

BFGoodrich

**GEON[®]
VINYL
RESIN**

**MATERIAL
SAFETY
DATA**

BFG38279

ABOUT THIS BULLETIN

The data in this bulletin apply to all Geon® vinyl resins. These resins are white, thermoplastic, granular powders manufactured by suspension, dispersion or mass polymerization processes. They are all 100% polyvinyl chloride homopolymer or copolymer. Although properties may vary in terms of molecular weight, particle size, porosity and other characteristics, safety and handling precautions are similar for each resin.

Vinyl resin is normally used in combination with functional additives such as stabilizer, lubricant, pigment, etc. When combined with these other ingredients, the resulting product is commonly called a vinyl "compound." This bulletin does not apply to compound. For information applicable to compound, please read BFGoodrich Bulletin G-62 CMPD, "Material Safety Data. Geon® Vinyl Compound."

The data in this bulletin does not include any information on the suitability of vinyl for any particular application nor does it discuss any precautions that may apply to specific end products. Moreover, this bulletin cannot

cover all possible situations which the user may experience during processing. Each aspect of your operation should be examined to determine if, or where, additional precautions may be necessary. All health and safety information contained in this bulletin should be provided to your employees or customers. We must rely on you to use this information to develop appropriate work practice guidelines and employee instructional programs for your operation.

SPECIAL NOTE: Vinyl chloride and polyvinyl chloride (PVC) are not the same material. Vinyl chloride is a flammable gas that is strictly regulated by DOT, EPA and OSHA. Through a chemical reaction, this gas – known as a monomer – is converted to a non-hazardous white granular powder called polyvinyl chloride resin, PVC, or simply, vinyl. Vinyl resin is not a cancer suspect agent. Moreover, the reaction is not reversible. That is, thermal processing or decomposition will not cause polyvinyl chloride to revert back to vinyl chloride monomer. (See Section II and Appendix 1.)

SECTION I

Manufacturer's Name The BFGoodrich Company, Chemical Group
Address 6100 Oak Tree Boulevard, Cleveland, OH 44131
Telephone Number (216) 447-6000
Trademark Geon® Vinyl
Chemical Name/Synonyms Poly(vinyl chloride), PVC, vinyl.
Formula Homopolymer resin: $(CH_2CHCl)_n$
Chemical Family Ethene, chloro-, homopolymer
CAS Registry Number Homopolymer resin: 9002-86-2
Transportation Emergency Telephone CHEMTREC: (800) 424-9300

- Virtually all Geon® vinyl resins are polyvinyl chloride homopolymer. We do manufacture a limited number of copolymer dispersion resins. These are polymerized with another monomer, e.g., carboxylic acid, vinyl acetate or a vinyl ester.
- Specific grades of Geon® vinyl resin comply with applicable provisions of the U.S. Food and Drug Administration regulations governing food contact (21CFR). Please consult product literature for details.

- Geon® vinyl resins are included in the Toxic Substances Control Act, Inventory of Chemical Substances, developed by the U.S. Environmental Protection Agency.

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SECTION II

HAZARDOUS INGREDIENTS

Vinyl resin contains a very small amount of residual vinyl chloride monomer (CAS Registry Number: 75-01-4). Extensive product and process improvements have resulted in the reduction of residual monomer to average levels less than 1.5 parts per million (ppm) in most prime grades of Geon® vinyl resins. Today, there is virtually no employee exposure to vinyl chloride monomer above the OSHA action level of 0.5 ppm when handling or processing Geon® vinyl resin. Please read Appendix 1 for workplace exposure limits.

Please read Appendix 2 - Hazardous Substances.

SECTION III

PHYSICAL DATA

(Typical data, not specifications)

Inherent Viscosity – 0.50 - 1.16

Specific Gravity – 1.40

Solubility in Water – Slight

Particle Size, microns

Dispersion resin: 0.2-15

Blending resin: 25-130

Suspension resin: 70-150

Appearance and Odor

White, free-flowing powder. Practically odorless or bland odor.

Other

Characteristics such as vapor pressure, vapor density, boiling point and evaporation rate do not apply to solid materials such as vinyl resin.

SECTION IV

FIRE AND EXPLOSION HAZARD DATA

Ignition Characteristics (ASTM D-1929)

Vinyl resin has a flash-ignition temperature of about 391°C (735°F) and a self-ignition temperature of about 454°C (850°F). Vinyl resin by itself will not support combustion because it requires a higher concentration of oxygen for burning than is present in the earth's atmosphere. Vinyl resin can be forced to burn by continuous application of intense heat. Like all combustible material, protect from open flame and maintain proper clearance when using portable heat devices, etc. Store flammable liquids away from vinyl resin.

