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TOC Issues: Part 1 - Sampling Materials

This Cleaning Memo will address the proper selection of sampling materials used if Total Organic Carbon (TOC) is the sampling method of choice. Particularly since TOC is subject to a multitude of interferences, it is necessary to make sure that the sampling materials provide a consistent TOC value due to those “interfering” materials. Those materials contribute to the TOC “blank”, and are preferably materials which provide a blank with a low, consistent TOC value.

Swab sampling materials will be covered first. The swab used for sampling should be a “low extractables” grade of swab. Each swab supplier generally has at least one swab which is recommended for TOC sampling. This swab typically has a polyester knit fabric swab head, which is attached to a relatively inert plastic handle. The fabric is typically laundered in a cleanroom to reduce extractables. Furthermore, the swab head is attached to the handle not by using an organic adhesive, but rather by an induction heat seal to prevent a TOC contribution from the adhesive.

The water used for swab sampling should have a low TOC value. There are several options here. One is to buy gallon/liter containers of “low TOC water” from the various suppliers of TOC instruments. A second is buy “HPLC quality” water from a scientific supply house. These two are preferred because they provide a container of water with a low and consistent TOC value. Water from these sources will generally provide TOC values less than 100 ppb. A third option is to utilize the company’s Purified Water or WFI. This water may have a low TOC value. However, as a practical matter, the water must be placed in a clean container for use. The issue is making sure that the “clean” container does not significantly contribute to the TOC value of the sampling water such that the value is consistent, but relatively high. [Note: The rationale for having low values for the sampling water will be discussed next month when we discuss “blanks”.]

The vials used for sampling purposes are preferably “EPA” vials. These are precleaned, and they are certified clean. These EPA vials (available with septa) were originally developed for environmental sampling for the US Environmental Protection Agency (hence the term “EPA vials”). While more expensive than reusable vials, these vials are definitely worthwhile to assure low and consistent blanks.

Other items needed for swab sampling include “surgical” gloves and, optionally, clean scissors or wire cutter. The gloves should be surgical quality to allow appropriate manipulation of the swab (to help assure consistency in coverage). Powder-free gloves should be utilized. The gloves need not be sterile (sterilization has no effect on the TOC of the gloves; it just converts “TOC from microorganisms” to “TOC from dead microorganisms”). It is not recommended that gloves be sanitized with 70% isopropanol (or another alcohol) prior to sampling. The rationale for this is that alcohol on the gloves or in the air around the gloves may serve to increase the TOC due to absorption of alcohol by the swab during sampling. While it can be argued that this can be accounted for by an appropriate blank, it is also true that the amount of alcohol absorbed by the validation sample may be (and probably will be) different from the amount of alcohol absorbed by the blank.

Clean scissors (or perhaps clean wire cutters) may also be needed to cut the swab handle such that the swab head (and part of the handle) fall into the vial. The reason for this is that usually the swab is longer than the vial is tall. The swab head is typically cut off, thus minimizing contribution of TOC from the swab handle, and

particularly any contribution of that portion of the swab handle which is handled by the gloved hand. Care should be used to prevent contamination of the scissors. One option to avoid this is to utilize swabs with pre-scored handles, such that the swab head can be readily “broken” off into the vial.

There may be other items utilized for swab sampling. These include a template for accurately swabbing a certain surface area. The main issue with the use of a template that is specific to swabbing for TOC is just the issue of contamination of gloves through handling. [Note: The issue of using one template per swab site is not specific to swabbing for TOC; it is something that applies to swabbing for a variety of analytical methods.]

The issues for rinse sampling with TOC analysis are similar. However, the water used for rinse sampling is generally the same quality water used for the final process rinse (Purified Water or WFI). EPA vials are preferred for collecting samples. If a backup sample is needed for sampling, it is preferred to collect a series of individual samples in EPA vials rather than collecting a larger sample in a different container and then transferring portions of that larger sample to an EPA vial. The reason for this is to avoid the issue of TOC contributions from that intermediate sample container.

Another important issue is also to avoid TOC contributions from the sampling port itself. Some of the same practices that are used for sampling recirculating water systems can be utilized here. These include rinsing the external parts of the sampling port with water, hydrogen peroxide and/or alcohol. Of course, if alcohol is used, it must be flushed from the surfaces or allowed to evaporate to avoid significant TOC contributions from the alcohol itself. In all cases, the sampling port is flushed for a given time prior to collecting the validation sample. This assists in removing any extraneous carbon sources from the collected sample. It should be noted that for rinse sampling, any “foreign” contributions to organic carbon cannot be dealt with by use of a blank since the blank is taken from a different sampling port.

The issues discussed should be considered for sampling where TOC is the analytical method. These issues may be applicable for other analytical methods also. In addition, there may be good sampling practices that are independent of the analytical method utilized. The attempt of this Cleaning Memo is to address issues that are of major concern for sampling where TOC is the analytical method.