Product Safety Assessment

LAMAL™ Two-Component Alcohol or Alcohol/Water-Based General-Purpose Adhesives

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Names
- LAMAL™ Two-Component Alcohol or Alcohol/Water-Based General-Purpose Adhesives
- LAMAL 408-40 Resin
- LAMAL 408-40A Resin
- LAMAL 408-40A SLIP Resin
- LAMAL HSA Resin
- LAMAL HSA SLIP Resin
- LAMAL L 90-103 Resin
- LAMAL SN 378 SLIP Resin
- LAMAL T8 Resin
- LAMAL C Coreactant
- LAMAL 81S Coreactant
- LAMAL C5083 Coreactant
- LAMAL CR-1-80 Coreactant
- LAMAL CR 7-106 Coreactant

Product Overview
- LAMAL™ Two-Component Alcohol or Alcohol/Water-Based General-Purpose Adhesives are two-part urethane laminating adhesives. They can be diluted with alcohol and/or alcohol and water. These products combine a urethane-based resin with a hydroxyl-functional coreactant, which chemically react to form an adhesive that solidifies within hours and fully cures in days.1,2,3 For further details, see Product Description.
- LAMAL Two-Component Alcohol or Alcohol/Water-Based General-Purpose Adhesives are used in the manufacture of flexible packaging. These products are specifically formulated for use on lamination presses and can be applied to a variety of substrates to produce flexible food packaging, as well as barrier laminations for industrial uses.4 For further details, see Product Uses.
- Exposure to LAMAL Two-Component Alcohol or Alcohol/Water-Based General-Purpose Adhesives may occur during the manufacture or use of this product. This product is not sold for direct consumer use, but it is used in the production of flexible packaging with which consumers may come into contact. Exposure to cured and/or dried product is not considered to present a risk to consumers.1 For further details, see Exposure Potential.
- Urethane resins: Contact with the uncured urethane resin liquid or vapor may cause severe eye irritation and permanent eye injury. Exposure to skin may cause severe irritation. Some individuals may experience an allergic skin reaction. Inhalation of vapor or mist

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may cause severe irritation of the nose, throat, and lungs, and respiratory sensitization. These products may be harmful if swallowed. Prolonged or repeated exposure to components in these products may cause adverse reproductive effects, liver damage, and heart damage.1,2,5

- Coreactants: Contact with the uncured hydroxyl-functional coreactants may cause moderate to severe eye irritation. Exposure to skin may cause moderate irritation. Some individuals may experience an allergic skin reaction. Inhalation of vapor or mist may cause headache and narcosis. These products may be harmful if swallowed. Prolonged or repeated exposure to components in these products may cause kidney, liver, and heart damage, central nervous system effects, blood changes, and lung damage.3 For further details, see Health Information and request the relevant Safety Data Sheet from the Dow Customer Information Group.

- Cured LAMAL™ Two-Component Alcohol or Alcohol/Water-Based General-Purpose Adhesives are expected to be inert in the environment. The urethane resin components are expected to slowly degrade in the environment. Due to their high molecular weight, the resins are unlikely to accumulate in the food chain and would be expected to be nontoxic to fish and other aquatic organisms. The solvent components are readily biodegradable, have a low tendency to accumulate in the food chain, and are practically non-toxic to aquatic organisms. The main component in liquid hydroxyl-functional formulations is inherently biodegradable, is not expected to accumulate in the food chain, and is moderately toxic to aquatic organisms on an acute basis.1,2,3,6 For further details, see Environmental Information.

- These products are stable under recommended storage and normal use conditions. These products are flammable. Keep away from moisture, heat, or flame. Closed containers may explode when heated or when contents are contaminated with water. Avoid contact with water, strong oxidizers, acids, bases, peroxides, and amines.1,2,6,7 For further details, see Physical Hazard Information.

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Manufacture of Product

- Locations – The Dow Chemical Company and its global affiliates manufacture LAMAL™ Two-Component Alcohol or Alcohol/Water-Based General-Purpose Adhesives at several global locations, including facilities in North America, Latin America, and Europe.

