Sodium Borohydride Nabh4 Pubchem Pubchem Ncbi Nlm

Exploring Sodium Borohydride NaBH4: Insights from PubChem and NCBI NLM **sodium borohydride nabh4 pubchem pubchem ncbi nlm** are terms you might encounter frequently when diving into chemical databases or scientific literature related to this versatile compound. Sodium borohydride, with the chemical formula NaBH4, is an essential reagent widely used across various fields such as organic synthesis, pharmaceuticals, and industrial chemistry. Thanks to comprehensive resources like PubChem and the National Center for Biotechnology Information (NCBI) under the National Library of Medicine (NLM), researchers and enthusiasts alike can access detailed information about sodium borohydride's properties, applications, and safety data with ease. In this article, we'll take a closer look at sodium borohydride by exploring the wealth of information provided by PubChem and NCBI NLM, highlighting its chemical behavior,

practical uses, and safety considerations. Whether you are a student, a researcher, or simply curious, understanding how to navigate and interpret data from these databases can elevate your knowledge and application of this remarkable compound.

What is Sodium Borohydride (NaBH4)? An Overview

Sodium borohydride, commonly abbreviated as NaBH4, is a white to greyish crystalline powder known primarily for its role as a strong reducing agent. Its molecular structure consists of a sodium ion (Na^+) and a borohydride ion ($BH4^-$), where boron is centrally bonded to four hydrogen atoms. This compound is stable in dry conditions but reacts readily with water, releasing hydrogen gas. The versatility of sodium borohydride comes from its ability to selectively reduce various organic functional groups such as aldehydes and ketones to their corresponding alcohols, making it indispensable in organic synthesis. Additionally, its relatively mild reducing power compared to other agents like lithium aluminium hydride (LiAlH4) allows for safer and more controlled reactions.

Accessing Sodium Borohydride Data on PubChem

PubChem, a free chemistry database maintained by the National Institutes of Health (NIH), offers an extensive repository of chemical information. By searching “sodium borohydride” or “NaBH4” in PubChem, users can find detailed chemical and physical data, including: - Molecular weight and formula - Chemical structure and 3D models - Physical properties such as melting point, solubility, and density - Safety and hazard information - Spectral data like NMR and IR spectra - Bioactivity and toxicity information This centralized platform allows chemists to quickly compare sodium borohydride with related compounds and access experimental data for research or educational purposes.

The Role of NCBI NLM in Providing Scientific Literature on Sodium Borohydride

While PubChem focuses primarily on chemical data, the National Center for Biotechnology Information (NCBI), part of the National Library of Medicine (NLM), provides access to a vast collection of

biomedical and scientific literature through databases like PubMed. Searching for sodium borohydride nabh4 pubchem pubchem ncbi nlm in PubMed yields thousands of research articles, patents, and reviews that discuss the compound’s applications, safety profiles, and emerging uses.

Exploring Research Articles and Reviews

NCBI’s literature databases allow users to: - Track the latest advancements in sodium borohydride synthesis and applications - Understand biochemical interactions and toxicological effects - Study environmental impacts and disposal methods - Review clinical and pharmaceutical research involving sodium borohydride derivatives This wealth of information supports scientists in designing experiments and understanding the broader implications of using sodium borohydride in various contexts.

Applications of Sodium Borohydride: From Laboratory to

Industry

Sodium borohydride’s reputation as a reliable reducing agent transcends academic laboratories. Its applications span diverse industries and processes, reflecting its importance in modern chemistry.

Organic Synthesis

In organic chemistry, sodium borohydride is primarily used to reduce aldehydes and ketones to their corresponding alcohols. It’s favored because it selectively targets these groups without affecting other sensitive functionalities such as esters or carboxylic acids in many cases. This selectivity makes it particularly useful in multi-step synthetic routes, including pharmaceutical synthesis.

