



Designation: D4934 – 02 (Reapproved 2025)

Standard Test Method for Rubber Compounding Materials: 2-Benzothiazyl Sulfenamide Accelerators—Insolubles¹

This standard is issued under the fixed designation D4934; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers a general procedure for the determination of insoluble impurities of sulfenamides in suitable organic solvents.

1.2 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

D4483 Practice for Evaluating Precision for Test Method Standards in the Rubber and Carbon Black Manufacturing Industries

3. Summary of Test Method

3.1 A specimen of sulfenamide is dissolved in a prescribed solvent, stirred, and filtered through a crucible. The insoluble content is calculated from the amount of residue.

¹ This test method is under the jurisdiction of ASTM Committee D11 on Rubber and Rubber-like Materials and is the direct responsibility of Subcommittee D11.11 on Chemical Analysis.

Current edition approved Nov. 1, 2025. Published December 2025. Originally approved in 1989. Last previous edition approved in 2021 as D4934 – 02 (2021). DOI: 10.1520/D4934-02R25.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

4. Significance and Use

4.1 Sulfenamides can degrade in chemical purity and functional performance, usually characterized by a drop in assay, a release of free amine, and an increase in insolubles. This test method may be used as an indication of such degradation.

4.2 Since MBTS (mercaptobenzothiazole disulfide) is a primary degradation product of sulfenamides, the determination of MBTS is a means of assessing possible degradation of sulfenamides. Insolubles are a means of mercaptobenzothiazyl disulfide (MBTS) content of the sulfenamide; MBTS is a primary degradation product of sulfenamides. Amine salts of mercaptobenzothiazole (MBT) may also be insoluble. However, certain soluble species may also be generated during sulfenamide degradation. Consequently, insolubles are not an absolute measure of purity and can actually decrease with sulfenamide degradation.

5. Apparatus

5.1 Erlenmeyer Flask, 300 cm³.

5.2 Sintered Glass Crucible, G4.

5.3 Measuring Cylinder, 250 cm³.

5.4 Magnetic Stirrer.

5.5 Watch Glass.

5.6 Vacuum Flask.

5.7 Explosion-proof, Vented Air Circulating Oven, capable of temperature regulation of $70 \pm 2^\circ\text{C}$.

5.8 Balance, analytical, with a sensitivity of ± 0.01 g.

5.9 Washing Bottle.

5.10 Sieve, 30 Mesh (U.S. Standard), or equivalent (for example, 0.6 mm).

6. Reagents

6.1 *Purity of Reagents*—Reagent grade chemicals shall be used in all tests. Unless otherwise indicated, it is intended that all reagents conform to the specifications of the Committee on Analytical Reagents of the American Chemical Society where