- Process – LAMAL Two-Component Alcohol or Alcohol/Water-Based General-Purpose Adhesives are manufactured and formulated using proprietary materials, processes, and compounding technology.

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Product Description1,2,3,4,5

LAMAL™ Two-Component Alcohol or Alcohol/Water-Based General-Purpose Adhesives are two-part urethane laminating adhesives. They can be diluted with alcohol and/or alcohol and water. These products combine a urethane-based resin with a hydroxyl-functional coreactant, which chemically react to form an adhesive that solidifies within hours and fully cures in days. Because they are alcohol- and water/alcohol-based, these adhesives can be used in applications where low levels of retained organic solvents are desirable. The adhesives provide optical clarity, high bond strength, high heat resistance, and moderate chemical resistance.

The urethane resins are colorless to yellow or white, clear to opaque liquids with a mild alcohol or solvent odor. They contain up to 76% urethane resin blended with smaller amounts of alcohols, light naphtha, ethyl acetate, residual amines, or isocyanates. Formulations vary based on the production process for which the adhesive is designed. Some products, designated as SLIP products, contain an additive designed to increase the slip level of laminated polyolefin films.

The hydroxyl-functional coreactants are 100% bisphenol-A epichlorohydrin polymer, or blends of bisphenol-A epichlorohydrin polymer with ethyl acetate and/or alkoxyisilane. These formulations are clear or pale yellow liquids with a mild odor.

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Product Uses6

LAMAL™ Two-Component Alcohol or Alcohol/Water-Based General-Purpose Adhesives are used in the manufacture of many types of flexible food packaging, as well as barrier laminations for industrial uses. These products are specifically formulated for use on lamination presses and can be applied to a variety of substrates, including cellophane, treated polyolefins, paper, polyester, polyamides, polyvinylidene-coated and metallized materials, vinyl and heat-treated sealable layers of coextrusions. These products are registered as safe for use in certain indirect food-contact applications.

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A lamination press is similar to a printing press. It contains large rolls of substrate (paper, plastic film, aluminum foil, etc.). The adhesive is applied as a thin film to one substrate. The substrate is carried along a series of rollers, and then the adhesive side is pressed onto a second substrate, bonding the two together. For example, a printed plastic film can be bonded to aluminum foil.

Exposure Potential

LAMAL™ Two-Component Alcohol or Alcohol/Water-Based General-Purpose Adhesives are used in flexible food packaging manufacture and other industrial applications. Based on these uses, individuals could be exposed through:

- **Workplace exposure** – Exposure can occur either in facilities that manufacture LAMAL Two-Component Alcohol or Alcohol/Water-Based General-Purpose Adhesives or in the various industrial or manufacturing facilities that use these products. They are produced, distributed, and stored in closed systems. Those working with these products in manufacturing operations could be exposed during maintenance, sampling, testing, or other procedures. Each manufacturing facility should have a thorough training program for employees and appropriate work processes, ventilation, and safety equipment in place to prevent exposure. See Health Information.

- **Consumer exposure to LAMAL Two-Component Alcohol or Alcohol/Water-Based General-Purpose Adhesives** – These products are not sold for direct consumer use; however, they are used in flexible packaging for food and other industrial uses. Exposure to cured and/or dried product is not considered to present a risk to consumers. LAMAL Two-Component Alcohol or Alcohol/Water-Based General-Purpose Adhesives used for food-contact applications should comply with applicable standards set by the U.S. Food and Drug Administration (FDA) and European Union (EU) Directives concerning food-contact. Always read the product information prior to use and carefully follow instructions. See Health Information.

