Product Safety Assessment

UNOFLEX™ Laminating Adhesives


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Names
- UNOFLEX™ Laminating Adhesives
- UNOFLEX Mark III Laminating Adhesive
- UNOFLEX E Laminating Adhesive
- UNOFLEX E-US Laminating Adhesive

Product Overview
- UNOFLEX™ Laminating Adhesives are single-component, isocyanate-terminated, polyether adhesives. They contain a urethane-based resin and the solvent, ethyl acetate, and require moisture to cure. They are viscous yellow liquids with a solvent odor. For further details, see [Product Description](#).
- UNOFLEX Laminating Adhesives are used in the manufacture of industrial flexible film laminations and flexible food packaging. These products are specifically formulated for use on lamination presses and can be applied to a variety of substrates. For further details, see [Product Uses](#).
- Exposure to UNOFLEX Laminating Adhesives may occur during manufacture or use of this product. This product is not sold for direct consumer use, but it is used in the production of flexible food packaging, so consumers may come into contact with this product in a cured form. Exposure to cured and/or dried product is not considered to present a risk to consumers. For further details, see [Exposure Potential](#).
- Exposure to the individual components or uncured product may cause moderate irritation to the eyes, skin, and mucus membranes. These products may cause sensitization by inhalation and skin contact. Inhalation of vapor or mist may cause shortness of breath, and bronchial constriction may develop after exposure to isocyanates, even in individuals who have not been previously sensitized. These products may cause severe irritation and adverse effects if swallowed. Prolonged or repeated exposure to components in these products may cause adverse effects to the liver, kidney, and central nervous system. For further details, see [Health Information](#) and request the relevant Safety Data Sheet from the [Dow Customer Information Group](#).
- Cured UNOFLEX™ Laminating Adhesives are expected to slowly degrade in the environment. Due to their high molecular weight, they are unlikely to accumulate in the food chain and they are not expected to be toxic to fish and other aquatic organisms. Ethyl acetate, the solvent used in the products, is readily biodegradable, has a low tendency to accumulate in the food chain (bioconcentration potential is low), and is practically non-toxic to aquatic organisms on an acute basis. When introduced to the environment, isocyanates and disocyanates in the products react rapidly with water to form insoluble polyureas which are expected...
to slowly degrade in the environment. Due to their high molecular weight, these polyureas do not accumulate in the food chain, and are practically non-toxic to aquatic organisms on an acute basis.\textsuperscript{1,2,5} For further details, see \textit{Environmental Information}.

- UNOFLEX\textsuperscript{™} Laminating Adhesives are stable under recommended storage and normal use conditions. These products are flammable. Keep away from moisture, heat, or flame. Avoid contact with water, strong oxidizers, acids, bases, and amines.\textsuperscript{1} For further details, see \textit{Physical Hazard Information}.

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**Manufacture of Product**

- **Locations** – The Dow Chemical Company and its global affiliates manufacture UNOFLEX\textsuperscript{™} Laminating Adhesives at facilities in North America and Europe.
- **Process** – UNOFLEX Laminating Adhesives are manufactured and formulated using proprietary materials, processes, and compounding technology.

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**Product Description\textsuperscript{1,2}**

UNOFLEX\textsuperscript{™} Laminating Adhesives are single-component, isocyanate-terminated, polyether adhesives. In addition to the polyurethane resin, these products contain 23 to 26\% of the solvent, ethyl acetate (CAS No. 141-78-6), and smaller amounts (<1\%) of isocyanates and diisocyanates. They are viscous yellow liquids with a solvent odor.

These products are insoluble in water and require moisture to cure. They provide optical clarity, high bond strength, and high heat and chemical resistance for packaging materials.

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**Product Uses\textsuperscript{3,4}**

UNOFLEX\textsuperscript{™} Laminating Adhesives are used in the manufacture of industrial flexible film laminations and flexible food packaging, including snack food packaging, bottle label laminations, meat and cheese packaging, dry food packaging, and non-foil condiment packaging.

These products are specifically formulated for use on lamination presses and can be applied to a variety of substrates, including cellophane, treated polyolefins, polyester, polyamide, paper, polyvinylidene chloride (PVDC)-coated materials, and the treated heat sealable layers of coextrusions. These products are considered to be safe for use in certain indirect food-contact applications.

A lamination press is similar to a printing press. It coats 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.

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**Exposure Potential\textsuperscript{1}**

UNOFLEX\textsuperscript{™} Laminating Adhesives are used to manufacture flexible film laminations. Based on this use, individuals could be exposed through:

- **Workplace exposure** – Exposure can occur either in facilities that manufacture UNOFLEX Laminating 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, production, sampling, testing, application, 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 and comply with relevant occupational exposure limits. See \textit{Health Information}.

