Alpha Isotope wipe tests with Triathler

Key words: Alpha Isotope, wipe test, MaxiLight

Introduction

Wipe (also called smear or swipe) tests are common in monitoring surfaces for beta isotope contamination. The alpha/beta separation capability of Triathler allows wipe testing to be efficiently extended also for alpha contamination.

Recommended procedure

1. According to your preference, wipe the surface either with a dry filter (dry wipe), or with a moistened filter (wet wipe) and dry it.
2. By rolling the filter, insert it vertically in the counting vial, loosely along its inner side wall.
3. Add a small amount (1 - 1.5 ml) of lipophilic liquid scintillation cocktail in the vial.
4. Cap the vial and tilt it so that the cocktail wets the filter.
5. Insert the vial in the counting adapter, the filter facing to the opening and count, preferably with alpha/beta separation.

Counting of dry filters allows lipophilic (hydrophobic) cocktails which have the highest light output. An ideal cocktail is e.g. MaxiLight from Hidex which belongs to “safe” category and has good alpha/beta separation characteristics. The small amount of cocktail helps in adhering the filter to the vial wall and minimizing background.

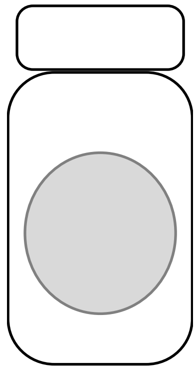

Fig. 1. A 25 mm filter disk in a standard 20 mL vial

Three filter media were investigated: paper (Macherey Nagel), mixed ester (Schleicher & Schuell ME 25) and glass fiber (Whatman GF/A). In tests with 241Am-chloride spots on a plastic laminate surface, all media performed equally well in terms of collected activity. With tap water wet wipe, the collection efficiencies were about 80 %.

However, there were great differences between the spectral characteristics (Figs. 2-4). Glass fiber gave the highest amplitudes and thence the best alpha/beta separation. Mixed ester was a bit poorer and paper the poorest.

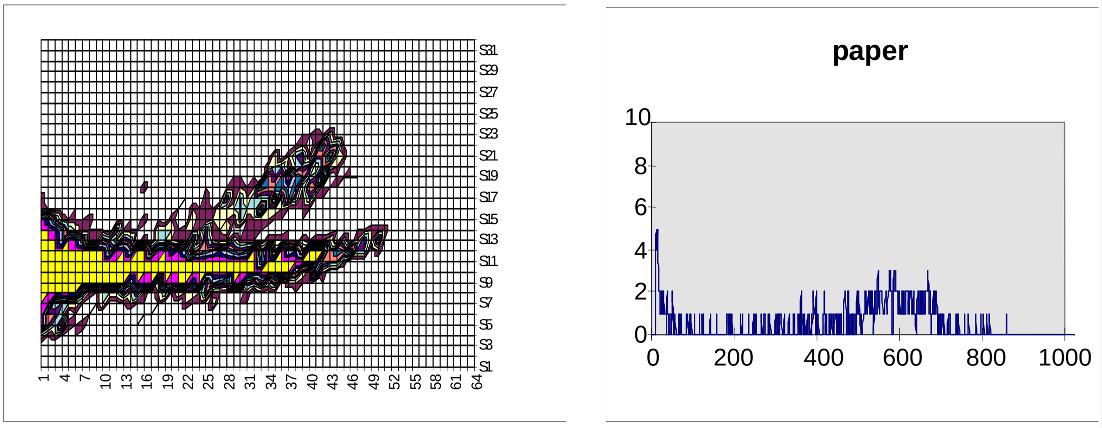

Fig. 2. 241Am (8 CPM) on a paper filter.