Industrial Uses

Beyond the lab, sodium borohydride plays a role in: - **Pulp and paper industry:** It serves as a bleaching agent, helping to maintain paper brightness. - **Water treatment:** It acts as a reducing agent to remove excess chlorine and heavy metals. - **Hydrogen storage and fuel cells:** Due to its capacity to release hydrogen upon hydrolysis, sodium

borohydride is studied as a potential hydrogen storage material for clean energy applications.

Analytical Chemistry and Other Uses

Sodium borohydride is also used in analytical chemistry to prepare samples or reduce metal ions in solution. Its ability to generate hydrogen gas makes it useful in certain gas-generation reactions and sensors.

Safety, Handling, and Environmental Impact

Handling sodium borohydride requires awareness of its reactive nature. Although it is safer than many hydride reagents, improper use can lead to hazards such as fire or hydrogen gas explosions.

Safety Precautions

- Store in a cool, dry place away from moisture and acids. - Use personal protective equipment (PPE) such as gloves and goggles. - Avoid contact with water or acidic substances to prevent uncontrolled hydrogen gas release. - Handle under a fume hood to avoid inhalation of dust or fumes.

Environmental Considerations

Disposal of sodium borohydride must be managed carefully to minimize environmental impact. It decomposes in water, releasing hydrogen gas and borates, which can contribute to water pollution if not neutralized properly. Consulting safety data sheets (SDS) and environmental regulations is essential for responsible use.

How to Leverage PubChem and NCBI NLM for Sodium Borohydride Research

For anyone working with sodium borohydride, becoming proficient in navigating PubChem and NCBI's resources can be a significant advantage. Here are some practical tips:

1. **Use PubChem's Compound Summary:** Start with the compound's page to get an overview of its properties and related substances.
2. **Explore BioAssays:** Check biological activity data linked to sodium borohydride to understand potential biochemical effects.
3. **Search PubMed for Latest Studies:** Use specific keywords related to your research interest (e.g.,

"NaBH4 reduction of ketones") to find relevant articles.

4. **Utilize Chemical Structure Search:** PubChem allows structure or substructure searching, helpful for finding derivatives or analogs.
5. **Review Safety and Toxicology Information:** Both PubChem and NCBI provide access to toxicology reports and safety guidelines critical for laboratory work.

Mastering these tools can accelerate the research process and improve the design and safety of chemical experiments involving sodium borohydride.

Emerging Trends and Research Directions

Current research around sodium borohydride continues to explore innovative applications, especially in green chemistry and sustainable energy. For instance, the development of catalysts that enhance hydrogen release from NaBH4 under mild conditions is a hot topic, aiming to utilize it as a hydrogen carrier for fuel cells. Additionally, modifications of sodium borohydride to improve its stability and selectivity are being investigated, expanding its utility in fine chemical synthesis and

pharmaceutical production. Whether you're looking up sodium borohydride nabh4 pubchem pubchem ncbi nlm for academic purposes or practical applications, the combination of chemical databases and biomedical literature repositories offers a comprehensive view. These platforms enable a deeper understanding of sodium borohydride's chemical nature, safety protocols, and cutting-edge research, making them invaluable resources in the scientific community.

Sodium Borohydride NaBH4: A Comprehensive Review from PubChem and NCBI NLM Perspectives

sodium borohydride nabh4 pubchem pubchem ncbi nlm represents a critical keyword cluster for researchers, chemists, and professionals seeking detailed chemical information and biological data on this widely used reducing agent. Sodium borohydride (NaBH4) is a cornerstone reagent in organic synthesis and industrial applications, renowned for its ability to donate hydride ions efficiently. Leveraging trusted scientific databases such as PubChem and the National Center for Biotechnology Information (NCBI) under the National Library of Medicine (NLM) umbrella allows for a comprehensive understanding of NaBH4's chemical properties, safety profiles, biological interactions, and potential applications.

This article delves into the multifaceted nature of sodium borohydride, synthesizing data from authoritative sources to offer a nuanced professional review.

