Product Safety Assessment

WALSRODER™ Nitrocellulose Products

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Names
- CAS No. 9004-70-0
- Nitrocellulose
- NC
- WALSRODER™ Nitrocellulose products
- WALSRODER™ Nitrocellulose A-grades
- WALSRODER™ Nitrocellulose AM-grades
- WALSRODER™ Nitrocellulose E-grades
- WALSRODER™ NC-Chips

Product Overview
- WALSRODER™ Nitrocellulose products are derivatives of natural cellulose produced by Dow Deutschland Anlagengesellschaft mbH, a business unit of The Dow Chemical Company (“Dow”). This family of products offers an outstanding range of properties. They dissolve readily in organic solvents to form a hard but flexible film – ideal for a good surface finish. WALSRODER Nitrocellulose products are formulated to contain at least 25% solvent or at least 18% plasticizer as required by law.\(^1\) For further details, see Product Description.
- In addition to printing inks and wood coatings, there are numerous other applications in which WALSRODER Nitrocellulose products are used.\(^2\) For further details, see Product Uses.
- Nitrocellulose can burn explosively and care must be taken to avoid burns. Health information differs for individual formulations depending on the damping material used. For further details, see Health Information.
- Workplace exposure to nitrocellulose products is possible. WALSRODER Nitrocellulose products are not sold for direct consumer use, but they are used as binders in food packaging printing processes. However, direct consumer exposure is unlikely because these materials rapidly volatilize (evaporate). For further details, see Exposure Potential.
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- If ignited, these materials will burn rapidly. If nitrocellulose is permitted to dry out, the dry residues may be explosive. Do not subject materials to grinding, shock, or friction. For further details, see Physical Hazard Information.
- WALSRODER™ nitrocellulose materials are biodegradable, unlikely to accumulate in the food chain, and are practically non-toxic to aquatic organisms on an acute basis. For more information, see Environmental Information.

**Manufacture of Product**

- **Capacity** – Dow Deutschland Anlagengesellschaft mbH produces nitrocellulose products at manufacturing facilities in Bomlitz, Germany.
- **Process** – Nitrocellulose is produced by reacting ground natural sources of cellulose, such as cotton and trees, with nitrating acid (a mixture of nitric acid and sulfuric acid). The cellulose is separated from the acids, which are recycled. The cellulose is then treated with hot water in the “digestion” process to reduce the viscosity and remove any free acids. Following the complex washing and stabilizing stages, damping agents (solvents or water) or plasticizers are added to the nitrocellulose to formulate it for the desired end application. These formulations are then marketed as WALSRODER™ Nitrocellulose products (damped NC and NC-Chips). The schematic flow chart that follows gives an outline of the individual stages of the process.

**Product Description**

Nitrocellulose has an outstanding range of properties and is a derivative of natural cellulose. It dissolves readily in organic solvents and, with its relatively rigid molecule chain, it forms a hard but flexible film – ideal for a good surface finishes.

Nitrocellulose is produced from a natural macromolecule (cellulose), so it does not contain hazardous monomers. Pure nitrocellulose is toxicologically harmless. It has wide compatibility with many other binders and plasticizers, which allows it to be formulated for particular applications, such as inks and coatings that are used in food packaging.
WALSRODER™ Nitrocellulose products used in these and other applications use quick-drying formulations that have extremely low solvent retention and comply with relevant regulations and guidelines. The rapid and complete solvent evaporation obtainable with nitrocellulose-based printing inks allows high printing speeds to be achieved on modern high speed printing machines.

Industrial nitrocellulose is required by law to contain at least 25% of a damping agent (e.g., solvent, water) or 18% plasticizer. The purpose of damping agents or plasticizers is to deactivate the hazardous properties of dry nitrocellulose (high flammability, high burning rates). Nitrocellulose, with a damping agent content below 25% or respectively a plasticizer content of under 18%, is classified as an explosive without regard to its nitrogen content. The nitrocellulose grades offered by Dow Deutschland Anlagengesellschaft mbH are damped with at least 30% solvent or water, or in the case of NC-Chips, phlegmatized (stabilized or desensitized) with 20% plasticizer. The difference between WALSRODER™ Nitrocellulose and WALSRODER™ NC-Chips is the type of phlegmatizer used (solvent or plasticizer). The most noticeable difference between the two is their physical form and the method of handling them.9