Flash-Ignition Temperature: The lowest initial temperature of air passing around the specimen at which sufficient combustible gas is evolved to be ignited by a small external pilot flame.

Self-Ignition Temperature: The lowest initial temperature of air passing around the specimen at which, in the absence of an ignition source, ignition occurs of itself, as indicated by an explosion, flame or sustained glow.

Extinguishing Media

Water is most effective. ABC dry chemical, AFFF, and protein type air foams are also effective. Geon® vinyl

resins are "ordinary combustibles" (NFPA defined Class A). Carbon dioxide is not generally recommended for use on Class A fires as a lack of cooling capacity may result in reignition.

Special Fire Fighting Procedure

Wear positive pressure, Self-Contained Breathing Apparatus (SCBA). Personnel not having suitable respiratory protection must leave the area to prevent significant exposure to toxic combustion gases from any source. In enclosed or poorly ventilated areas, wear SCBA during cleanup immediately after a fire as well as during the attack phase of firefighting operations.

Combustion Products

When forced to burn, about 97% of the combustion gases from vinyl resin will be a combination of hydrogen chloride, carbon monoxide and carbon dioxide. Other gases will include small amounts of benzene and aromatic and aliphatic hydrocarbons.

The combustion products of vinyl resin, like those from other natural and synthetic materials, must be considered toxic. Like wood, paper and cotton, the major hazard is carbon monoxide. Carbon monoxide is an asphyxiant while hydrogen chloride is an irritant. When vinyl is burned, it will have a detectable, pungent odor.

Unusual Fire and Explosion Hazards

- Hydrogen chloride has a corrosive effect on many metals. Affected equipment surfaces and unprotected structural elements of buildings should be washed to remove corrosive deposits as soon as possible after depositions have occurred.
- Vinyl resin is not considered to be a dust explosion risk. The potential hazard has been evaluated using the Hartmann Vertical Tube Apparatus. Data have also been reported by the National Fire Protection Association (NFPA).

(1) In the Hartmann apparatus, vinyl resin representing fine particle size (2 Microns), medium particle size (75 Microns) and large particle size (130 Microns) does not ignite or explode in concentrations up to 2.0 gm/liter.

(2) The NFPA shows "fine" particle size vinyl resin to have a low order of risk.*

Explosibility index: < 0.1 (Weak)

Ignition sensitivity: < 0.1 (Weak)

Explosion severity: < 0.1 (Weak)

Ignition temp., dust cloud: 660°C (1220°F)

*Source: NFPA 654-1975, "Prevention of Dust Explosions in the Plastics Industry." < 0.1 means that ignition of the dust cloud is not obtained by a spark or flame source.

As a precaution, it is prudent to employ standard safety measures used in handling finely divided organic powders.

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SECTION V

HEALTH HAZARD DATA

Threshold Limit Value

None established

Effects of Overexposure

- There are no significant health hazards from vinyl resin at ambient temperature (see Dust Exposure).
- No adverse health effects are expected from processing vinyl resin when potential exposures are minimized by good industrial hygiene practice and adequate ventilation. Nevertheless, at processing temperatures, the sum total of all ingredients in a vinyl-based compound (e.g., vinyl resin, stabilizer, lubricant, modifier, etc.) may emit fumes and vapors that are irritating to the respiratory tract, eyes or skin of some sensitive people. This depends upon processing technique and temperature, volume processed and, most importantly, the effectiveness of exhaust ventilation provided to the process area.
- Inhalation of decomposition or combustion products, especially hydrogen chloride, will cause irritation of the respiratory tract, eyes and skin. Depending on the severity of exposure, physiological response will be coughing, pain and inflammation. Individuals with bronchial asthma and other types of chronic obstructive respiratory diseases may develop bronchospasm if exposure is prolonged.

SPECIAL NOTE: Hydrogen chloride is detectable by its sharp, pungent odor in concentrations as low as 1-5 ppm. Low concentrations (below 50 ppm) are not harmful in short-term exposures, but do provide excellent warning properties by causing coughing or irritation. Because the protective response is so strong, humans rarely submit to damaging concentrations – instead, there is an unmistakable urge to leave the area. Repeated or prolonged exposure to high concentrations can cause eye and respiratory damage. In studies sponsored by the Federal Aviation Administration, no incapacitation, no impairment to escape and no significant post-exposure effects occurred in baboons exposed to hydrogen chloride up to 11,400 ppm (1.14%). OSHA has established a ceiling limit of 5 ppm for workplace exposure to hydrogen chloride.

