Product Safety Assessment

Nitrapyrin


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Names

- CAS No. 1929-82-4
- Nitrapyrin
- 2-chloro-6-(trichloromethyl) pyridine
- INSTINCT® nitrogen stabilizer
- N-SERVE® nitrogen stabilizer
- N-SERVE 24
- N-SERVE TG

Product Overview

- Nitrapyrin is the common name for the active ingredient in several nitrogen stabilizer products registered to Dow AgroSciences LLC, a wholly owned subsidiary of The Dow Chemical Company. Its purpose is to inhibit the nitrification of ammonium-N to nitrate-N in the soil. For further details, see the relevant Product Label and Product Description.
- Nitrapyrin technical is a white crystalline solid with a mildly sweet odor. In N-SERVE® it is formulated as an emulsifiable concentrate. In INSTINCT® it is formulated as a capsule suspension. For further details, see the relevant Product Label and Product Description.
- Nitrapyrin is currently registered by the U.S. Environmental Protection Agency (EPA) as a nitrification inhibitor to slow and reduce the loss of nitrogen from soil when used together with urea and other ammoniacal (ammonia containing) fertilizers. For further details, see the relevant Product Label and Product Uses.
- Nitrapyrin is not used in residential lawn products. The EPA has determined that public exposure to nitrapyrin through food and water is negligible and below the agency’s level of concern. Occupational exposure to nitrapyrin could occur in manufacturing or formulating operations or during farm field handling. Workers can minimize the potential for exposure by carefully following workplace procedures, adhering to label directions, and wearing the proper protective equipment. For further details, see the relevant Product Label and Exposure Potential.
- Nitrapyrin exhibits low mammalian toxicity by the oral, dermal and inhalation routes of exposure. Eye contact with pure nitrapyrin may cause severe but temporary irritation. Brief skin contact may cause slight irritation, but is unlikely to result in absorption of harmful amounts. Inhalation may cause adverse effects such as irritation. For further details, see Health Information or the Safety Data Sheet.
- Nitrapyrin hydrolyzes and photo degrades rapidly, so it should not persist in most environments. In soil, nitrapyrin binds strongly to organic matter and is only moderately mobile, thus posing little threat to groundwater. Nitrapyrin is moderately to non-toxic to birds.

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and moderately toxic to fish and most aquatic invertebrates.\textsuperscript{5,6} For further details, see the relevant Product Label and Environmental Information.

- Nitrpyrin is thermally stable at recommended temperatures and pressures, but can decompose at elevated temperatures.\textsuperscript{7} For further details, see the relevant Product Label and Physical Hazard Information.

Manufacture of Product\textsuperscript{8}

- \textbf{Capacity} – Dow AgroSciences, a wholly owned subsidiary of The Dow Chemical Company, manufactures and formulates nitrpyrin at facilities located in the U.S.

- \textbf{Process} – Nitrpyrin is a chlorinated pyridine compound produced using proprietary processes and materials. The chemical structure is shown below:

\begin{center}
\includegraphics[width=0.2\textwidth]{nitrpyrin_structure.png}
\end{center}

Product Description\textsuperscript{9,10}

Nitrapyrin is a nitrification inhibitor that helps retain fertilizer-applied nitrogen in soil in a form (ammonia) readily available to crops but resistant to loss from the soil profile. It delays the nitrification process by inhibiting the \textit{Nitrosomonas} spp. bacteria that typically convert ammonia to nitrite, thus preventing the loss of soil nitrogen through leaching, runoff or gaseous emissions.

Nitrapyrin is formulated and sold under several trade names, including INSTINCT\textsuperscript{®} nitrogen stabilizer and N-SERVE\textsuperscript{®} nitrogen stabilizer.

