TDTS 19

Minimising artefacts – Considerations for storage and transport of sorbent tubes

It is recommended that this Application Note is read in conjunction with Application Note TDTS 5 (Advice on sorbent selection, tube conditioning, tube storage and air sampling).

General tube handling

- Samples must be introduced onto the grooved (sampling) end of the tube and desorbed from the same end.
- Tubes should always be stored and handled in clean environments, for example a well-ventilated office, well away from laboratory solvents or major emission sources like photocopiers or laser printers.
- Brief exposure of the tubes to moderately contaminated air (such as would be typical of laboratory, factory or clinical environments) is inevitable when preparing tubes for collection and analysis, *e.g.* uncapping and recapping. However, contamination accumulated during these brief periods is generally not significant, and can be corrected for with appropriate use of blanks. In cases where this contamination would be significant, *e.g.* when sampling at extremely low ambient concentrations (ppt and below), the use of Markes' SafeLok™ tubes[4] ensures that even this brief exposure does not allow contaminants into the tube.
- Ensure that the outside surface of the tube does not become heavily contaminated. For example, tubes or caps should not be marked with felt pen, sticky labels, correction fluid or other solvent-based material.

Capping tubes

- Sorbent tubes are most effectively sealed with two-piece, brass, ¼″ screw-caps with single PTFE ferrules (Figure 1). These types of seal have been demonstrated to ensure minimum ingress of external artefacts and minimal loss of sampled components over storage periods up to 27 months[1–3].

Figure 1: Two-piece brass storage caps.

- Once sampling or analyis is completed, tubes should be recapped with the brass storage caps as soon as possible and returned to a clean environment for storage.
- Caps should be taken on and off using the CapLok™ tool (Figure 2). Capping and recapping is best achieved by taking the two brass pieces of the cap apart, and moving the female nut (containing the ferrule) 1 or 2 cm down the tube. Hold the male nut over the end of the tube and bring the female nut up to it. Tighten finger-tight then a further half-turn with the CapLok tool. If capping/recapping multiple tubes, a good quality check is to make sure that all fully capped tubes are the same length. Any tube on which one or other cap is not properly fitted will appear longer than the others.

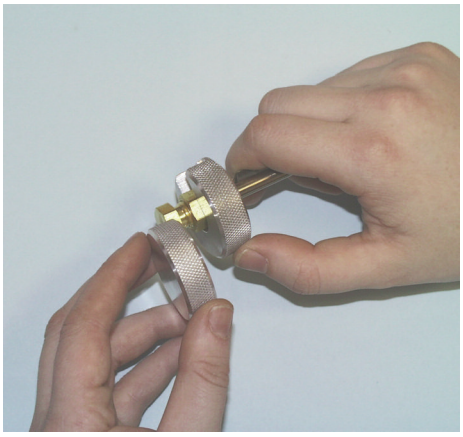

Figure 2: Using the CapLok tool.

- Tubes should be kept capped at all times, except when collecting samples or being prepared for analysis.
- It is a good idea to recheck the seals on a batch of tubes that have just been capped, especially if the temperature of the tube has changed, *e.g.* immediately after analysis. It is always advisable to retighten caps on tubes once they have cooled down to room temperature.
- To check cap tightness, grip the tube firmly and attempt to pull the cap off the tube by hand. Any caps that can be removed this way are not tight enough.

Tube storage

- Conditioned or sampled tubes should be stored inside a clean, non-emitting, air-tight container such as a glass jar, food storage container or uncoated, unused paint can.
- It is also recommended that a small amount of clean charcoal is kept inside the storage container to minimise VOC concentrations. The charcoal must not be in direct contact with any of the tubes.

Tube wrapping

- As a further precaution against the ingress of external artefacts or loss of retained analytes during long-term storage, tubes used for trace-level monitoring (sub-ppb levels) can be wrapped in clean aluminium foil before and after sampling.
- Tubes should be capped before wrapping, and wrapped tubes should be stored inside the normal storage container.

