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BF Goodrich

**GEOM[®]
VINYL
COMPOUND**

**MATERIAL
SAFETY
DATA**

CHARDO 00387

ABOUT THIS BULLETIN

The data in this bulletin apply to all Geon® vinyl compounds except polyblends (blend of polyvinyl chloride and nitrile rubber). Geon® vinyl compounds are mixtures of thermoplastic polyvinyl chloride resin, which is a white granular powder, and functional additives such as processing aid, heat stabilizer, plasticizer, lubricant, impact modifier, pigment and/or other ingredients. Compound may be prepared as either granules (i.e., pellets of varying size and shape) or free-flowing powders.

Although they may vary in terms of physical properties or other characteristics, safety and handling precautions are similar for all compounds. *Please note:* Pellet compound does not represent any inhalation hazard because of its physical form. However, fine particle size additives in powder compound may result in airborne dust. Respiratory protection against nuisance dust may be necessary when handling powder 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 opera-

tion 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.

For information pertinent to resin, please read BFGoodrich Bulletin G-62 RES, "Material Safety Data, Geon® Vinyl Resin." Also, a separate safety data bulletin is available for Geon® vinyl polyblend compounds.

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. It is this vinyl resin that is then combined with functional additives to make compound. 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	Vinyl resin* plus functional additives. $*(CH_2CHCl)_n$
Chemical Family	Vinyl resin: chloroethene polymer
CAS Registry Number	Not applicable to compounds.
Transportation Emergency Telephone	CHEMTREC: (800) 424-9300

Virtually all Geon® vinyl compounds are manufactured with homopolymer polyvinyl chloride resin (CAS Registry Number: 9002-86-2). We do market a limited number of compounds based upon vinyl chloride/vinyl acetate copolymer resin.

Specific grades of Geon® vinyl compounds 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 resin and the functional additives used to manufacture compound are included in the Toxic Substances Control Act, Inventory of Chemical Substances, developed by the U.S. Environmental Protection Agency.

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 the vinyl resins used to manufacture compound. 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 compound. Please read Appendix 1 for workplace exposure limits.
- The sum total of ingredients present in virtually any thermoplastic compound will emit vapors and odors during processing. The visible fumes that occur during normal processing of vinyl compound are mainly water vapor. Trace amounts of hydrogen chloride, an irritant, are possible if there is any hangup or stagnation of compound in processing equipment. Vapors from non-PVC components are principally trace amounts of volatiles from stabilizers, plasticizers, lubricants, etc. Some people may be sensitive to fumes or odors from these additives. The primary effect is irritation to the eyes, respiratory tract or skin. To protect your employees' health, conduct any operation emitting fumes or vapors under well-ventilated conditions.
- Functional additives mixed with vinyl resin to create compounds may include:
 - Stabilizer generally in amounts less than 5% by weight. These may include organometallics such as tin, lead, cadmium, barium and zinc and metallic salts such as basic lead carbonate and basic lead sulfate.
 - Polymeric, monomeric or mixed ester plasticizer in amounts generally between 20-50% by weight in plasticized compound (also known as flexible compound). Plasticizers are volatile when heated, and they will contribute to the sum total of the vapors released during processing.
 - Commercially available pigments based on iron oxide, carbon black, chromium, ultramarines, titanium dioxide, cadmiums, phthalocyanines, molybdates, lead, quinacridones and other organic or inorganic materials.

In pellet compound, additives are bound-up in the manufacturing process and are not expected to create any hazard when handled or processed in accordance with good manufacturing and industrial hygiene practices and by following the guidelines presented in this bulletin. With powder compound, respiratory protection against nuisance dust may be required.

Please read Appendix 2 and 3 for more information about additives and hazardous substances.

SECTION III

PHYSICAL DATA

(Typical data, not specifications)

Solubility in Water – Slight

Specific Gravity ($H_2O = 1$) – Range: 1.35-1.55

Appearance and Odor

Pigmented or unpigmented pellets or powder. Practically odorless or bland odor. The appearance of pellet compound will vary from cubical granules measuring approximately $\frac{3}{16}$ -inch per side to spheres to wafers depending upon manufacturing method.