Emergency and First Aid Procedure

If irritation persists from exposure to processing vapors or decomposition products, remove the affected individual from the area. Call a physician. Provide protection before allowing reentry.

Toxicology Overview

Geon® vinyl resins have been evaluated by studies involving the intracutaneous (skin) and intramuscular injection in rabbits, by studies involving dietary administration (i.e., ingestion) to rats for nearly the lifetime of the animals, and by numerous human patch tests using panels of 50 or more people. No significant reactions, skin irritation, sensitization, or other deleterious effects have been observed in these studies.

Dust Exposure

Vinyl resin has little effect on the lungs and is not known to cause any disease when dust exposure is minimized.

While there is no evidence of a substantial risk to health, a British study found a small decrease in breathing capacity for workers who smoked and were exposed to vinyl resin dust. This decrease was about one-seventh of that caused by normal aging and about equal to that expected with a one-pack-a-day cigarette smoker. There was no significant decrease in breathing capacity from inhalation of vinyl resin dust by non-smokers.

The American Conference of Governmental Industrial Hygienists' Threshold Limit Value (1984) for nuisance dust is 10 mg/m³ for total dust and 5 mg/m³ for respirable dust. Respirable dust are those particles in a size range below 10 microns. Typical particle size for suspension and mass vinyl resin is 70-150 microns; blending resin is 25-130 microns. Dispersion resin has an average particle size below 5 microns.

Routine inhalation of dust of any kind should be avoided. Exercise care when dumping bags, sweeping, mixing or doing other tasks which can create dust. Where large amounts of any dust may occur, wear a respirator approved by NIOSH/MSHA to protect against nuisance dust.

SECTION VI

REACTIVITY

Stability – Stable

Hazardous Polymerization – Will not occur

Hazardous Decomposition Products

Hydrogen chloride, carbon monoxide, carbon dioxide and small amounts of benzene and aromatic and aliphatic hydrocarbons.

Incompatibility (materials to avoid)

Avoid contact with acetal or acetal copolymers and with amine containing materials during processing. At processing conditions these materials are mutually destructive and involve rapid degradation. Thoroughly purge and mechanically clean processing equipment to avoid even trace quantities of these materials from coming in contact with each other. Prevent cross contamination of feedstocks.

SECTION VII

SPILL OR LEAK PROCEDURE

Steps to be taken in case material is released or spilled

Vacuum or sweep into a closed container for reuse or disposal.

Waste Disposal Method

Dispose of waste in a licensed landfill or by incineration in accordance with federal, state and local regulations. For waste disposal purposes, Geon® vinyl resins are not defined or designated as hazardous by current provisions of the Federal Resource Conservation and Recovery Act (RCRA – 40CFR261). If incinerated, be aware that hydrogen chloride is generated.

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SECTION VIII

SPECIAL PROTECTION INFORMATION

Ventilation

Provide effective exhaust ventilation to draw dust and/or fumes away from workers to prevent routine inhalation. Compounding, hot melt processing (extruding, molding, etc.), cutting or sawing, machining, regrinding, thermoforming, heat welding, and other processing or post-processing operations involving heat sufficient to result in polymer breakdown should be examined to ensure adequate ventilation.

Ventilation guidelines and techniques may be found in the following publications:

- NIOSH Recommended Industrial Ventilation Guidelines; GPO #017-033-00136-7. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402 (\$9.00 as of December 1984).
- Industrial Ventilation, 18th Edition. Available from the American Conference of Governmental Industrial Hygienists, 6500 Glenway Ave., Bldg. D-5, Cincinnati, Ohio 45211 (\$15.00 as of December 1984).

Respiratory Protection

Not normally required. Abnormal conditions such as equipment malfunction, use of improper equipment or procedures, or hangup or stagnation of vinyl-based compound during processing may cause decomposition. Employees involved in removing decomposing material should be provided with suitable air-supplied respirators, such as NIOSH/MSHA-approved positive pressure, self-contained breathing apparatus.

Protective Equipment

Not normally required. Wear protective gloves when handling hot material during processing. Safety glasses are recommended for all industrial workplaces.