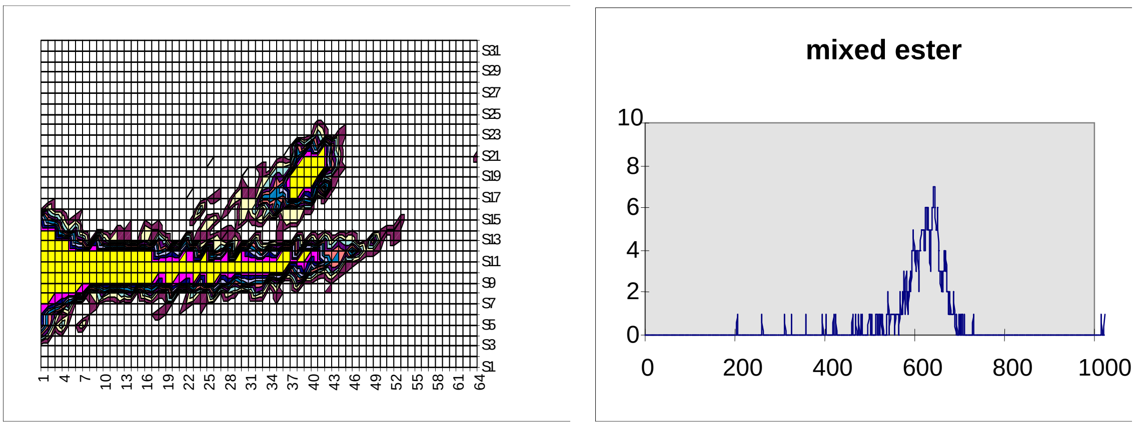

Fig. 3. 241Am (8 CPM) on a mixed ester filter.

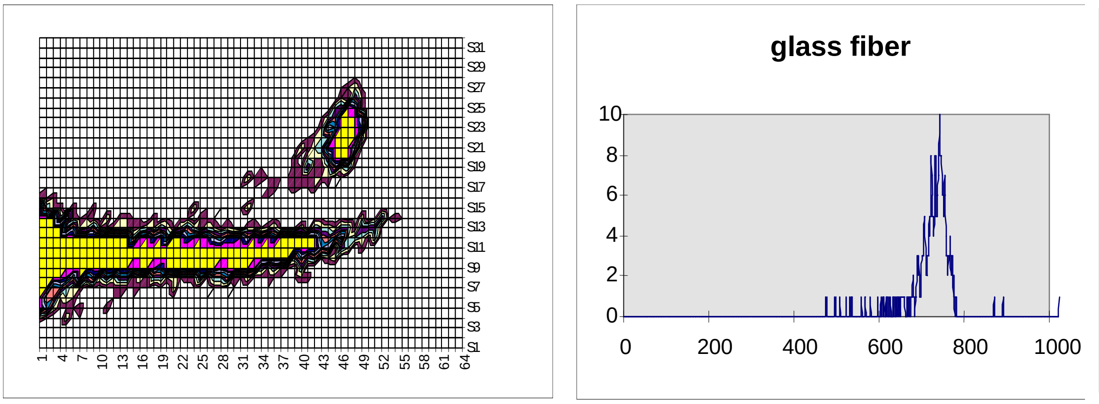

Fig. 4. 241Am (8 CPM) on a glass fiber filter.

Counting efficiencies and backgrounds

For accurate counting efficiency, a known activity of 241Am-chloride solution was pipetted on each filter type. Backgrounds were measured simply with pure filters.

241Am wipe performance

	paper	mixed ester	glass fiber
Alpha eff.%	75	85	85
Bgn 47 mm (CPM)	0.2	< 0.1*	0.9
Bgn 25 mm (CPM)	0.2	< 0,1*	0.25

*) no Rn-daughters present

Glass fiber was observed to contain a measurable alpha background, originating likely from the glass raw material (Fig. 5). Mixed ester has a very low background except in radon (222Rn) containing spaces where highly elevated count rates can be met due to trapping of Rn-daughters. See the next paragraph.

