Ansell

UNDERSTANDING ACETONE: **USES, RISKS AND SAFETY PRECAUTIONS**

SAFETY BRIEFING

INTRODUCTION TO ACETONE

Known for its colourless appearance and distinct, sweet odour, acetone (chemical formula: C3H6O) is the simplest ketone and plays a crucial role in several industries.[1] From paint thinners to medical instruments, its ability to dissolve other substances makes it a valuable solvent. However, while widely used, acetone poses health risks, especially in settings with significant exposure, requiring careful handling and safety measures.

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INDUSTRIAL PRODUCTION

Industrially, acetone is synthesised from benzene and propylene.[2] These compounds form cumene, which, after oxidation, yields cumene hydroperoxide, producing both phenol and acetone as byproducts.[2] The demand for acetone continues to grow, largely due to its extensive use across various industries.

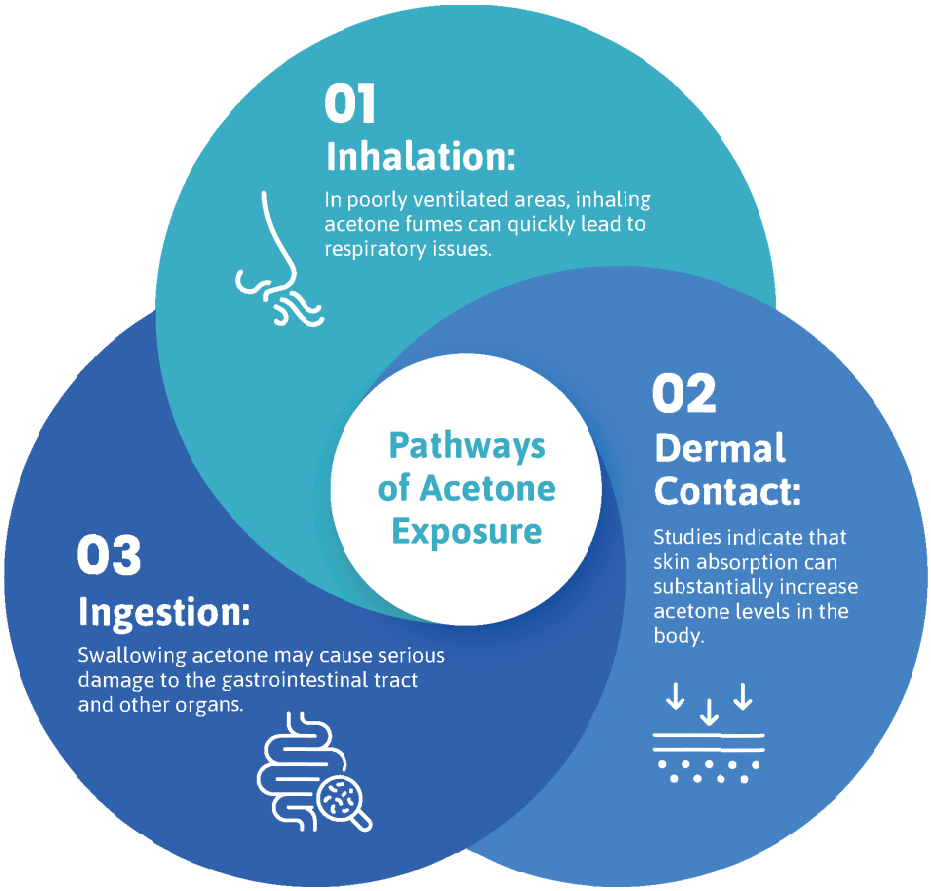
KEY USES OF ACETONE

One of the most significant applications of acetone is as a solvent. In 2024, approximately 36.2% of acetone is projected to be used for this purpose.[3] Its solvent properties are essential for dissolving substances like paints, plastics, resins, synthetic fiber, and glues.[3]

1. **Chemical:** The chemical industry is the largest consumer of acetone, responsible for 68.4% of its global use in 2021, underscoring its importance in chemical and industrial processes.[4]
2. **Manufacturing:** Acetone is used in the production of plastics, resins, and lacquers. It is also a key ingredient in the formulation of adhesives and coatings, providing the necessary properties for effective bonding. Additionally, acetone serves as a cleaning agent for removing glues, paint, and grease from components.
3. **Pharmaceuticals:** In the pharmaceutical industry, acetone serves as a solvent for active ingredients and fillers in medications. It aids in the formulation of drugs, ensuring that they are effective and stable.
4. **Textiles:** Acetone is employed to remove grease and sticky substances from fabrics and is used in the production of synthetic fibers. Its solvent properties help in dyeing processes and cleaning textiles.
5. **Electronics:** In the electronics industry, acetone is crucial for cleaning and degreasing electronic components. It ensures that surfaces are free from contaminants, which can affect performance and reliability.
6. **Cosmetics and Personal Care:** Acetone is a primary ingredient in nail polish removers and is used in various cosmetic formulations. Its ability to dissolve oils and other substances makes it effective for removing makeup and other residues.