- **Environmental releases** – In the event of a spill, the focus is on containing the spill to prevent contamination of soil, surface water, or groundwater. Respiratory protection is necessary for cleaning up spills and leaks. Small spills should be absorbed with inert absorbent materials such as sand. Spilled material may cause slippery conditions. If released, the cured products and the urethane resin components will tend to float in water and will be removed in wastewater treatment facilities by adsorption to biosolids. The main solvent components will have a low tendency to evaporate from water and minimal tendency to bind to soil and sediment. Since the main solvent components are readily biodegradable, they are expected to be removed from water and soil environment, including wastewater treatment plants. The main component in liquid hydroxyl-functional formulations will tend to float in water and will be removed in wastewater treatment facilities by adsorption to biosolids. Since the main component in hydroxyl-functional formulations is inherently biodegradable, it is expected to be removed from water and soil environments. 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 product should be captured, collected, and reprocessed or disposed of according to applicable governmental requirements. Soak up small spills with inert absorbent material such as sand; sweep up or vacuum up spillage. Evacuate personnel to safe areas. The floor may be slippery; use care to avoid falling. Eliminate all sources of ignition immediately. Ventilate the area of the spill. Avoid contact with the product and avoid breathing vapor. Use only explosion-proof equipment; ground and bond all containers and handling equipment. Appropriate protective equipment must be worn when handling a spill of this material. If exposed to material during clean-up operations, immediately remove all contaminated clothing and wash exposed skin areas with soap and water. Wash contaminated clothing before re-use. Do not take clothing home to be laundered. Keep spills and cleaning runoff out of municipal sewers and open bodies of water; spills on porous surfaces can contaminate groundwater. See Environmental, Health, and Physical Hazard Information.

- **In case of fire** – These products are flammable. Deny unnecessary entry into the area. Remain upwind and avoid breathing smoke. Use water spray (in very large quantities), carbon-dioxide or dry-chemical extinguishers, or foam to fight the fire. Remain upwind and avoid breathing smoke. Firefighters should wear positive-pressure, self-contained breathing apparatus (SCBA) and protective firefighting clothing. Vapors may travel a long distance to a source of ignition and flash back. Heated product can form flammable or explosive vapors with air. Cool closed containers with water spray. Do not permit water to enter containers. Closed containers may rupture via pressure build-up when exposed to heat, fire, or water. Harmful gases may be generated during combustion or decomposition. Keep fire water out of waterways and sewers to minimize the potential for environmental damage. Follow emergency procedures carefully. See Environmental, Health, and Physical Hazard Information.

For more information, request the relevant Safety Data Sheet from the Dow Customer Information Group.
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Health Information

Health information for LAMAL™ Two-Component Alcohol or Alcohol/Water-Based General-Purpose Adhesives is summarized on the relevant Safety Data Sheets. These materials may also contain minor components or additives that have additional health risks. It is important to note that health risks associated with individual products may vary based on their formulation or intended use. The Safety Data Sheet is the preferred source for specific health information. An overview of health information for LAMAL Two-Component Alcohol or Alcohol/Water-Based General-Purpose Adhesives appears below.

Urethane resins

**Eye contact** – Contact may cause moderate to severe eye irritation with pain, tearing, and conjunctivitis, resulting in corneal burns and permanent eye injury.

**Skin contact** – Contact may cause severe skin irritation with local redness, swelling, and burning. Some products may cause skin sensitization even at low concentrations in susceptible individuals. Prolonged or repeated overexposure may cause defatting and drying of the skin with irritation and dermatitis. Absorption through skin can sometimes cause respiratory sensitization.

**Inhalation** – Inhalation of mist or vapor may cause irritation to the upper respiratory tract (nose, throat, and lungs), headache, nausea, vomiting, central nervous system effects, tightness in the chest, shortness of breath, double or clouded vision, fatigue, narcosis, convulsions, weakness, lack of coordination, slurred speech, pulmonary edema, and unconsciousness. Prolonged exposure may result in respiratory sensitization. Asthma-like symptoms may include coughing, difficult breathing, and a feeling of tightness in the chest. Occasionally, breathing difficulties may be life threatening.

