

The swab material can dramatically affect counting efficiency. To demonstrate this, a known activity of H-3 sucrose solution was pipetted onto three swab types and dried: 1) wadstick, 2) 50 mm glass fiber disc, and 3) 50 mm paper disc.

	Wad	GF	Pap.
H-3 eff	7 %	20 %	5 %
BKG (CPM)	50	50	50

It is seen that glass fiber gives clearly the best efficiency.

4. REMARKS

Recovery of activity from the wiped object depends on several factors: properties of the

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surface, radioactive compound, and the swab; pressing force applied during wipe, degree of moistness/dryness of the swab, repeatability of procedure etc.. All this means that wipe tests should be regarded qualitative rather than quantitative. However, there is no practical alternative to monitor for weak beta emitters, especially tritium, than wipe testing followed by liquid scintillation counting. U.S. DOE regulations 10 CFR 835 (1998) suggests 10000 DPM/100 cm^2
for removable tritium.

Glass fiber filters with alpha/beta separation allows also sensitive wipe testing for alpha isotopes. Though filter fibers may produce some self absorption, counting efficiencies exceeding 50 % and backgrounds below one CPM can be achieved.

Caution: When counting a moist swab directly in a water-accepting cocktail may lead to drifting results because the cocktail may only gradually reach and dissolve the activity in filter capillaries.

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