PATHWAYS OF ACETONE EXPOSURE

Exposure to acetone can occur in several ways: [4,5]



Understanding these pathways is vital for individuals working in environments with acetone exposure, as it highlights the need for comprehensive safety protocols.

HEALTH EFFECTS OF ACETONE EXPOSURE

While small amounts of acetone are metabolised harmlessly by the liver, moderate to high levels of exposure can pose health risks. The short-term effects of exposure can vary but commonly include: [4,8]

NEUROLOGICAL EFFECTS

Symptoms like headaches, dizziness, and confusion may occur.

DIGESTIVE EFFECTS

Higher concentrations can lead to nausea, vomiting.

RESPIRATORY SYSTEM EFFECTS

Acetone vapours can irritate the respiratory system.

EYES EFFECTS

Acetone vapours can irritate the eyes and at high concentration can lead to a blurred vision.

SKIN EFFECTS

Skin irritation, and, with repeated or prolonged contact, acetone has a degreasing effect on the skin. It may cause redness, peeling, and cracking.

In severe cases, acetone exposure may result in respiratory failure, coma, or, in rare instances, death.[4] Additionally, research indicates that women may experience shortened menstrual cycles with high exposure levels.[4] Proper handling, therefore, becomes critical in reducing the risk of severe outcomes.

Absorption Through the Skin: Insights from Fukabori Study

A study conducted by Fukabori et al. in 1990 explored the absorption of acetone through the skin, revealing critical findings about its impact on the body. The study applied acetone to participants' skin for 2 hours per day over four days, which resulted in detecting traces in the blood, alveolar air, and urine. The results showed that:[5]

- **Increased Exposure Time:** Doubling exposure time to four hours per day more than doubled the acetone levels in the body.
- **Inhalation Equivalence:** Dermal exposure for two to four hours mirrored the effects of inhaling acetone over two hours.

These findings emphasize the importance of using protective equipment, such as gloves, to limit dermal contact, given how readily acetone is absorbed through the skin.

