Water Technologies & Solutions
application note

Dual Use Conductivity & TOC (DUCT) Vials

introduction

The Dual Use Conductivity & TOC (DUCT) vials were developed specifically to work with the conductivity option of the Sievers* M9 Total Organic Carbon (TOC) Analyzers. These 30-mL specialty coated glass vials allow a user to simultaneously sample for both conductivity and TOC from the same vial. This enables automated USP/EP Stage 1 conductivity analysis with results in minutes, saving time and eliminating sample handling issues. The DUCT vials are cleaned using validated and automated equipment in an ISO 9001 quality environment. The vials are scrupulously cleaned of organic residues using low TOC reagent water as the final rinse. Each case contains 30 DUCT vials certified for less than 10 ppb TOC and no ionic leaching.

DUCT vial storage

The DUCT vials' specialty coating makes them a suitable container for USP/EP Stage 1 conductivity and TOC compliance testing. The vial cap also includes a custom septum to minimize CO_2 intrusion from outside of the vial. With the specialty cap and vial properties, Sievers tested a five day sample storage time, supporting less than a 0.2 µS/cm rise in sample conductivity over this time period.

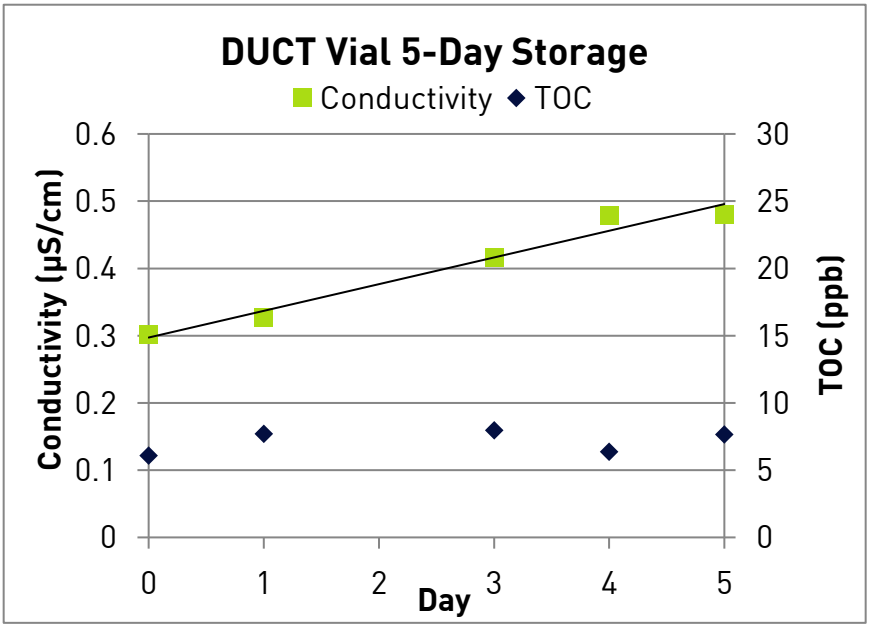

Figure 1: DUCT vial 5-day storage test

In order to test the five day storage time, a total of 50 DUCT vials were filled with deionized water and capped immediately. The first 10 vials were run within an hour of sampling on a Sievers M9 Laboratory TOC Analyzer with a Sievers Autosampler. The average of the 10 vials is represented as Day 0 in **Figure 1** for both conductivity and TOC. After one day, another 10 vials were run on the same TOC Analyzer. A subsequent 10 vials were run on day 3, 4, and 5. The average increase in conductivity over the five day period was less than 0.2 µS/cm. The TOC values were well below the 10 ppb limit over the same five day period. Please note users are welcome to store their samples beyond five days if their own conductivity levels and testing supports longer storage times.

DUCT vials vs. glass vials

A typical borosilicate glass vial is not an appropriate vessel for sampling conductivity as the surface can leach sodium ions that can contribute significantly to conductivity. Gingerella and Jacain said just this in The International Journal of Metrology: "Conductivity solutions packaged in glass bottles had significantly higher measured conductivities than their counterparts".[1]

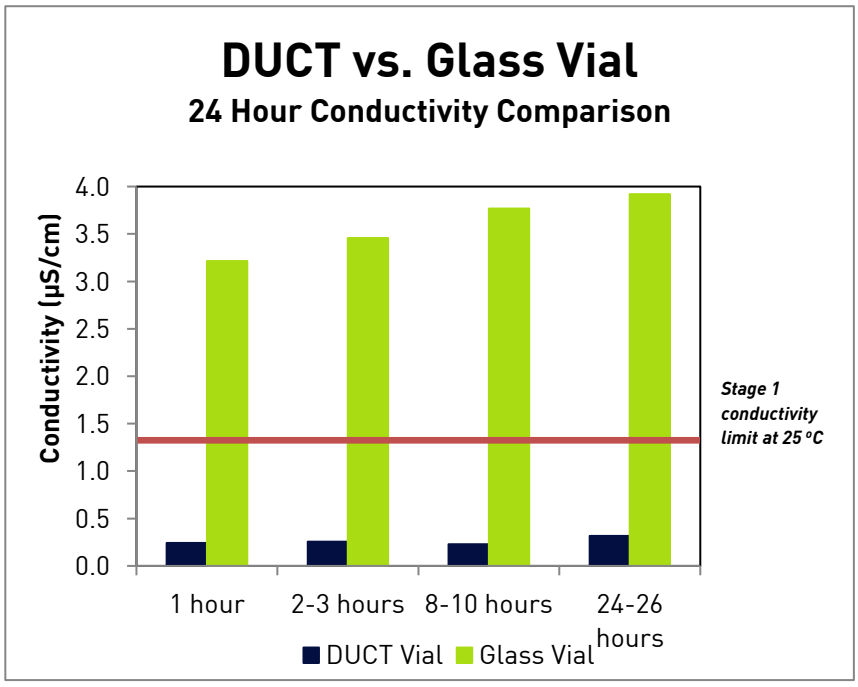

Figure 2: Conductivity comparison of DUCT vial vs. glass vial over 24 hours

In order to obtain a container that could be consistently certified to less than 10 ppb TOC and contributes no additional conductivity, Sievers developed the DUCT vial solution. For testing, a Sievers Certified TOC vial was used as the typical glass vial. Both the glass vial and DUCT vial tested well below 10 ppb over the 24 hour test. The side by side comparison for conductivity is shown in **Figure 2**. The samples stored in the glass vial were quickly contaminated with over 3 µS/cm conductivity from the glass compared to almost no contamination in a DUCT vial. This is critical as the USP <645> conductivity limit is 1.3 µS/cm at 25 °C.

Best Practices
Fill the vial so there is little to no headspace.
Fill the vial and analyse in an area free of VOC contamination.
Proven storage for up to five days.

DUCT vial best practices

Best results are obtained by carefully following a DUCT vial sampling procedure that minimizes contamination due to sample handling. DUCT vials should be filled with no headspace, since atmospheric CO_2 in the vial contributes to the conductivity reading. The vial should also be sampled and analyzed in an area with limited volatile organic carbon (VOC) contamination. This could impact both TOC and conductivity results from the vial.

making labs more productive

Current methods require two separate technologies to measure TOC and conductivity. Coupling the DUCT vial with the Sievers M9 TOC Analyzer makes complicated sample prep unnecessary, saving users valuable time. Not only can one measure and report sample conductivity in discrete grab samples using the DUCT vials, but results are available in minutes.

References

1. Gingerella, M., & Jacanin, J. (2000). Is there an Accurate Low-Conductivity Standard Solution? *The International Journal of Metrology*, (July-August), 29-36.

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