

MEMORANDUM

To: AIR QUALITY CONSULTANTS

From: John Sliwinski
OSB Lab

Re: Design of Multisorbent Tubes
GCBs and CMSs

Date: 24 June 2003

We originally investigated adsorbent tube design for sampling ambient air and process gas streams in 1990 as an alternative to established VOST Tenax/charcoal methods. The major trapping component for volatile organics in this system is charcoal. Tenax traps relatively high boiling point VOCs.

During this period Graphitized Carbon Blacks (GCBs) and Carbon Molecular Sieves (CMSs) were being promoted by Supelco based on work carried out by Bruner in Italy and Betz at Supelco in the 1980s. In-house literature reviews (including original primary VOST and semi-VOC research publications) and two literature packages provided by Bob Belardi (then with Supelco) suggested an alternate design for VOST tubes.

Initially, Envirochem glass C tubes were used and converted from Tenax/Ambesorb XE-340 (we had been using Envirochem thermal desorption systems since the 1980s) to C, B and S-III. Focusing traps were also prepared this new way but it became evident that S-III in its form was both too hydrophilic and too powerful a sorbent material for high concentrations of low boiling volatile organics and for modest breakthrough of higher boiling VOCs and semi-VOCs. Traps could not be easily cleaned, exhibited prolonged declining memory effects, and produced pyrolytic Benzene, substituted benzenes and assorted artifacts which interfered with subsequent analyses. Supelco recommended Carboxen-1000 as a replacement for S-III in focusing traps which was adopted with good results. The 1000s series appear to be less tenacious for VOCs than S-III and other CMSs during routine rapid thermal desorption.

The MB type glass tubes were designed with enormous capacity to replace a VOST pair. Again Carboxen-569 was introduced to prevent VOC retention and cleaning problems experienced with an all S-III CMS tube. Carboxen-569 is very hydrophobic and helps to buffer overloading S-III irreversibly with VOCs. Under some circumstances, if S-III is overloaded, it may not be cleanable and must be replaced with new S-III. This is the reason why Method 0031 recommends that Anasorb 747 be replaced after each sampling since it is inconceivable that 5g of charcoal-CMS type adsorbent can ever be thermally cleaned cost effectively.

The SS type stainless steel tubes were modified from the MB type to provide a more rugged field sampler and to be more compatible with other 0.25 inch/6.3mm O.D. formats. Whereas MB type tubes contain a total of 600mg of CMS, SS type tubes contain 210mg of CMS.

By mid-1997 C/B sorbents were no longer packed in tubes but replaced by Y/X sorbents. All SS tubes have been packed with only Y/X GCBs which provide greater adsorption strength than C/B GCBs.

Adsorption of moisture is a problem for recovering VOCs and creates difficulties in chromatography and mass selective detection. It is important to combine the most hydrophobic adsorbents to minimize capturing water vapour yet still achieving superior VOC retention.

Attached References

VOC Multisorbent Samplers (Actual Dimensions)

Adsorbents (Supelco)

VOST Charcoal Specification Study Project Summary

Vinyl Chloride Analysis VC 9907