SECTION IX

SPECIAL PRECAUTIONS

(For vinyl resin and vinyl-based compound)

Normal Melt Processing. Virtually all thermoplastic materials will emit fumes and/or vapors when heated to processing temperatures. The concentration and composition of these vapors will depend upon variables such as the specific compound formulation and processing method and temperature. Always use vinyl compound under well-ventilated conditions and avoid continued or prolonged breathing of process vapors. For personal hygiene, wash thoroughly after handling resin, especially before eating, smoking or using toilet facilities. Do not store or consume food in processing areas. Do not use processing equipment to heat food.

Cleanup following normal melt processing should be performed under well-ventilated conditions. Compound based upon vinyl resin may be held at process temperatures for a short time without significant thermal degradation. However, it should be recognized that

exposure to either elevated temperature or excessive heat history (time) will result in decomposition.* Equipment should not be shut down for extended time periods with vinyl compound in it, or decomposition and possible corrosion of unprotected metal may result. If dies and screws are not to be cleaned manually, then compound should be purged from processing equipment prior to shutdown using special vinyl purge compound or a compatible thermoplastic such as general purpose ABS (do not use flame-retarded or halogen-containing grades for this purpose).

*Time and temperature required to initiate degradation will vary depending upon processing technique, degree of compound stabilization and other factors. As a general rule-of-thumb, degradation begins to occur after about one hour at 177°C (350°F), about ten minutes at 204°C (400°F) and within five minutes at 232°C (450°F).

In case of power loss or other mishap, shut off the machine and dismantle the die assembly as soon as possible before degradation or decomposition begins. If decomposition begins (with gassing and "popping" sounds) before the die can be disassembled, dangerously high pressure may occur in the die system. In this event, shut off the machine, clear the area of personnel and wait until decomposition stops. Thoroughly ventilate the area. Remove and disassemble the die system. These are guidelines only. Refer to technical service reports and equipment manufacturer's recommendations for specific procedures.

Regrinding scrap normally generates substantial heat. Cool regrind before placing it in containers. The excellent insulating quality of vinyl will prevent heat in the center of a container from escaping, potentially resulting in slow thermal decomposition of the material. This may not only render the product unsatisfactory for further processing but also result in fumes and vapors being released into the workplace atmosphere.

Remove vinyl resin from walkways and floors to prevent slippery footing.

Sprinklered warehouse areas are recommended. Although vinyl resin by itself will not support combustion, materials such as wooden pallets, cardboard boxes and other combustibles can provide sufficient fuel to cause vinyl to burn.

Compounding vinyl resin. Many of the common compounding ingredients which are mixed with vinyl resin may require special handling, especially respiratory protection. It is the user's responsibility to obtain and follow the recommended precautions of the individual additive supplier.

SPECIAL NOTE: Vinyl compound at or above normal processing temperature must never be allowed to accumulate in thick masses, or it will begin to thermally decompose and to swell due to internal gassing. Gassing may cause a thick mass to explode if its outside surface is hardened. Molten waste should be collected as strands or flattened to 2-inches or less, and quenched in a drum of cold water provided for this purpose. Decomposing material should be removed to a well-ventilated area, preferably outdoors.

SECTION X

TRANSPORTATION

For domestic transportation purposes, vinyl resins are not classified as hazardous by the U.S. Department of Transportation under Title 49 of the Code of Federal Regulations, 1983 Edition.

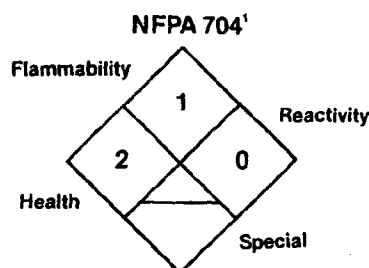
- DOT Proper Shipping Name: Not applicable
- DOT Hazard Class: Not applicable
- DOT Label: Not applicable
- UN/NA Hazard No.: Not applicable

SECTION XI

HAZARD CODES

Hazard Code Key

- 4 = Extreme
- 3 = High
- 2 = Moderate
- 1 = Slight
- 0 = Insignificant



HMIS²

HEALTH HAZARD	0
FLAMMABILITY HAZARD	1
REACTIVITY HAZARD	0
MAXIMUM PERSONAL PROTECTION	*

*Wear safety glasses. Wear gloves and/or dust respirator when needed.

(1) National Fire Protection Association.

(2) Hazardous Materials Identification System, National Paint and Coatings Association.

DISCLAIMER OF LIABILITY

As the conditions or methods of use are beyond our control, we do not assume any responsibility and expressly disclaim any liability for any use of this material. Information contained herein is believed to be true and accurate but all statements or suggestions are made without warranty, express or implied, regarding accuracy of the information, the hazards connected with the use of the material or the results to be obtained from the use thereof. Compliance with all applicable federal, state and local laws and regulations remains the responsibility of the user.