**Ingestion** – These products may be fatal if swallowed and may cause severe irritation of the mouth, throat, and digestive tract as well as facial flushing, low blood pressure, irregular heartbeats, nausea, narcosis, headache, diarrhea, vomiting, lack of coordination, drunkenness, drowsiness, central nervous system depression, stupor, coma, unconsciousness, and even death. Aspiration into the lungs may cause lung injury.

**Chronic exposure effects for components**

**Aminoethylethanolamine** – In repeated exposures of laboratory animals, adverse effects on the female reproductive system have been reported. Adverse effects on the male reproductive system have been reported in humans.

**Bisphenol A** – Refer to Dow’s BPA product safety assessment.

**Diisocyanates** – Prolonged exposure may cause lung damage including reduced lung function, which may be permanent. For more information on diisocyanates, refer to Dow’s MDI-based Isocyanate Products product safety assessment.

**Epichlorohydrin** – Refer to Dow’s Epichlorohydrin product safety assessment.

**Ethyl acetate** – Prolonged overexposure may cause damage to the kidney, liver, heart, and lung as well as nervous system effects.

**Ethanol** – Prolonged or repeated overexposure can cause fatty degeneration of the liver, heart muscle damage, irritation of the stomach, mental deterioration, and fetal abnormalities. In humans, ingestion of large amounts of ethanol has been shown to interfere with male fertility.

**Isopropyl alcohol** – Prolonged excessive exposure may cause adverse effects, including eye, nose, and throat irritation, lack of coordination, confusion, hypotension, hypothermia, circulatory collapse, respiratory arrest, and even death.

**Naptha** – Prolonged or repeated overexposure can cause liver or kidney damage. Naptha, petroleum, hydrotreated light is classified by IARC as a possible human carcinogen.

**N-hexane** – Prolonged or repeated overexposure may cause damage to the nervous system, testis, and lung as well as central nervous system effects and visual impairment.

Coreactants

**Eye contact** – Contact may cause moderate to severe eye irritation with burning, tearing, redness, conjunctivitis, and corneal opacity.

**Skin contact** – Contact with the solvent in these products may cause moderate skin irritation, burning sensation, redness, itching, and defatting and drying of the skin. Components in these products may cause skin sensitization in susceptible individuals.

**Inhalation** – Inhalation of vapor or mist may cause irritation of the nose, throat, and lungs with wheezing, headache, nausea, coughing, vomiting, narcosis, and central nervous system effects. Inhalation of vapor or mist may also cause allergic sensitization.

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**Ingestion** – These products may cause severe irritation of the mouth, throat, and digestive tract with nausea, vomiting, diarrhea, and abdominal pain if ingested.

**Chronic exposure effects for components**

**Ethyl acetate** – Prolonged overexposure may cause damage to the kidney, liver, heart, and lung as well as blood and nervous system effects.

For more information, request the relevant Safety Data Sheet from the Dow Customer Information Group.

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**Environmental Information**

Environmental information for LAMAL™ Two-Component Alcohol or Alcohol/Water-Based General-Purpose Adhesives is summarized on the relevant Safety Data Sheets. These materials may also contain solvents or additives that have additional environmental impact. It is important to note that environmental impact associated with individual products may vary based on their formulation or intended use. The Safety Data Sheet is the preferred source for specific environmental information. An overview of environmental information for LAMAL Two-Component Alcohol or Alcohol/Water-Based General-Purpose Adhesives appears below.

The cured LAMAL Two-Component Alcohol or Alcohol/Water-Based General-Purpose Adhesives are expected to be inert in the environment. The cured products are insoluble and will tend to float in water and adsorb to soil or sediment. Although the cured products are not biodegradable, they will be expected to slowly degrade in the environment, including degradation by physical action or by exposure to sunlight. The cured products are not expected to accumulate in the food chain due to their high molecular weight, and they are not expected to be toxic to fish and other aquatic organisms on an acute basis.

The liquid urethane resin and coreactant are blends of several chemicals.

**Urethane resins**

1–2 – The resin components in these products are insoluble and will tend to float in water and eventually bind to soil, suspended particles, or sediment. The main solvent components (ethyl acetate and ethanol) have moderate volatility and range from moderately soluble to miscible in water. When introduced, the solvents have a low tendency to evaporate from water to air and minimal tendency to bind to soil and sediment.