Nitrapyrin products are used in conjunction with farm field applications of anhydrous ammonia, urea and other ammoniacal fertilizers or with animal manures. By maintaining fertilizer-applied nitrogen in the root zone for a longer period of time, use of nitrapyrin provides the potential for increased crop yields. In addition, by retarding the conversion of ammonia nitrogen to more mobile species, use of nitrapyrin offers certain environmental quality benefits. These benefits include reduction of greenhouse gas emissions from soil (nitrous oxides) and mitigation of leaching and runoff pollution potential of water resources by nitrates.

Product Uses & Regulatory Information\textsuperscript{11}

Nitrapyrin is used in the formulation of nitrogen stabilizers. It is registered for use as a nitrification inhibitor in the United States by the U.S. Environmental Protection Agency (EPA), which first granted approval during 1974. It is authorized for use on corn, sorghum, and wheat crops. There are no registered residential uses for this material.

Nitrapyrin has been comprehensively evaluated under regulatory frameworks used for registration and approval of nitrification inhibitor products in the United States. These legal frameworks require both laboratory and field testing as per established EPA guidelines to determine the potential for use to result in human health or environmental impacts.

Regulations exist that govern the manufacture, sale, transportation, use, and/or disposal of nitrapyrin. In addition to federal regulation, additional regulations may apply which vary by state or region.

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Exposure Potential

Nitrapyrin is used in the formulation of nitrogen stabilizers. Based on the uses for nitrapyrin, the public could be exposed through:

• **Workplace exposure** – Exposure can occur in facilities that manufacture or formulate nitrapyrin. Those working with nitrapyrin in these operations could be exposed during maintenance, sampling, testing, or other procedures. Each facility should have a thorough training program for employees and appropriate work processes, ventilation, and safety equipment in place to limit exposure. Agricultural workers could be exposed while handling the product in the field (mixing, loading, applying) or upon reentering treated areas. Agricultural handlers are legally required to follow label directions and observe precautions, including wearing personal protective equipment that is appropriate to the application method. See Health Information and Product Label.

• **Consumer exposure to products containing nitrapyrin** – Consumers could be exposed to trace amounts of nitrapyrin through ingestion of residues in corn, wheat, or sorghum products or drinking water. To ensure product safety with regard to human health, the United States Environmental Protection Agency (EPA) performs comprehensive risk-assessment calculations using conservative estimates of nitrapyrin concentrations in drinking water, food, and nonfood sources. The U.S. EPA has determined that there is reasonable certainty that no harm to any population subgroup will result from aggregate exposure to nitrapyrin when considering dietary exposure from food and water. See Health Information and Product Label.

• **Environmental releases** – In the event of a spill, the focus is on containing the spill to prevent contamination of soil, ditches, sewers, waterways, or groundwater. Nitrapyrin breaks down quickly in soil and surface water. If released into the environment, it would not persist and would be removed by wastewater-treatment facilities. The potential for groundwater contamination is low because the material binds quickly to soil. Nitrapyrin may be toxic to aquatic organisms on an acute basis. Sweep up or soak up small spills with an absorbent material such as sand or dirt and collect the recovered material in a container suitable for disposal. Consult the relevant Safety Data Sheet or Product Label for detailed information about protective equipment and procedures. See Environmental, Health, and Physical Hazard Information.

• **Large release** – Industrial spills or releases are infrequent and generally contained. If a large spill does occur, dike the area to keep the material contained and contact Dow AgroSciences. Consult the relevant Safety Data Sheet or Product Label for more detailed information about protective equipment and procedures. See Environmental, Health, and Physical Hazard Information.

• **In case of fire** – Consult the Product Label and Safety Data Sheet for specific firefighting measures. Firefighters should wear positive-pressure, self-contained breathing apparatus (SCBA) and protective firefighting clothing. Use water fog, carbon-dioxide (CO₂) or dry-chemical extinguishers, or foam to fight the fire. Contain firewater for future disposal. Toxic and irritating gases and fumes can be formed in a fire. Follow emergency procedures carefully. See Environmental, Health, and Physical Hazard Information.