APPENDIX 1

VINYL CHLORIDE MONOMER (VCM)

Employee exposure to vinyl chloride monomer (CAS Registry Number: 75-01-4), a carcinogen, is regulated by OSHA (29CFR1910.1017). The current regulation requires that no employee may be exposed to VCM concentrations greater than 1.0 ppm (parts per million by volume) averaged over any eight-hour period or 5.0 ppm averaged over any period not exceeding 15 minutes. The action level is 0.5 ppm averaged over any eight-hour work day.

The regulation applies to the manufacture, packaging, repackaging, storage, handling or use of vinyl chloride or polyvinyl chloride, but does not apply to the handling or use of fabricated products made of polyvinyl chloride. Typically, purchasers of vinyl resin to be compounded or further processed must comply with the permissible exposure limits set by OSHA. Moreover, the regulation requires a program of initial monitoring in each facility to determine if there is any employee exposure in excess of the action level without the use of respirators. If monitoring does not find VCM above 0.5 ppm, no further action is necessary. Refer to OSHA regulations (including 29CFR1910.1017) for complete details.

SPECIAL NOTE: Vinyl Chloride Warning Labels on Resin Containers

Monitoring of vinyl processing and fabricating plants and modeling studies show that the action level (0.5 ppm) cannot be exceeded when residual VCM is at or below 8.5 ppm in Geon® vinyl resin. Shipping containers for these resins are not labeled by BFGoodrich unless a customer specifies otherwise. Vinyl prime, off-grade or scrap resin is labeled if residual monomer exceeds 8.5 ppm. The OSHA regulation requires that the label says "Polyvinyl chloride contains vinyl chloride. Vinyl chloride is a cancer suspect agent."

Polyvinyl chloride resin is not a cancer suspect agent. It is the trace amount of unreacted vinyl chloride monomer that must be controlled, not the vinyl itself.

Although some containers may be labeled, this does not necessarily mean that employee exposure to VCM will exceed permissible exposure limits. Using "worst case" conditions of thermal processing, our studies show that more than 30 ppm of unreacted monomer in vinyl resin is needed to cause 0.5 ppm to be present in the atmosphere of a hot, poorly ventilated workplace. For further information, please read BFGoodrich Technical Service Bulletin No. 12, "Vinyl Studies." Good ventilation in those areas where VCM might concentrate – such as where containers are stored and first opened, where materials are mixed and where resin is melted – will further ensure a work environment virtually free of VCM.

HAZARDOUS SUBSTANCES

29CFR1910.

- No lead, mercury, other heavy metals or heavy metal compounds and no polychlorinated biphenyls (PCB) or polybrominated biphenyls (PBB) are used to manufacture Geon® vinyl resins. These materials are ubiquitous and trace quantities may be found in the environment.

BFG38285

SECRET

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May 2, 1974

Regional and District Sales Managers
Director and National Account Managers
All Plastic Materials Salesmen
Plastic Materials Product Engineers

Subject: Material Safety Data Sheets for Geon Resins and Compounds

We are sending to all our Geon Resin and compound customers who have previously requested and received our M.S.D.S. the attached appendix entitled "Interim Information - Vinyl Chloride Monomer." This appendix alerts the customer that he, as a plastics processor, is responsible for monitoring and maintaining ambient air quality in worker areas in his plants. This appendix will also be attached to future M.S.D.S. requests as well as those being currently processed.

You may receive requests for additional information on this subject, in which case Walt Lodge's letter and attachments of April 11, 1974 should be referred to for acceptable responses.


R. J. Andrews

RJA/slg

cc: E. B. Osborne
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BFG

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Appendix - A*

OSHA - M. S. D. S.

INTERIM INFORMATION - VINYL CHLORIDE MONOMER

The Occupational Safety and Health Administration (OSHA) announced on April 5, 1974, an Emergency Temporary Health Standard for exposure to Vinyl Chloride. (Federal Register, Vol. 39, No. 67, April 5, 1974, pp. 12342-44) This emergency standard established an exposure ceiling of 50 parts per million (ppm) in air for Vinyl Chloride (VC). OSHA, in paragraph 1910.93q of the subject standard, has set down temporary in-plant monitoring requirements for ambient air for employee protection.

*To be attached to GEONOR Resin and Compound Material Safety Data Sheets.

Date: 4-9-74

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