Although the resin components are not biodegradable, they will be expected to slowly degrade in the environment, including degradation by physical action or by exposure to sunlight. The resins would likely be removed in biological wastewater treatment plants by adsorption to biosolids. The main solvent components are readily biodegradable, which suggests that they will be removed from water and soil environments, including biological wastewater treatment plants.

The resin components are unlikely to accumulate in the food chain (bioconcentration potential is low) because of their high molecular weight, and they would be expected to be nontoxic to fish and other aquatic organisms. The main solvent components are not expected to accumulate in the food chain and are practically non-toxic to fish and other aquatic organisms on an acute basis (LC\textsubscript{50}/EC\textsubscript{50} > 100 mg/L in the most sensitive species tested).

**Coreactants**

3–6 – Hydroxyl-based formulations are insoluble and will tend to float in water and eventually bind to soil, suspended particles, or sediment. The main component is inherently biodegradable, which suggests that it will be removed from water and soil environments as well as in biological wastewater treatment plants by biodegradation and by adsorption to biosolids. Because of the high molecular weight, the main component is unlikely to accumulate in the food chain (bioconcentration potential is low) and is moderately toxic to fish and other aquatic organisms on an acute basis (LC\textsubscript{50}/EC\textsubscript{50} between 1.0 and 10 mg/L in the most sensitive species tested).

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**Physical Hazard Information**

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The resin and hydroxyl-based components of LAMAL™ Two-Component Alcohol or Alcohol/Water-Based General-Purpose Adhesives have different physical hazards as described below.

Urethane resins\(^1\)\(^2\) – These products are stable under recommended storage and normal use conditions. Spilled resin is a potential slipping hazard. Keep away from moisture, heat, or flame. Most products are flammable. Avoid temperature extremes during storage and store in an approved area with automatic sprinklers. Thermal decomposition may yield toxic gases and fumes. Avoid contact with water, strong oxidizers, acids, bases, peroxides, and amines. These products can undergo hazardous polymerization if contaminated with water.

Coreactants\(^6\)\(^7\) – Liquid hydroxyl-functional products are stable under recommended storage and normal use conditions. Keep away from moisture, heat, or flame. These products are flammable. Avoid temperature extremes during storage and store in an approved area with automatic sprinklers. Thermal decomposition may yield harmful gases and fumes. Avoid contact with strong oxidizers, acids, bases, and amines.

For more information, request the relevant Safety Data Sheet from the Dow Customer Information Group.

Regulatory Information

Regulations may exist that govern the manufacture, sale, transportation, use, and/or disposal of LAMAL™ two-component alcohol or alcohol/water-based general-purpose adhesives. These regulations may vary by city, state, country, or geographic region. Information may be found by consulting the relevant Safety Data Sheet or Contact Us.

Additional Information

- Request the Safety Data Sheet from the Dow Customer Information Group (www.dow.com/assistance/dowcig.htm)
- Contact Us (www.dow.com/assistance/thoughts.htm)

For more business information about LAMAL™ general-purpose adhesives visit the LAMAL™ Products website at www.dow.com/products/#/product-line/lamal/product/lamal-hsa/?&_suid=13613988204090564837709743231.

Reference

1. LAMAL™ HSA [Resin] Material Safety Data Sheet, The Dow Chemical Company
2. LAMAL™ T-8 [Resin] Material Safety Data Sheet, The Dow Chemical Company
4. LAMAL™ L 90-103/CR 7-106 Laminating Adhesive [Technical Data Sheet], Rohm and Haas Company
5. LAMAL™ SN378 SLIP [Resin] Material Safety Data Sheet, The Dow Chemical Company
6. LAMAL™ C 81S [Coreactant] Material Safety Data Sheet, The Dow Chemical Company
7. LAMAL™ C [Coreactant] Material Safety Data Sheet, The Dow Chemical Company
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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