• **Emergency response information** – In the case of an emergency such as poisoning, product spillage, or fire associated with a Dow AgroSciences product in the U.S. call 800-992-5994

For more information, see the Product Label or Safety Data Sheet.
Health Information

**Laboratory testing** – Nitrapyrin has been comprehensively evaluated in the laboratory for potential acute, short-term, and long-term health effects. These tests help scientists and regulators determine how chemicals might affect humans, domestic animals, or wildlife in case of exposure. Nitrapyrin products used according to label directions are unlikely to cause adverse effects. The amount of nitrapyrin nitrogen stabilizer that people may be exposed to is very low compared to the levels that may be used in laboratory testing.

A summary of health characteristics is listed below for nitrapyrin active ingredient. Formulated, end-use products contain lower concentrations of active ingredient and co-formulants which may modify handling hazards (generally reduced versus the pure active ingredient or “technical” product).

**Eye contact** – Contact may cause severe but temporary eye irritation. Corneal injury is unlikely.

**Skin contact** – Contact may cause slight skin irritation with local redness. Prolonged contact is unlikely to result in absorption of harmful amounts. Contact may cause an allergic response in a small proportion of individuals.

**Inhalation** – Prolonged excessive exposure may cause adverse effects. May cause irritation to upper respiratory tract (nose and throat).

**Ingestion** – This material has low toxicity if swallowed. Swallowing small amounts incidental to normal handling operations is not likely to cause injury; however, swallowing larger amounts may cause injury.

**Repeated exposure** – Effects have been reported on the kidney, liver, blood, and female reproductive organs in animal testing.

**Birth Defects/Developmental Effects** – Has been toxic to the fetus in laboratory animals at doses toxic to the mother. Exposures having no effect on the mother should have no effect on the fetus.

**Cancer information** – In animal studies, kidney effects and/or tumors have been reported in some testing. These effects are believed to be specific to the species and are unlikely to occur in humans. Thus, nitrapyrin has been classified as “suggestive evidence of carcinogenic potential” by the U.S. EPA, a category which requires no cancer risk assessments to be necessary.

For more information, see the Product Label or Safety Data Sheet.

Environmental Information

Although not readily degraded by microorganisms, nitrapyrin degrades rapidly via hydrolysis (chemical reaction with water) and photodegradation (exposure to sunlight). If released to the environment, it would not persist and would be removed by common wastewater-treatment facilities. Nitrapyrin has a moderate bioconcentration potential but is unlikely accumulate in the food chain and medium soil mobility.

The potential for groundwater contamination is low because nitrapyrin tends to bind to organic matter in the soil and is only moderately mobile in most soils.

Nitrapyrin is moderately volatile and may be readily lost from moist soil surfaces. When incorporated into the soil profile or applied as a capsule suspension formulation (e.g., INSTINCT®), the nitrapyrin active ingredient is protected from volatility loss.

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Nitrapyrin is moderately- to non-toxic to birds and moderately toxic to fish and most aquatic invertebrates. It is moderately to highly toxic to some estuarine/marine invertebrates. For more information, see the Product Label or Safety Data Sheet.

Physical Hazard Information

Nitrapyrin is stable at recommended temperatures and pressures, but can decompose at elevated temperatures. Decomposition products can include carbon monoxide, carbon dioxide, hydrogen chloride, and nitrogen oxides. Avoid contact with metals such as aluminum alloys, magnesium, and magnesium alloys. Consult the Product Label for specific use and storage information. Some products may be combustible because of the solvents used. For more information, see the Product Label or Safety Data Sheet.

Additional Information

- Safety Data Sheets and Product Labels (www.dowagro.com/products/label/index.htm)
- Contact Us (www.dowagro.com/company/contact/index.htm)
- Dow AgroSciences INSTINCT® nitrogen stabilizer website (www.dowagro.com/usag/prod/090.htm)
- Dow AgroSciences N-SERVE® nitrogen stabilizer website (www.dowagro.com/usag/prod/025.htm)

For more business information about nitrapyrin, visit the Dow AgroSciences website at www.dowagro.com/.

References


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