WALSRODER™ Nitrocellulose and WALSRODER™ NC-Chips are characterized or described by: the nitrogen content (degree of substitution), the viscosity (molecular weight), the phlegmatizer (damping agent or plasticizer respectively), and the phlegmatizer content. The product name contains all four characteristics.9

- WALSRODER™ Nitrocellulose products with a nitrogen content of 10.7% to 11.3% have the designation A. These products exhibit thermoplastic characteristics.
- WALSRODER™ Nitrocellulose products with a nitrogen content of 11.3% to 11.8% have the designation AM (representing solvent Medium-soluble). AM-grades lie in their behavior between the A and the E-grades.
- WALSRODER™ Nitrocellulose products with a nitrogen content of 11.8% to 12.3% have the designation E, as this nitrocellulose is soluble in Esters (the A and AM-grades are also soluble in esters). E-grades are the standard grades for wood and leather coatings.10
- WALSRODER Nitrocellulose products and WALSRODER™ NC-Chips for coatings and printing inks have a nitrogen content between 10.7% and 12.3%.

Nitrocellulose with nitrogen content above 12.6% is classified as an explosive; WALSRODER™ Nitrocellulose products are controlled to remain below this nitrogen level.11

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WALSRODER™ Nitrocellulose products are used in:

- **Liquid printing inks** – for printing plastic films and aluminum foils intended mainly for food packaging; printing inks that require high brilliance and high resolution
- **Wood coatings** – in primers, intermediate coats, and top coats; acid-cured lacquers and two component (two-pack) polyurethane coatings to accelerate solvent evaporation and to provide a harder finish and a smoother, more decorative surface than water-based coating systems
- **Metal coatings**
- **Paper coatings**
- **Leather coatings**
- **Effect finishes**
- **Nail varnishes**

WALSRODER™ NC-Chips are specifically formulated with a plasticizer as their phlegmatizing agent to meet specific application requirements, including use in:14

- **Printing inks** – with ethyl acetate as the solvent
- **Spray coatings** – for electrostatic spraying

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Exposure Potential

Nitrocellulose products are used in the production of industrial and consumer products. Based on the uses for these materials, the public could be exposed through:

- **Workplace exposure** – Exposure can occur either in a nitrocellulose manufacturing facility or in the various industrial or manufacturing facilities that use it. It is produced, distributed, stored and consumed in closed systems. Those working with nitrocellulose in manufacturing, formulating or printing/coating operations could be exposed during maintenance, sampling, testing or other procedures. Local exhaust ventilation may be necessary for some operations. Each manufacturing facility should have a thorough training program for employees, appropriate work processes and safety equipment in place to limit unnecessary nitrocellulose exposure. See Health Information.

- **Consumer exposure to products containing WALSRODER™ Nitrocellulose products** – WALSRODER™ Nitrocellulose products are not sold for direct consumer use; however, they are used in food packaging printing processes and in coatings for products that consumers use. WALSRODER™ Nitrocellulose products used in these and other applications use quick drying formulations that have extremely low solvent retention and comply with relevant regulations and guidelines. Nitrocellulose itself has no hazardous monomers and is toxicologically harmless. Always read the product information before use and follow the label/use instructions. See Health Information.

- **Environmental releases** – Nitrocellulose may be released slowly from coatings or other products containing it. Small amounts may be released to sewers and enter wastewater treatment plants. However, because its water solubility is very low, the material will tend to adsorb to the biosolids and other suspended particles. The compound is expected to biodegrade in the environment. In the event of a spill, the focus is on containing the spill to prevent contamination of soil, surface or ground water. Spilled nitrocellulose should be damped sufficiently with water or solvent and kept in a tightly-sealed container until proper disposal. Respiratory protection is necessary for cleaning up spills and leaks. Eliminate all sources of ignition immediately. Spilled material may cause a slipping hazard. For small spills, nitrocellulose should be washed with water. This material not classified as dangerous to aquatic organisms See Environmental, Health and Physical Hazard Information.

- **Large release** – Industrial spills or releases are infrequent and generally contained. If a large spill does occur, the material should be captured, collected and re-processed, or disposed of according to applicable governmental requirements. A positive pressure, self-contained breathing apparatus (SCBA) with a full-face mask approved by NIOSH is recommended for emergency work. Eliminate all sources of ignition immediately. Use only explosion-proof equipment; ground and bond all containers and handling equipment.

