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Three methods frequently cited for the analysis of volatile organic compounds (VOCs) in air are EPA TO-14, TO-14A and TO-15. This technical note traces the chronology of their publication and identifies the principal differences among them.

Compendium Method TO-14A

Determination of Volatile Organic Compounds (VOCs) in ambient air using specially prepared canisters with subsequent analysis by Gas Chromatography

TO-14A is a slightly revised version of an earlier method, TO-14. Method TO-14 was originally published in March of 1989 in the second supplement to *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air*.¹

Method TO-14 was revised and updated as Method TO-14A in the Second Edition of the *Compendium of Methods in January 1999*.² As such, Method TO-14 has been superseded by TO-14A.

TO-14A differs from TO-14 in these respects:³

- TO-14A specifies a permeation type dryer instead of allowing alternative “water management” techniques.
- Instead of specifying Summa passivated steel canisters, TO-14A expands canister requirements to include other specially prepared canisters as well.
- TO-14A provides for gas chromatography coupled to an ion trap detector. That is in addition to the other detectors already specified in TO-14 (such as NPD, FID, ECD, PID and MS).

Compendium Method TO-15

Determination of VOCs in air collected in specially prepared canisters and analyzed by Gas Chromatography Mass Spectrometry (GCMS)

TO-15 was a new method added to the Second Edition of the Compendium in January 1999. TO-15 is larger in scope and better defined for the analysis of VOCs in air and other gaseous matrices than TO-14A. The major improvements in the revised methodology include the following points:⁴

- TO-15 addresses a more extensive set of VOCs, including many polar compounds that cannot be analyzed by TO-14A, such as ketones, alcohols and esters. This is achieved by modifying the approach to water management during the analysis, which is important because moisture in air samples can cause significant analytical problems. TO-15 utilizes a multisorbent/dry purge technique, rather than the permeation type dryer found in TO-14A. This approach reduces the amount of polar compounds lost during water removal.
- TO-15 specifies a mass spectrometer as the only detector used to identify and quantify target analytes. Mass spectrometry is considered a more definitive identification technique than either the single specific detectors or the multi-array detectors found in TO-14A.

- TO-15 establishes method performance criteria for acceptance of data which were incomplete in TO-14A. It allows for the use of alternate but equivalent sampling and analytical equipment. This is an important point due to the advances achieved in instrumentation technology. Current instrumentation can provide better method performance and automation than with instruments previously available.
- TO-15 details quality control provisions that were lacking or inadequate in TO-14A, providing higher confidence in the data.

Advantages and Disadvantages

- TO-14A is considered a very good method for the broad speciation of unknown trace volatile organics, and it has proven field and analytical technology.
- Strictly speaking, TO-14A is limited to the analysis of non-polar compounds. In addition, the detection systems allowed may not provide the best possible identification and quantification of unknowns.
- Due to these points, Compendium Method TO-15 is considered a more general yet better defined method for the identification and quantification of VOCs than TO-14A.

How to select the appropriate method

In practice, TO-15 has supplanted TO-14A as the preferred method for the analysis of VOCs in air. Unless otherwise specified by project documentation, permit requirements or other regulation, TO-15 is the method recommended by the Columbia Analytical.

For additional information, the methods may be reviewed directly at the following links:

<http://www.epa.gov/ttn/amtic/files/ambient/airtox/tocomp99.pdf>

<http://www.epa.gov/ttn/amtic/files/ambient/airtox/to-14ar.pdf>

<http://www.epa.gov/ttn/amtic/files/ambient/airtox/to-15r.pdf>

References

1. EPA 600/4-89-018
2. EPA 625/R-96/010b
3. Winberry, Jr., Jerry, *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition*, Project Summary, January 1999, p.12.
4. *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition*, January 1999, p. 15-3.

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