- **Consumer exposure to UNOFLEX Laminating Adhesives** – These products are not sold for direct consumer use; however, they are used in flexible packaging for food. Exposure to cured and/or dried product is not considered to present a risk to consumers. UNOFLEX Laminating Adhesives used for food-contact applications 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 \textit{Health Information}.

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• **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 and other recommended personal protective equipment are 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 to the environment, the cured products will tend to float in water and will be removed in biological wastewater treatment plants by adsorption to biosolids. The ethyl acetate component will tend to remain in water. Since the compound is readily biodegradable, it is expected to be removed from water and soil environments, including biological wastewater treatment plants. The isocyanates and diisocyanates will readily react with water to form insoluble polyureas which will tend to float on water and ultimately bind to soil and sediments. These polyureas will likely be removed in wastewater treatment facilities by adsorption to biosolids. 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 any unnecessary entry into the area and fight advanced fires from a protected location. 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.

**Health Information**

Health information for UNOFLEX™ Laminating 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 UNOFLEX™ Laminating Adhesives appears below.

**Eye contact** – Contact with the solvent in these products may cause moderate eye irritation with pain, tearing, and conjunctivitis and may result in temporary eye injury.

**Skin contact** – Contact may cause moderate skin irritation with redness and itching. 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.

**Inhalation** – Inhalation of solvent vapor or mist may cause irritation of the upper respiratory tract (nose, throat, and lungs), headache, nausea, vomiting, central nervous system effects, tightness in the chest, and shortness of breath, and may result in damage to the lung, liver, and kidney. Inhalation of isocyanates may cause respiratory sensitization.

**Ingestion** – These products may cause severe irritation of the mouth, throat, and digestive tract as well as nausea, narcosis, diarrhea, vomiting, and headache.

**Repeated exposure** – Prolonged overexposure to ethyl acetate may cause damage to the kidney, liver, heart, and lung as well as blood and nervous system effects. Prolonged exposure to isocyanates 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 and Toluene Diisocyanate (TDI) product safety assessments.

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**Other** - An oral study in which high doses of TDI were reported to cause cancer in animals has been found to contain numerous deficiencies which compromise the validity of the study. TDI did not cause cancer in laboratory animals exposed by inhalation, the most likely route of exposure. TDI did not cause birth defects in laboratory animals. Slight effects were observed in the fetus but only at doses which caused toxic effects to the mother.

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

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**Environmental Information**¹²⁶

Environmental information for UNOFLEX™ Laminating 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 UNOFLEX™ Laminating Adhesives appears below.

Cured UNOFLEX™ Laminating Adhesives are nonvolatile and insoluble in water. They will tend to float in water and bind to soil, suspended particles, or sediment. Ethyl acetate, the solvent, has moderate volatility and is moderately soluble in water. When introduced, the solvent has low tendency to volatilize from water or bind to soil and sediment. The isocyanates and diisocyanates in the products, when released to the environment, will react rapidly with water to form insoluble polyureas which will tend to bind to soil, suspended particles, or sediment.

Although the cured UNOFLEX™ Laminating Adhesives and the polyureas are essentially non-biodegradable, they will be expected to slowly degrade in the environment, including degradation by physical action or by exposure to sunlight. They would likely be removed in biological wastewater treatment plants by adsorption to biosolids. Ethyl acetate is unlikely to persist in the environment. The compound is readily biodegradable, which suggests that it will be removed from water and soil environments, including biological wastewater treatment plants.

The cured UNOFLEX™ Laminating Adhesives and the polyureas 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 or other aquatic organisms. Ethyl acetate is not likely to accumulate in the food chain (bioconcentration potential is low) and is practically non-toxic to fish and other aquatic organisms on an acute basis (LC₅₀/EC₅₀ > 100 mg/L in the most sensitive species tested).

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

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**Physical Hazard Information**¹

UNOFLEX™ Laminating Adhesives are stable under recommended storage and normal use conditions. Avoid contact with moisture, heat, and flame. If exposed to water (moisture), these products may undergo hazardous polymerization. Thermal decomposition may yield harmful or irritating decomposition products.

Avoid contact with strong oxidizers, acids, bases, and amines.

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

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**Regulatory Information**

Regulations may exist that govern the manufacture, sale, transportation, use, and/or disposal of UNOFLEX™ Laminating 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 UNOFLEX™ Laminating Adhesives, visit from the Dow Customer Information Group website at www.dow.com/assistance/dowcig.htm.

Reference

3. UNOFLEX™ E-US Laminating Adhesive, Technical Data Sheet, Rohm and Hass Company
4. UNOFLEX™ Mark III Laminating Adhesive, Technical Data Sheet, Rohm and Hass 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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