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PPG INDUSTRIES, INC. / ONE GATEWAY CENTER / PITTSBURGH, PENNSYLVANIA 15222

May 15, 1970

Mr. William Brydon
Ethyl Corporation
451 Florida
Baton Rouge, Louisiana 70801

Dear Mr. Brydon:

Thought you would be interested in a copy of our most recent literature on Vinyl and Vinylidene Chloride.

Very truly yours,

Fred H. Moulton
Fred H. Moulton
Product Manager

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Send card to
KL Johnson
10/10

ETHYL CORP. R+D DEPT. BATON ROUGE	
MAY 20 1970	
☒ JCC	☐ JDU
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☐ SCC	☐ HS
☐ KLL	☐ AJH
☐ NET	☐ BMO
☐ RLM	☐ FMB
☐ FJI	☐ EDH
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☐ RLM	☐ LFA
	☐ ROH
	☐ H-F

Vinyl Chloride



Vinyl chloride monomer is the base material used in the manufacture of polyvinyl chloride resins. In today's increasingly plastic world, PVC is one of the most widely used modern thermoplastics, finding applications from clear bottles to building products and clothing.

Vinyl chloride monomer (VCM) is now produced by PPG Industries Chemical Division at Lake Charles, Louisiana, and will soon be produced in a new plant in Puerto Rico. When the new plant is in production, total output will exceed 800 million pounds annually. VCM from the Puerto Rico plant will be shipped to customers in the continental United States from a bulk terminal on the East coast.

Uninhibited VCM is quite stable and can be routinely shipped, handled and stored provided proper procedures, outlined below, are followed. To prevent polymerization in transit or storage, it is essential that the monomer be protected at all times from contact with air, oxygen, moisture, catalytic impurities, and light. PPG normally supplies VCM uninhibited. The use of uninhibited VCM eliminates the need for subsequent processing to remove the inhibitor. If required, suitable inhibitors will be added.

PPG Industries operates two pilot reactors — one of 500 gallons capacity, the other of 50 gallons — for polymerization experiments at its Barberton, Ohio, Research Center. PPG researchers use these pilot plants to conduct polymerization studies involving VCM, vinylidene chloride, and other monomers, as well as PPG's peroxide polymerization initiators.

GRADES

In addition to the regular polymer grade VCM, PPG Industries produces a special grade of vinyl chloride to meet more stringent specifications that may be required for particular end uses. Information about this special grade VCM may be obtained from a PPG Chemicals sales office.

PROPERTIES

Chemical Names: Vinyl chloride; vinyl chloride monomer; chloroethylene; chloroethene

Chemical Formula: CH_2CHCl ; $\begin{array}{c} \text{H} & \text{H} \\ & \backslash & / \\ & \text{C} = \text{C} \\ & / & \backslash \\ \text{H} & & \text{Cl} \end{array}$

Molecular Weight: 62.5

Description: At ordinary temperatures and pressures, vinyl chloride is a colorless gas with a mild, sweet odor. But as supplied in tank cars under pressure, it is a liquid. Vinyl chloride is highly volatile and its vapor is extremely flammable.

Boiling Point, °C	-13.8	Autoignition Temperature, °C	472
°F	+7.0	°F	882
Freezing Point, °C	-153.7	Liquid Density at 60°F	0.9192
°F	-245	Vapor Density, air=1	2.15
Flash Point, open cup, °C	-78	Vapor Pressure, psia at 0°C	25.1
°F	-108.4	20° C	49.2
		40° C	87.6
Explosive Limits, volume %		Solubility,	
in air at 25°C (77°F)	4 to 22	water in monomer, weight %	0.11

Solubility: Vinyl chloride is relatively insoluble in water but soluble in most organic solvents.

Reactivity: Vinyl chloride polymerizes exothermically in the presence of light, air, oxygen or catalysts. Heat alone will not initiate polymerization. Vinyl chloride is thermally stable to quite high temperatures. Peroxide formation due to

USES

Most vinyl chloride is polymerized to polyvinyl chloride (PVC) or copolymerized with other monomers such as PPG's vinylidene chloride. A significant percentage goes to other uses, including aerosol propellants, pesticides and extraction solvents.

air exposure is a slow reaction and there is usually no special hazard from peroxide products. Vinyl chloride is noncorrosive to metals when dry at normal temperatures, but water and elevated temperatures accelerate corrosion. The double bond behaves as in other unsaturated compounds. The chlorine atom is relatively inactive and is more stable than in saturated or allylic compounds.