WORKPLACE SAFETY AND OCCUPATIONAL HEALTH

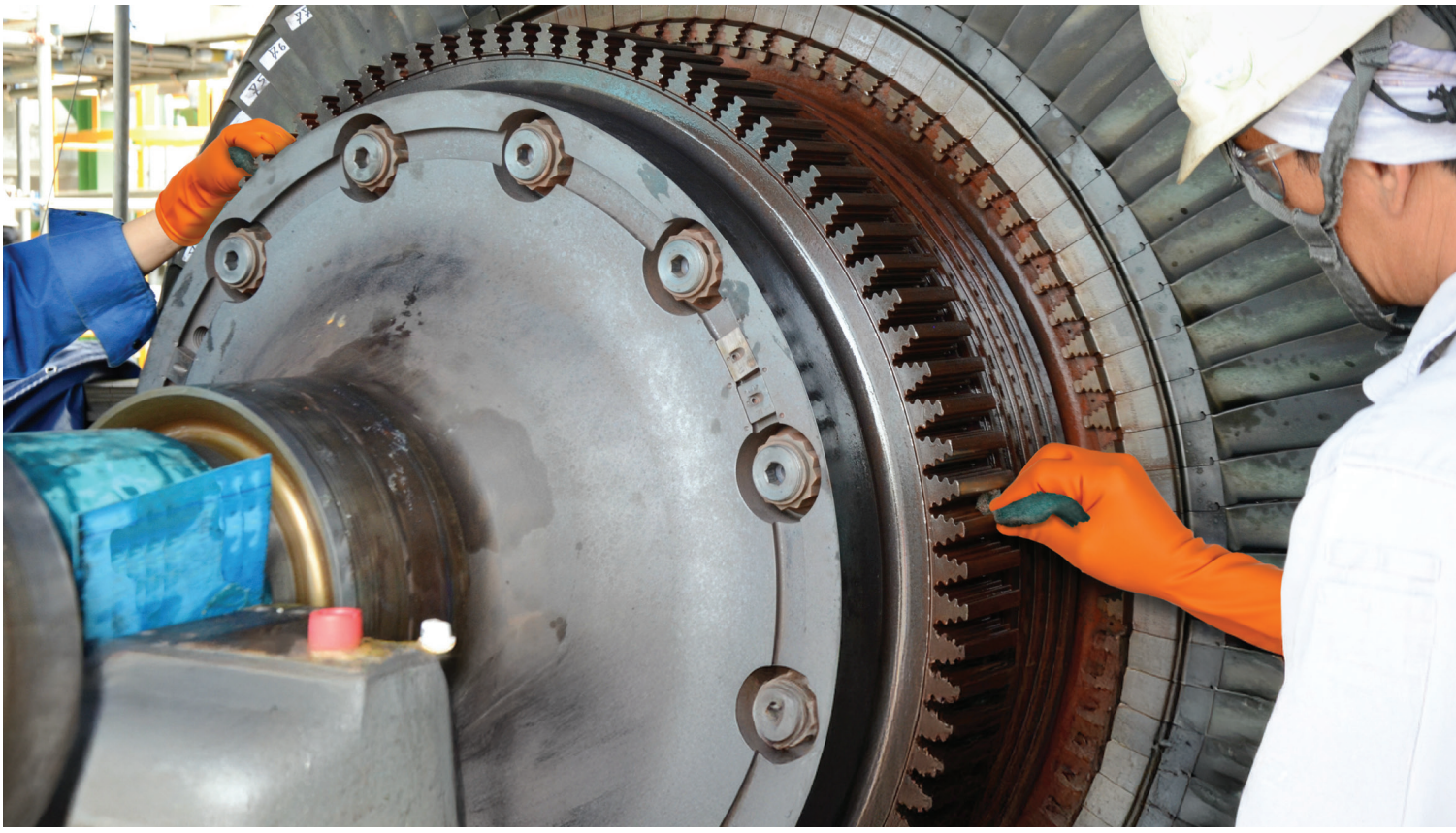
Given acetone's widespread industrial use, safety in the workplace is paramount. Statistics from the Occupational Safety and Health Administration (OSHA) indicate that acetone-related accidents can be deadly. In recent years, 4 out of 10 acetone-related incidents led to fatalities, underlining the chemical's potential hazards in industrial settings.[6] Poison control data from 2019 reported 1,553 cases of acetone-related poisoning, with only one fatality, suggesting that while acetone is dangerous, lower concentrations typically aren't fatal.[7]

To minimise risks, OSHA and other safety organisations recommend:[1,2,6,8]

Ventilation: Proper ventilation reduces the concentration of acetone vapour in the air. Acetone's volatility is another factor that requires attention. Its high evaporation rate means it can quickly disperse into the air, increasing the likelihood of inhalation exposure in confined spaces. Therefore, ensuring adequate ventilation and routine monitoring of air quality in workplaces is essential.

Personal Protective Equipment (PPE): Gloves, masks, and goggles can shield workers from inhalation and dermal exposure.

Exposure Limitation: Restricting the amount of time spent in contact with acetone reduces health risks.



MARKET AND INDUSTRY TRENDS

In 2024, the Asia Pacific region dominated the global acetone market, holding approximately 47.5% of the market share. This growth was driven by rapid industrialization and the relocation of manufacturing facilities to the region due to cost advantages. Meanwhile, Europe and North America each accounted for around 20% of the market.[9-11]

The acetone market remains robust, with global sales reaching $6.95 billion in 2023.[12] This growth is driven by the chemical sector's demand for acetone in solvents and consumer products.[12] As industries continue to expand, the demand for acetone is projected to rise, positioning it as an indispensable component of modern manufacturing.

Conclusion

Acetone's versatility and functionality make it an invaluable asset across various industries. However, handling it requires a thorough understanding of the associated health risks and strict adherence to safety protocols. The 1990 Fukabori study on dermal absorption underscores the importance of protective measures to minimise skin contact. Additionally, data on acetone-related accidents and poisonings demonstrate the need for appropriate ventilation, PPE, and exposure limitations to ensure safety in workplaces.

As the acetone market continues to grow, both employers and employees must remain vigilant about safety practices to protect against the potentially harmful effects of this powerful chemical. By doing so, industries can harness acetone's benefits while prioritising the health and well-being of those handling it.

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