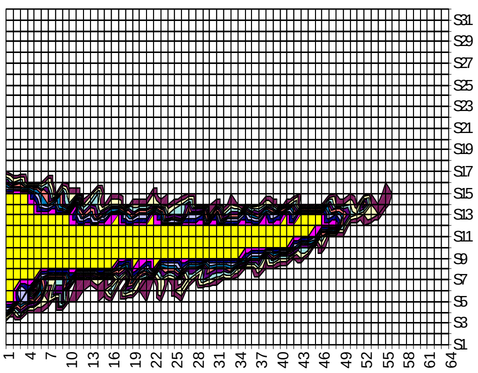

Fig. 5A. 2D graph of background. Mixed ester

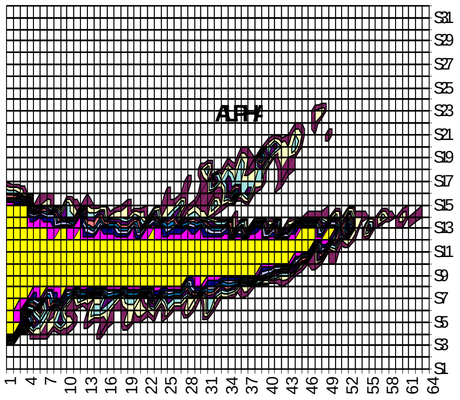

Fig. 5B. 2D graph of background. Glass fiber.
The alpha spot in glass fiber is about 0.9 CPM

Trapping of Rn-daughters from air

It was observed that mixed ester can trap Rn-daughters directly from air, probably due to its electrostatic nature. This can be falsely interpreted as surface contamination and should be kept in mind when wiping with this material. On the other hand, the phenomenon can be utilized in simple monitoring of spaces for radon. Paper and glass fiber did not trap Rn-daughters markedly.

In figure 6. are results from a room with brick walls, likely to contain radon. A mixed ester filter disk (Schleicher & Schuell ME 25, dia 47 mm) was simply kept exposed for 30 seconds, inserted in a counting vial, wet with 1 mL of MaxiLight cocktail and counted immediately with 3 minute repeats. The counting window was broad covering the 218Po and 214Po region. The results show a decline in alpha CPM. Two decay components are visible: fast (about 3 min half-life) and slow (over 30 min half-life).

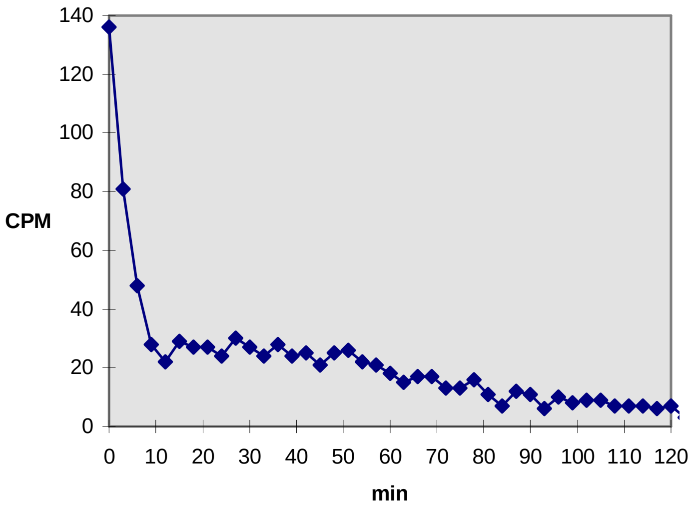

Fig 6. Total alpha CPM (218Po plus 214Po) from a mixed ester filter, exposed for 30 seconds in a room containing radon (222Rn).

Conclusions and remarks

1. Of the studied media, glass fiber gives the best light output, mixed ester the second and paper the poorest.
2. If possible, use small size filters (e.g. 25 mm disks rather than 47 mm disks). The activity distribution is then more favorable optically.
3. With glass fiber, be aware of its natural alpha background (0.25 CPM with 25 mm disks, 0.9 CPM with 47 mm disks). This again motivates use of small size filters.
4. Especially with mixed ester and other electrostatic materials, be aware of their tendency to trap Rn-daughters from air, which may be falsely interpreted as surface contamination. On the other hand, the phenomenon can be used for crude on-site radon monitoring of interior spaces.