Tube conditioning

- It is essential that tubes are carefully conditioned before they are used for sample collection. This is best done using Markes' TC-20™ tube conditioner. Conditioning parameters should be more stringent than those for subsequent analysis. Typically, tubes should be conditioned 10°C below the maximum safe temperature of the least stable sorbent.
- Extra care should be taken when conditioning carbonised molecular sieves to ensure that all oxygen is eliminated from the tube before sorbent temperatures exceed 250°C.
- More details of recommended tube conditioning parameters are given in Application Note TDTS 5.
- After conditioning, a representative number of the cleaned tubes (usually 1 in 10) should be desorbed under analytical conditions to check artefact levels. For Tenax®, individual artefacts (peaks on the blank chromatogram) should be no more than 1 ng in toluene equivalents. For other porous polymer sorbents, artefact levels may be as high as 25–50 ng, and these sorbents are not recommended for trace-level monitoring. Artefact levels can be reduced to below 0.1 ng after stringent conditioning for most carbon sorbents.

N.B. It is advisable to keep a record of blank chromatograms for individual tubes or series of tubes so that trends in artefact levels can be monitored.

Blanks

In most monitoring/sample collection exercises at least two forms of blank tube will be required.

- **Laboratory blanks** are prepared in the same way and at the same time as tubes to be used for a monitoring exercise, but are never removed from the laboratory. They are simply kept inside a suitable storage container throughout the sample collection process and analysed with the sampled tubes. Laboratory blanks are used to check tube conditioning procedures and inherent sorbent stability.
- **Field (transport) blanks** are prepared as laboratory blanks above, but are transported with the tubes to be used for sample collection. Once at the monitoring location, all the processes carried out on the sampling tubes (unwrapping, uncapping, recapping, rewrapping, *etc.*), except sample collection itself, should also be carried out on the field blanks. They provide important controls for all tube handling, storage and transport procedures.
- **Environment/apparatus blanks** (required by some monitoring procedures, *e.g.* breath collection and materials emissions testing) are typically prepared by collecting a sample of background or supplied air, *via* the appropriate sampling apparatus, into a conditioned tube. The volume of background or supplied air collected should be the same as that used during sample collection.

Long-term storage

- Single-bed sorbent tubes can be reliably stored at room temperature[1,2].
- If multi-bed tubes are to be stored long-term (>1 week), they should be refrigerated[3,5]. This minimises the risk of migration of low-volatility compounds onto the stronger sorbents inside a tube.
- If tubes are to be stored under refrigerated conditions, care should be taken to ensure that the atmosphere inside the refrigerator or freezer is as clean as possible – for example, it should not contain solutions in volatile solvents.
- Within a refrigerator/freezer, tubes should be placed inside a storage container.
- Once tubes have been allowed to reach the storage temperature, they should be briefly removed from cold storage and the brass caps should be retightened.
- To prevent condensation, tubes removed from the refrigerator/freezer should be allowed to equilibrate at room temperature before being removed from the storage container for unwrapping/uncapping and analysis.

References

1. S. Vandendriessche and B. Griepink, The certification of benzene, toluene and *m*-xylene sorbed on Tenax in tubes, CRM 112, Community Bureau of Reference, EUR 12308 EN, 1989.
2. F. Lindqvist and H. Bakkeren, Stability of chlorinated hydrocarbons on Tenax, TNO Division of Technology for Society, Netherlands, R 90/268, 1990.
3. M.D. Wright *et al.*, Storage stability study of TO-14 compounds on single and multi-bed thermal desorption tubes. Measurement of Toxic and Related Air Pollutants, A&WMA Conference Proceedings, 1–3 September 1998, Vol. 1, pp. 550–566.
4. For further information on SafeLok tubes, please visit http://www.markes.com/Sample-Collection/SafeLok-Tubes.aspx.
5. J.F. Pankow *et al.*, Determination of a wide range of volatile organic compounds in ambient air using multisorbent adsorption/thermal desorption and gas chromatography/mass spectrometry, *Analytical Chemistry*, 1998, 70: 5213–5221.

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Version 2
June 2012