- **In case of fire** – Deny any unnecessary entry into the area and consider the use of unmanned hose holders. Water is the only effective agent for extinguishing burning nitrocellulose. Use water spray to cool fire exposed containers and fire affected zone until fire is out and danger of reignition has passed. Foam and CO₂ are not suitable extinguishing agents as they prevent the presence of sufficient oxygen. If there is insufficient oxygen, nitrous gases may form. Nitrocellulose presents a flashback potential. Fight fire from protected location or safe distance. Use of a direct water stream may spread fire. The public should be warned of down-wind vapor explosion hazards. Keep out of sewers. Immediately withdraw all personnel from the area in case of rising sounds from venting safety device or discolorations of the container. Follow emergency procedures carefully. See Environmental, Health and Physical Hazard Information.

For more information, request the relevant Safety Data Sheet using Contact Us.
Health Information

Health information for WALSRODER™ Nitrocellulose products are summarized on the relevant Safety Data Sheets. It is important to note that health risks associated with individual products may vary based on their formulation or intended use. All WALSRODER Nitrocellulose products contain nitrocellulose and a damping or phlegmatizing agent. These agents also have hazards associated with them. Thus, the Safety Data Sheet is the preferred source for specific health information for WALSRODER Nitrocellulose products. Consumers are not expected to come into contact with these materials. To minimize the potential for exposure to products containing these materials, always read the product information before use and follow the label/use instructions.

Damping or phlegmatizing agents present in nitrocellulose products

Eye – Exposure to vapors may cause pain disproportionate to the level of irritation to eye tissues. Moderate eye irritation may occur. Moderate corneal injury is possible. Vapor may cause eye irritation experienced as mild discomfort and redness. Vapor may cause tears.

Skin – Brief contact may cause skin irritation with local redness. There may be a more severe skin reaction if skin is abraded (scratched or cut). Exposure may cause more severe response on covered skin if the material gets under clothing or gloves. Prolonged skin contact is unlikely to result in absorption of harmful amounts.

Inhalation – With good ventilation and under proper storage conditions, single exposure is not likely to be hazardous. In poorly ventilated areas, vapors or mists of the secondary components may accumulate and cause respiratory irritation. Prolonged excessive exposure may cause adverse effects.

Ingestion – Low toxicity is expected if the material is swallowed. Small amounts swallowed incidentally as a result of normal handling operations are not likely to cause injury; however, swallowing larger amounts may cause injury. Ingestion of formulated nitrocellulose products may cause central nervous system depression, nausea, and vomiting.

For the minor component isopropanol present in nitrocellulose products

In animals, effects have been reported on the liver. Observations of over exposure to isopropanol in animals include lethargy. Kidney effects and/or tumors have been observed in male rats. These effects are believed to be species specific and unlikely to occur in humans.

Isopropanol has been toxic to the fetus in laboratory animals at doses toxic to the mother. In animal studies, over-exposure to isopropanol did not interfere with reproduction.

For the minor component ethanol

In humans, effects have been reported on the central nervous system and the liver. Symptoms of over exposure to ethanol may include: central nervous system depression, dizziness, drowsiness, and/or headache.

Ethanol has been shown to cause birth defects and toxicity to the fetus in laboratory animal tests. It has also been shown to cause human fetotoxicity and/or birth defects when ingested during pregnancy. In animal studies, it has been shown to interfere with fertility in males. Ingestion of large amounts of ethanol has been shown to interfere with fertility in human males.

Ethanol when not consumed in an alcoholic beverage is not classifiable as a human carcinogen. Epidemiology studies provide evidence that drinking of alcoholic beverages (containing ethanol) is associated with cancer, and IARC has classified alcoholic beverages as carcinogenic to humans.

For more information, request the relevant Safety Data Sheet using Contact Us.
**Environmental Information**

Nitrocellulose has very low water solubility. Once introduced into the water environment, the material will tend to bind with soil, suspended particles, or sediment.

Nitrocellulose is unlikely to persist in the environment. The compound is expected to biodegrade in the environment.

Nitrocellulose is not likely to accumulate in the food chain (bioconcentration potential is low) and is practically nontoxic to fish and aquatic organisms on an acute basis.

**Physical Hazard Information**

Physical hazard information for WALSRODER™ Nitrocellulose products are summarized on the relevant Safety Data Sheets. It is important to note that the risks associated with individual products may vary based on their formulation or intended use. All WALSRODER Nitrocellulose products contain nitrocellulose and a damping or phlegmatizing agent. These agents also have hazards associated with them. Thus, the Safety Data Sheet is the preferred source for specific health information. However, a general overview of the physical hazards associated with WALSRODER Nitrocellulose products is included below.

