

literature melting point of salicylic acid

literature melting point of salicylic acid is a crucial parameter widely referenced in chemical and pharmaceutical research. Salicylic acid, a common organic compound with significant applications in medicine and industry, has a well-documented melting point that can vary slightly depending on purity and measurement conditions. Understanding the literature melting point of salicylic acid not only aids in quality control but also supports identification and characterization processes. This article explores comprehensive data on the melting point of salicylic acid as reported in scientific literature, discusses factors influencing these values, and explains methods used to determine this thermal property. Additionally, the article will highlight the importance of melting point in practical applications and provide insights into the interpretation of melting point data in research and industrial settings.

- Understanding the Melting Point of Salicylic Acid
- Reported Literature Values for Melting Point
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- Methods for Determining the Melting Point
- Significance of Melting Point in Application and Quality Control

Understanding the Melting Point of Salicylic Acid

The melting point of a compound is defined as the temperature at which it changes from a solid to a liquid under atmospheric pressure. Salicylic acid, chemically known as 2-hydroxybenzoic acid, exhibits a distinct melting point that serves as an important physical constant. This property is vital for verifying the identity and purity of salicylic acid samples. The literature melting point of salicylic acid typically ranges within a narrow temperature window, reflecting its crystalline nature and molecular structure.

Chemical Structure and Impact on Melting Point

Salicylic acid consists of a benzene ring substituted with hydroxyl and carboxyl groups. The presence of these functional groups facilitates intramolecular hydrogen bonding, influencing the stability and packing of molecules in the solid state. These interactions contribute to a relatively high melting point compared to other similar organic acids. The molecular arrangement and intermolecular forces directly affect the thermal behavior of salicylic acid, which is consistently reported in literature values.

Definition and Importance of Literature Melting Point

The term "literature melting point" refers to the melting point value(s) reported in scientific publications, reference books, and chemical databases. These values are established through standardized experimental methods and provide benchmarks for comparison. Having an accurate literature melting point for salicylic acid allows chemists to confirm substance identity, assess purity, and detect potential adulteration in commercial samples.

Reported Literature Values for Melting Point

Various authoritative sources document the melting point of salicylic acid, typically reporting a range due to slight variations in sample purity and experimental conditions. The literature melting point of salicylic acid generally falls between 158 °C and 161 °C, with many references citing a precise melting point near 159 °C.

Summary of Melting Point Data from Key Sources

Several well-established chemical handbooks, peer-reviewed articles, and pharmacopeias provide melting point data for salicylic acid. These include:

- Merck Index: 159 °C
- CRC Handbook of Chemistry and Physics: 158–160 °C
- British Pharmacopoeia: Approximately 159 °C
- Journal articles reporting experimental measurements commonly note values from 158.5 °C to 160.5 °C

The consistency among these values highlights the reliability of the literature melting point of salicylic acid as a standard reference.

Variation Across Different Studies

Despite general agreement, minor deviations occur in melting point values reported by different researchers. Factors such as sample preparation, heating rate, and instrument calibration can lead to variations. Nonetheless, these differences are typically within ± 1 °C and do not undermine the overall consensus on salicylic acid's melting point range in literature.

Factors Affecting the Melting Point of Salicylic Acid

While the literature melting point of salicylic acid provides a standard reference, several factors influence the experimentally observed melting point. Understanding these variables is essential for accurate determination and interpretation of melting point data.

Purity of the Sample

Impurities in salicylic acid samples commonly cause depression and broadening of the melting point range. Even trace amounts of contaminants disrupt the crystal lattice, lowering the temperature at which melting initiates. High-purity salicylic acid exhibits a sharp melting point close to literature values, whereas impure samples display reduced and less distinct melting points.

Heating Rate During Measurement

The rate at which temperature is increased during melting point determination affects the accuracy and reproducibility of the result. Rapid heating can cause overshooting or lag in temperature measurement, leading to higher or inconsistent melting point readings. Controlled, slow heating is recommended to approach the literature melting point of salicylic acid reliably.

Atmospheric Pressure and Environmental Conditions

Although melting point is primarily dependent on temperature, atmospheric pressure and humidity can influence the observed value. Standard atmospheric pressure is assumed in literature values; deviations from this condition may slightly alter melting behavior.

Physical Form and Particle Size

The crystalline form and particle size of salicylic acid also affect melting characteristics. Finely powdered samples tend to melt more uniformly, while larger crystals may show uneven melting. Polymorphic forms, although rare in salicylic acid, can present distinct melting points and should be considered during analysis.

Methods for Determining the Melting Point

Several analytical techniques are employed to measure the melting point of salicylic acid, each with specific advantages and limitations. Accurate determination is critical for aligning experimental results with the literature melting point of salicylic acid.

Capillary Tube Method

This traditional and widely used method involves placing a small amount of finely powdered salicylic acid in a thin capillary tube, then heating it gradually in a melting point apparatus. The temperature at which the solid transitions to liquid is recorded. This method is favored for its simplicity and effectiveness in quality control laboratories.

Differential Scanning Calorimetry (DSC)

DSC is a more advanced technique that measures heat flow associated with phase transitions. It provides precise melting point data and can detect subtle thermal events. DSC is instrumental in research settings where detailed characterization of salicylic acid's thermal properties is required.

Thermogravimetric Analysis (TGA)

While TGA primarily measures changes in weight with temperature, it can complement melting point analysis by detecting decomposition temperatures. Combining TGA and melting point data ensures that observed melting corresponds to the pure compound, not degradation.