Other

Characteristics such as vapor pressure, vapor density, boiling point and evaporation rate are not applicable to solid materials such as vinyl compound.

SECTION IV

FIRE AND EXPLOSION HAZARD DATA

Ignition Characteristics (ASTM D-1929)

Rigid vinyl compound (i.e., no plasticizer) has a flash-ignition temperature of about 391°C (735°F) and a self-ignition temperature of about 454°C (850°F). When plasticizer is added, ignition temperatures decrease. At a 30% plasticizer content, the flash-ignition temperature will be about 321°C (610°F) and the self-ignition temperature will be about 435°C (815°F). By themselves, most vinyl compounds (i.e., rigid compound and compound with less than about 35% plasticizer) will not support combustion because they require a higher concentration of oxygen for burning than is present in the earth's atmosphere. Any vinyl compound 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 compound.

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® vinyls 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, the primary combustion gases from vinyl compound will be hydrogen chloride, carbon monoxide and carbon dioxide. Other gases will include small amounts of benzene and aromatic and aliphatic hydrocarbons. Plasticized compounds will also contribute aliphatic olefins.

The combustion products of vinyl, 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.
- Pellet compound does not represent any explosion risk because of its large particle size. Powder compound may have dust explosion potential because of fine particle size fillers and additives or liquids added to vinyl resin.

For plasticized powder compound, the National Fire Protection Association (NFPA) reports the following for a PVC/plasticizer mixture (i.e., 67% PVC/33% dioctyl phthalate):*

Explosibility index:	2.9 (Strong)
Ignition sensitivity:	3.6 (Strong)
Explosion severity:	0.8 (Moderate)
Ignition temp., dust cloud:	320°C (608°F)

*NFPA 654-1975, "Prevention of Dust Explosions in the Plastics Industry"

Because of the wide variety of possible ingredient combinations, operations using plasticized or unplasticized powder compound should be evaluated on an individual basis. Implement precautions to control or eliminate likely sources of ignition, such as static build-up. Maintain good housekeeping, notably, ventilation, to prevent accumulation of potentially explosive dust concentrations. Properly maintain and operate dust control devices.

SECTION V

HEALTH HAZARD DATA

Threshold Limit Value

None established

Effects of Overexposure

- There are no significant health hazards from vinyl compound at ambient temperature (see Dust Exposure).

- No adverse health effects are expected from processing vinyl compound when potential exposures are minimized by good industrial hygiene practice and adequate ventilation. Nevertheless, individual additives and/or various combinations of additives may affect the overall toxicological properties. Detailed studies have not been performed on each of the many possible additive combinations. At processing temperatures, additives 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.

Dust Exposure

Fine particle size additives in powder compound may result in airborne dust. 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. Plasticized compounds will also contribute aliphatic olefins.

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 compounds 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.

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, heat welding, thermoforming, 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 Avenue, Bldg. D-5, Cincinnati, Ohio 45211 (\$15.00 as of December 1984).

Respiratory Protection

Not normally required. Abnormal conditions such as equipment malfunction or use of improper equipment or procedures, or hangup or stagnation of 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

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 processing compound, 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. Vinyl compound 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 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).

*The 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 10 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 bulletins (such as BFGoodrich Bulletin G-63, "Injection Molding Guide, Rigid Geon® Vinyls) and to equipment manufacturer's recommendations for further information.

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 compound from walkways and floors to prevent slippery footing. Always wear rubber gloves when cleaning condensate from exhaust equipment or other surfaces.

Sprinklered warehouse areas are recommended. Although most vinyl compound 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.

SPECIAL NOTE: 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 large 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 compounds are not classified as hazardous by the U.S. Department of Transportation under Title 49 of the Code of Federal Regulations, 1983 Edition.

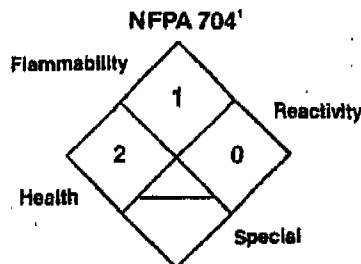
- DOT Proper Shipping Name: Not applicable
- DOT Hazard Class: Not applicable
- DOT Label: Not applicable
- UN/NA Hazard No.: Not applicable

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 compound for processing purposes 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 Compound 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 compound. Shipping containers for these compounds are not labeled by BFGoodrich unless a customer specifies otherwise. Vinyl compound will be 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 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 compound is melted – will further ensure a work environment virtually free of VCM.