Understanding Sodium Borohydride: Chemical and Physical Properties

Sodium borohydride (NaBH4) is an inorganic compound with the molecular formula NaBH4. It is a white to grayish powder, highly soluble in water and several polar solvents. According to PubChem, NaBH4 has a molecular weight of approximately 37.83 g/mol and exhibits a melting point around 400 °C (decomposes). The compound’s structure features a central boron atom tetrahedrally coordinated to four hydride ions, stabilized by a sodium cation. PubChem’s comprehensive database provides detailed 2D and 3D structural visualization, physicochemical properties, and spectral data. This is invaluable for chemists designing synthetic routes or exploring reaction mechanisms involving sodium borohydride. Additionally, the compound’s stability profile indicates that it decomposes in acidic conditions, liberating hydrogen gas, a feature

exploited in various industrial processes.

Mechanism of Action and Chemical Reactivity

Sodium borohydride functions primarily as a hydride donor in reduction reactions. Its chemical reactivity centers on the transfer of hydride ions (H-) to electrophilic centers, such as aldehydes and ketones, facilitating their conversion into alcohols. Compared to other hydride reagents like lithium aluminum hydride (LiAlH4), NaBH4 exhibits milder reducing power and greater selectivity, especially in protic solvents. Data from NCBI and related biochemical literature reveal that the mildness of NaBH4 often makes it the reagent of choice for selective reductions without affecting sensitive functional groups. Moreover, its relatively safe handling profile compared to other hydrides is frequently highlighted in safety data sheets accessed via NLM resources.

Applications and Industrial Significance

Sodium borohydride’s versatility extends beyond laboratory-scale organic synthesis into important industrial applications. The compound is widely

employed in:

1. Pharmaceutical synthesis – reducing key intermediates in drug manufacturing.
2. Paper and pulp industry – bleaching agent to remove residual lignin.
3. Water treatment – detoxification of chlorinated contaminants.
4. Hydrogen storage and generation – releasing hydrogen gas upon hydrolysis.

PubChem entries include references to patents and industrial processes that utilize NaBH4, underscoring its economic and functional relevance. The NCBI NLM databases further provide toxicological and pharmacological data that inform safe industrial practices and regulatory compliance.

Safety and Toxicological Profile

Accessing sodium borohydride’s safety data via NLM’s TOXNET and PubChem’s safety section reveals key considerations for handling and exposure. NaBH4 is classified as a hazardous chemical due to its reactivity with water and acids, which can lead to the release of flammable hydrogen gas. Direct contact with skin or eyes can cause irritation or burns. The National Library of Medicine’s resources detail acute

toxicity levels, with oral LD50 values in rodents generally exceeding 1700 mg/kg, indicating moderate toxicity. Chronic exposure data are limited but suggest caution in prolonged occupational handling. These insights assist laboratories and industries in implementing appropriate personal protective equipment (PPE) and emergency response protocols.

Comparative Analysis: Sodium Borohydride vs. Other Hydride Reagents

An analytical comparison of sodium borohydride with other hydride donors provides practical guidance for chemists and process engineers. PubChem and NCBI host extensive datasets that facilitate such evaluations, focusing on parameters like:

1. **Reactivity:** NaBH4 is less reactive than LiAlH4, making it suitable for selective reductions.
2. **Solubility:** NaBH4’s water solubility contrasts with LiAlH4, which reacts violently with water.
3. **Handling:** Sodium borohydride is safer and easier to handle, with fewer stringent storage requirements.
4. **Cost-effectiveness:** NaBH4 is generally more

economical for large-scale applications.

This comparative framework supports informed reagent selection tailored to specific synthetic needs, balancing efficiency and safety.