Automated Melting Point Instruments

Modern automated devices offer high reproducibility and user-friendly operation. These instruments often include digital temperature controls and video monitoring to precisely identify melting points, aligning closely with the literature melting point of salicylic acid.

Significance of Melting Point in Application and Quality Control

The literature melting point of salicylic acid serves as a fundamental reference point in various practical contexts, from pharmaceutical manufacturing to academic research.

Identification and Purity Assessment

Determining the melting point is a routine method for confirming the identity of salicylic acid and assessing its purity. A melting point matching the literature value within a narrow range typically indicates a pure and correctly identified sample.

Quality Control in Pharmaceutical Production

Pharmaceutical companies rely on melting point data to ensure consistency and quality of salicylic acid used in drug formulations. Deviations from the literature melting point may signal contamination or processing errors, prompting corrective actions.

Research and Development Applications

In chemical research, precise melting point data support the synthesis and characterization of salicylic acid derivatives. The literature melting point acts as a benchmark for novel compounds and intermediates in synthetic pathways.

Standardization and Regulatory Compliance

Regulatory agencies often require adherence to specified melting point ranges for substances like salicylic acid. Compliance with literature melting point values ensures that products meet established quality standards and legal regulations.

Key Considerations in Melting Point Analysis

- Ensure sample purity to obtain accurate melting point readings
- Use appropriate and calibrated equipment for measurement
- Control heating rates to prevent overshoot and inaccurate data
- Compare experimental results directly with literature melting point values for validation

Frequently Asked Questions

What is the literature melting point of salicylic acid?

The literature melting point of salicylic acid is typically reported as 158–161°C.

Why is the melting point range of salicylic acid given as a range rather than a single value?

The melting point of salicylic acid is given as a range (158–161°C) due to slight variations in sample purity, measurement methods, and experimental conditions.

How does the purity of salicylic acid affect its melting point?

Impurities in salicylic acid lower and broaden its melting point range, causing it to melt at temperatures below the literature value of 158–161°C.

What is the significance of comparing the experimental melting point of salicylic acid to the literature value?

Comparing the experimental melting point to the literature value helps determine the purity and identity of salicylic acid in laboratory analysis.

Are there any variations in the reported literature melting points of salicylic acid from different sources?

While most sources report the melting point of salicylic acid as 158–161°C, slight variations may occur due to differences in measurement techniques and sample quality.

Additional Resources

1. *Understanding the Thermal Properties of Organic Compounds: Salicylic Acid as a Model*

This book explores the fundamental principles behind the thermal behavior of organic compounds, with a particular focus on salicylic acid. It discusses the molecular structure and intermolecular forces that influence melting points, providing experimental data and analysis. Ideal for chemistry students and researchers, it bridges theoretical concepts with practical applications.

2. *Melting Points in Pharmaceutical Chemistry: Case Studies Including Salicylic Acid*

Focusing on the pharmaceutical relevance of melting points, this volume includes detailed case studies on salicylic acid and related compounds. It covers techniques for measuring melting points, the significance in drug formulation, and stability testing. The book also highlights how melting point data can indicate purity and compound identity.

3. *Thermal Analysis Techniques: Investigating Salicylic Acid and Similar Molecules*

This text delves into various thermal analysis methods such as DSC (Differential Scanning Calorimetry) and TGA (Thermogravimetric Analysis), using salicylic acid as a key example. Readers will gain insight into how these techniques are applied to determine melting points and thermal stability. It's a practical guide for materials scientists and chemists.

4. *Organic Chemistry Experiments: Measuring Melting Points with Salicylic Acid*

Designed for students, this lab manual provides step-by-step instructions for experiments involving the melting point determination of salicylic acid. It explains the importance of accurate measurements and common sources of error. The book also includes background theory and suggestions for further experiments.

5. *Intermolecular Forces and Melting Points: The Case of Salicylic Acid*

This book focuses on the role of hydrogen bonding, van der Waals forces, and other intermolecular interactions in determining melting points. Salicylic acid serves as a primary example due to its well-known hydrogen bonding patterns. The text helps readers understand how molecular interactions influence physical properties.

6. *Material Science Perspectives on Organic Compound Melting Points: Salicylic Acid Insights*

Bringing a material science viewpoint, this book examines how crystal structure and morphology impact the melting points of organic compounds like salicylic acid. It discusses polymorphism and its effects on thermal properties. Researchers interested in solid-state chemistry will find valuable information here.

7. Analytical Methods in Chemistry: Determining Salicylic Acid Purity via Melting Point

This publication details analytical approaches for assessing the purity of salicylic acid by melting point analysis. It includes comparative studies with other purity assessment techniques such as chromatography. The book is a resource for quality control professionals in chemical manufacturing.

8. Historical Development of Thermal Analysis: From Early Studies to Salicylic Acid

Tracing the history of thermal analysis, this book highlights landmark studies involving salicylic acid. It provides context on how melting point determination evolved as an essential tool in chemistry. Readers gain appreciation of the technique's development and modern applications.

9. Practical Handbook of Organic Compound Properties: Melting Points and Beyond

This comprehensive handbook compiles physical and chemical properties of numerous organic compounds, with a special section dedicated to salicylic acid. It covers melting points, boiling points, solubility, and more, making it a handy reference for chemists. The book aids in quick comparison and data retrieval for research and education.

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