APPENDIX 2

FUNCTIONAL ADDITIVES USED IN PVC COMPOUND

Additives chosen for a specific compound will vary according to processing and final product requirements. The following list does not represent all possible additives but it does represent typical ingredients which may be used in vinyl compounds.

- **Stabilizer** inhibits thermal degradation of the compound during processing and throughout the service life of the product. Stabilizers may be grouped into four classes: organometallic tins, lead salts, mixed metal salts and special-purpose stabilizers. The most common organometallic tin stabilizers are tin mercaptides, mainly methyl tin and butyl tin. Some stabilizers, including di-n-octyl and dimethyl tin mercaptide, are FDA acceptable for food contact applications. Lead salts, like dibasic lead phosphite, are mainly organic lead compounds and include sulfates, silicates, phosphates, stearates, phthalates and maleates. Mixed metal salts include calcium-zinc and barium-cadmium systems. Special-purpose stabilizers include flame retardants such as antimony derivatives and ultraviolet light absorbers. Stabilizer will typically be present in amounts up to 5% by weight.

- **Processing aids.** The most common processing aids used with vinyl compound are acrylics or styrene-acrylonitrile copolymers present at levels up to 5.0% by weight.

- **Impact modifiers** commonly used with vinyl include acrylates, chlorinated polyethylene, methacrylate-butadiene-styrene (MBS), acrylonitrile-butadiene-styrene (ABS), and rubber. Although not present in all compounds, when used, impact modifier may range up to 20% by weight.

- **Fillers.** Most common are metal carbonates, mainly calcium carbonate, which is unusually in the form of ground limestone and coated with stearic acid. Other fillers may be silicates, gypsum, clay, alum and barytes.

- **Plasticizer.** Many kinds of plasticizers are available such as dioctyl, dihexyl and dibutyl phthalates, phosphate esters such as isodecyl diphenyl phosphate, aliphatic alcohol esters such as dioctyl adipate, polymeric plasticizer such as polyesters of adipic acid, and monomeric esters such as trimellitate. Dioctyl phthalate is FDA acceptable for food contact applications. When used in flexible vinyl compound, plasticizer concentration will generally range between 20-50%, by weight.

- **Lubricants** include paraffin waxes, mineral oils, polyethylene, salts of fatty acids and fatty acids, esters and amides. Lubricants would be present up to approximately 5%.

- **Pigment.** A list of common pigments appears in Section II. Pigments may be present up to 5% to achieve opacity and color. In weatherable compounds, titanium dioxide may be present at concentrations up to 10-15% to achieve acceptable ultraviolet light screening.

APPENDIX 3

HAZARDOUS SUBSTANCES

No polychlorinated biphenyls (PCB) or polybrominated biphenyls (PBB) and none of the following materials designated as toxic and hazardous by the U.S. Department of Labor (OSHA) are used to manufacture Geon® vinyl resin or compound nor are they anticipated by-products in our production process. Some of these materials are ubiquitous and trace quantities may be found in the environment or as impurities in ingredients used in compound.

29CFR1910.

1001 Asbestos	1012 Ethyleneimine
1002 Coal tar pitch volatiles	1013 beta-Propiolactone
1003 4-Nitrobiphenyl	1014 2-Acetylaminofluorene
1004 alpha-Naphthylamine	1015 4-Dimethylaminoazobenzene
1006 Methyl chloromethyl ether	1016 N-Nitrosodimethylamine
1007 3,3'-Dichlorobenzidine (and salts)	1018 Inorganic arsenic
1008 bis-Chloromethyl ether	1029 Coke oven emissions
1009 beta-Naphthylamine	1043 Cotton dust
1010 Benzidine	1044 1,2-Dibromo-3-chloropropane
1011 4-Aminodiphenyl	1045 Acrylonitrile
	1047 Ethylene oxide

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