Recent Research and Developments from NCBI NLM

The NCBI database offers access to cutting-edge research articles and reviews exploring emerging uses of sodium borohydride. Recent studies have investigated NaBH4’s role in nanomaterial synthesis, where it acts as a reducing agent to produce metallic nanoparticles with applications in catalysis and electronics. Furthermore, biomedical research has explored sodium borohydride’s potential in reductive stress modulation and its interactions with biological macromolecules. While these applications are still under investigation, PubChem and NLM repositories provide valuable experimental data, toxicity assessments, and mechanistic insights that drive innovation.

Accessing Sodium Borohydride

Data on PubChem and NCBI NLM

For professionals seeking comprehensive data on sodium borohydride, PubChem offers an intuitive platform featuring:

1. Chemical identifiers (CAS number 16940-66-2, InChI, SMILES)
2. Physical and chemical properties
3. Biological activities and toxicity data
4. Patent information and literature references
5. 3D molecular models and spectra

Similarly, NCBI, through its PubMed and PubChem integration, provides access to peer-reviewed articles, toxicological profiles, and biomedical literature. The National Library of Medicine ensures that all data comply with rigorous scientific standards, making these platforms indispensable for researchers and regulatory bodies alike.

Optimizing Research Through Database Integration

The synergy between PubChem’s chemical data and NCBI NLM’s biomedical literature creates a robust ecosystem for exploring sodium borohydride from multiple scientific angles. Researchers can cross-

reference chemical properties with biological effects, facilitating multidisciplinary studies in chemistry, pharmacology, toxicology, and materials science. This integration enhances the ability to conduct risk assessments, develop safer synthetic methodologies, and innovate new applications, reaffirming sodium borohydride's position as a versatile and valuable chemical reagent. In the evolving landscape of chemical research and industrial applications, sodium borohydride continues to be a subject of intensive study. The wealth of information accessible via PubChem and NCBI NLM empowers scientists and professionals to harness its potential responsibly and effectively.

The way people approach learning has changed significantly over the past decade. Information is no longer something that must be carefully planned around time, place, or availability. Instead, knowledge is increasingly woven into everyday life. In this environment, the ability to download ***Sodium Borohydride Nabh4 Pubchem Pubchem Ncbi Nlm*** has become an important part of how individuals read, study, and grow intellectually.

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Digital books are particularly valuable in professional contexts. Many careers demand continuous skill development and updated knowledge. Downloadable resources allow professionals to learn on their own terms, without disrupting work schedules. With ***Sodium Borohydride Nabh4 Pubchem Pubchem Ncbi Nlm*** readily available, reference material is always close at hand.

Students also experience clear benefits. Academic success often depends on access to reliable study materials. Digital PDFs support offline learning, repeated review, and efficient note-taking. The ability to organize files digitally reduces stress and improves focus, allowing students to manage multiple subjects more effectively.

Digital access supports diverse learning styles. Some readers prefer structured, linear reading, while others focus on specific sections or revisit content selectively. Digital formats accommodate both approaches. Readers can skim, search, annotate, or

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Accessibility features further expand the reach of digital books. Adjustable font sizes, screen reader compatibility, night modes, and text-to-speech functions help ensure that ***Sodium Borohydride Nabh4 Pubchem Pubchem Ncbi Nlm*** remains usable for readers with different needs. Inclusive design makes knowledge more equitable and widely available.

Environmental considerations add another perspective. Producing and transporting printed books requires significant resources. While digital technology has its own environmental footprint, distributing books electronically often reduces paper usage and physical transportation. Downloading ***Sodium Borohydride Nabh4 Pubchem Pubchem Ncbi Nlm*** contributes to a more efficient and sustainable model of information sharing.

Organization is another understated advantage of digital libraries. Files can be categorized, labeled, backed up, and retrieved instantly. Readers can build long-term collections without physical clutter. When

information is organized effectively, it becomes easier to revisit ideas and build upon previous learning.