If ignited, WALSRODER Nitrocellulose products will burn rapidly. The container may vent and/or rupture due to fire. If nitrocellulose is permitted to dry out, the dry residues may be explosive. Do not subject these materials to grinding, shock, or friction. To reduce the potential for dust explosions, electrically bond and ground equipment and personnel. Do not permit dust to accumulate. Dust can be ignited by static discharge. If dust layers are exposed to elevated temperatures, spontaneous combustion may occur. During a fire, smoke may contain the original material in addition to combustion products of varying composition which may be toxic and/or irritating.

To reduce the risk of frictional heat, WALSRODER Nitrocellulose and WALSRODER NC-Chips are packed in fibreboard or paperboard containers consisting of a material with poor thermal conductivity. Therefore, nitrocellulose must be stored in its original packaging only. Damped or plasticized nitrocellulose must be stored in a cool and dry place.

Nitrocellulose damped with water or solvent may dry out if the damping agent is allowed to evaporate. The nitrocellulose is subsequently sensitive to impact and heat. The nitrocellulose container should therefore always be kept tightly sealed to prevent any evaporation. Nitrocellulose must not be allowed to come in contact with acids, alkaline solutions, amines or oxidants, as this could cause spontaneous decomposition or even ignition.

There must be a strict ban on smoking and naked flames where nitrocellulose is handled. Any work procedures which might generate sparks through friction or impact are to be avoided. It is advisable always to completely empty containers of damped nitrocellulose. Containers which have been partly emptied must be sealed tightly again immediately to prevent the damping agent from evaporating.

Automatic sprinkler systems are recommended for storage areas. Nitrocellulose damped with solvent has a far higher burning rate than pure solvents such as butyl acetate. Nitrocellulose chips burn even faster (evolving greater heat) than solvent-damped nitrocellulose. The heat generated by fire causes pressure to build up inside the drums. Caution must be exercised in the event of fire in case of any flying lids and jets of flame. Fire-fighting activities should always be carried out from a safe distance. If there is insufficient oxygen...
when nitrocellulose is burning, nitrous fumes may be given off. For this reason, all persons involved in fire-fighting must wear suitable protective clothing and equipment (i.e., overalls providing protection from chemicals, breathing apparatus). It is recommended that the protective clothing and equipment should also be used during fire-fighting drills.\textsuperscript{24}

For more information, request the relevant Safety Data Sheet using Contact Us.

Regulatory Information

Regulations may exist that govern the manufacture, sale, transportation, use and/or disposal of WALSRODER™ nitrocellulose. These regulations may vary by city, state, country or geographic region. Information may be found by consulting the relevant Safety Data Sheet using Contact Us.

Additional Information

- Safety Data Sheet (http://www.dow.com/en-us/eLibrary)
- Contact Us (http://www.dow.com/dowwolff/en/industrial_solutions/contact/)
- WALSRODER™ Nitrocellulose Storage and Handling, Dow Wolff Cellulosics.
- WALSRODER™ Essential for an Extra-Special Finish, Dow Wolff Cellulosics.

For more business information about WALSRODER Nitrocellulose, visit the Dow Wolff Cellulosics web site at www.dowwolffcellulosics.com.

References

1. WALSRODER™ Nitrocellulose Storage and Handling, Dow Wolff Cellulosics
2. WALSRODER™ Essential for an Extra-Special Finish, Dow Wolff Cellulosics
3. WALSRODER™ Nitrocellulose E 560 Isopropanol 30% Material Safety Data Sheet, Dow Wolff Cellulosics GmbH
4. WALSRODER™ Nitrocellulose E 560 Isopropanol 30% Material Safety Data Sheet, Dow Wolff Cellulosics GmbH.
5. WALSRODER™ Nitrocellulose A 400 Ethanol Material Safety Data Sheet, Dow Wolff Cellulosics GmbH.
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NOTICES:

As part of its 2015 Sustainability Goals, Dow has committed to make publicly available safety assessments for its products globally. This product safety assessment is intended to give general information about the chemical (or categories of chemicals) addressed. It is not intended to provide an in-depth discussion of health and safety information. Additional information is available through the relevant Safety Data Sheet, which should be consulted before use of the chemical. This product safety assessment does not replace required communication documents such as the Safety Data Sheet.

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