Global accessibility is one of the most powerful aspects of digital books. Readers from different countries and backgrounds can access the same material without delay. This shared access fosters dialogue, collaboration, and cultural exchange. Downloading ***Sodium Borohydride Nabh4 Pubchem Pubchem Ncbi Nlm*** connects individuals to a broader global learning community.

Digital literacy naturally develops through regular interaction with digital resources. Learning how to evaluate sources, manage information, and use reading tools responsibly is now a vital skill. Engaging with ***Sodium Borohydride Nabh4 Pubchem Pubchem Ncbi Nlm*** in digital form helps users build these competencies through practical experience.

Perhaps the most meaningful change lies in how digital access influences attitudes toward learning. When information is easy to obtain, curiosity feels encouraged rather than inconvenient. Readers are more willing to explore new topics, revisit familiar

ideas, and continue learning over time.

This mindset supports lifelong learning. Education becomes an ongoing process shaped by evolving interests and challenges. Having ***Sodium Borohydride Nabh4 Pubchem Pubchem Ncbi Nlm*** available digitally ensures that learning remains flexible and adaptable throughout different stages of life.

In conclusion, the ability to download ***Sodium Borohydride Nabh4 Pubchem Pubchem Ncbi Nlm*** reflects a broader transformation in how knowledge is shared and experienced. Digital access offers convenience, affordability, functionality, and ethical distribution, making learning more inclusive and practical. When used responsibly, ***Sodium Borohydride Nabh4 Pubchem Pubchem Ncbi Nlm*** becomes more than a digital book—it becomes a trusted resource for reflection, growth, and continuous intellectual development in an ever-changing world.

Questions & Answers About

sodium borohydride nabh4 pubchem pubchem ncbi nlm

No	Question	Answer
1	What is sodium borohydride (NaBH4) according to PubChem?	Sodium borohydride (NaBH4) is a chemical compound used as a reducing agent in organic and inorganic chemistry. According to PubChem, it is a white to grayish solid that is soluble in water and commonly used for the reduction of carbonyl compounds.
2	What is the molecular formula and structure of sodium borohydride on PubChem?	The molecular formula of sodium borohydride is NaBH4. Its structure consists of a sodium ion (Na+) and a borohydride ion (BH4−), where boron is centrally bonded to four hydrogen atoms in a tetrahedral geometry.
3	What are the common uses of sodium borohydride listed in NCBI and NLM resources?	According to NCBI and NLM, sodium borohydride is commonly used as a reducing agent in chemical synthesis, particularly for reducing aldehydes, ketones, and acid chlorides to alcohols. It is also used in pharmaceuticals and as a hydrogen storage material.

4	What safety information about sodium borohydride is available on PubChem?	PubChem provides safety information indicating that sodium borohydride is flammable and reacts violently with water and acids, releasing hydrogen gas. Proper handling with protective equipment is necessary to prevent fire and explosion hazards.
5	How does sodium borohydride function as a reducing agent in chemical reactions?	Sodium borohydride donates hydride ions (H−) to electrophilic centers in molecules, such as carbonyl groups, reducing them to their corresponding alcohols. Its selectivity and mildness make it useful for reductions that require gentle conditions.
6	What is the PubChem Compound ID (CID) for sodium borohydride?	The PubChem Compound ID (CID) for sodium borohydride is 24403.
7	Are there any environmental or toxicity data for sodium borohydride on NLM or NCBI?	Yes, NLM and NCBI provide toxicity data showing that sodium borohydride can be harmful if inhaled or ingested and can cause irritation to skin and eyes. It should be handled with care to minimize exposure and environmental release.

8	What are some related compounds to sodium borohydride found on PubChem?	Related compounds to sodium borohydride include lithium borohydride (LiBH4), potassium borohydride (KBH4), and other borohydride derivatives used as reducing agents in organic synthesis.

sodium borohydride, NaBH4, reducing agent, chemical compound, PubChem CID 14290, NCBI chemical database, boron hydride, hydride donor, chemical reagent, molecular formula NaBH4

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