Specification for polymer grade:

Appearance	clear, free of suspended matter
Color	colorless, water-white
Acidity, as HCl, maximum ppm	5
Iron, as Fe, maximum ppm	0.5
Nonvolatile residue, maximum weight %	0.05
Water, maximum ppm	100
Sulfur, as SO ₂ , maximum ppm	3
Acetaldehyde, maximum ppm	5
Acetylene, maximum* ppm	2

TOXICITY

Uninhibited monomer is not absorbed through the skin, but the liquid may cause frostbite because it evaporates so fast. If an inhibitor is included, it may cause local skin burns.

In comparison with other chlorinated hydrocarbons, vinyl chloride vapor has a relatively low toxicity. Vapor concentrations in work areas should not exceed 500 ppm as a time-weighted average atmospheric concentration for an 8-hour day to avoid adverse effects on workmen. High vapor concentrations can cause dizziness and anesthesia. More information appears in "Industrial Hygiene and Toxicology," second revised edition, volume II, edited by Irish and Fasset, Interscience Publishers, New York, N.Y., 1967, pages 1303-1305.

HANDLING AND STORAGE

Aluminum and its alloys must not be used in equipment to store or handle vinyl chloride because explosive aluminum chloroalkyls can be formed. PPG's vinyl chloride is made from ethylene and contains no detectable amount of acetylene. Vinyl chloride made from acetylene by an older process contains traces of acetylene that could react explosively with copper or its alloys to form copper acetylides. It is not safe to use such vinyl chloride in processing equipment containing copper or brass.

Exposure of vinyl chloride to oxygen and air results, after a time, in polymer formation. This can cause problems in equipment used for storage and transfer of monomer. Vinyl chloride should be stored under a blanket of nitrogen with a maximum oxygen content of 10 ppm.

Fire hazard

Vinyl chloride vapor is extremely flammable. Its explosive limits are between 4 and 26% by volume in air. Proper ventilation and the elimination of ignition sources are mandatory in areas where vapor concentrations may reach a flammable level. When a tank car is unloaded, both the car tank and the unloading pump should be electrically grounded.

The products of combustion include toxic and corrosive hydrogen chloride as a major product, and the possibility of very small quantities of phosgene being produced cannot be ruled out. Carbon dioxide or dry chemical agents extinguish fires effectively. Streams of water cannot extinguish a liquid vinyl chloride fire because the monomer does not mix with water and will float on top. Water may be sprayed to cool equipment. No one without proper protective respiratory equipment should enter an area where there has been a fire until the area has been adequately ventilated.

Unloading tank cars

If tank car valves are defective or leaky, do not unload. Telephone the PPG Chemicals plant at Lake Charles, Louisiana, 318-882-1200. Information on unloading appears in Manual Sheet TC-4 on "Unloading Flammable Liquids From Tank Cars," published by the Manufacturing Chemists Association, 1825 Connecticut Avenue, N.W., Washington D.C. 20009.

Warning: Air should never be permitted to enter vinyl chloride tank cars or other containers during or after unloading. Close and seal all openings. Leave approximately 10 psig of vinyl chloride or

nitrogen gas pressure in empty tank car being returned. Use nitrogen with a maximum oxygen content of 10 ppm.

More Information. The Manufacturing Chemists Association also publishes Chemical Safety Data Sheet SD-56 on the "Safe Handling and Use of Vinyl Chloride." More information is also available from the technical service staff of PPG Industries Chemical Division.

PACKAGING AND SHIPPING

PPG Industries delivers vinyl chloride by ship, barge, tank car and tank truck. There are 3 shipping points: Lake Charles, Louisiana, Guayanilla, Puerto Rico, and an East coast terminal.

PPG maintains a fleet of tank cars for vinyl chloride service. All cars are equipped for top unloading. There are two car sizes: 180,000-pound net weight; and 220,000-pound net weight. Tank trucks hold up to 40,000 pounds. Ships and barges hold up to several million pounds.

SAMPLES AND SERVICE

Samples of vinyl chloride are available on special request in returnable laboratory-size steel cylinders holding 5 pounds or in cylinders holding 200 pounds.

The technical service staff of PPG Industries Chemical Division is available for consulting on handling, storage and use.

*This maximum is an industry standard; however, the PPG product contains no detectable amount of acetylene.

Vinylidene Chloride



Vinylidene chloride monomer (VDC) is a versatile product used with other monomers to make a wide variety of copolymer resins and latices.

Properly inhibited and protected from exposure to air, oxygen, water and light, VDC is stable in shipment and storage at ambient temperatures. Correct handling practices, outlined below, must be followed at all times.

VDC supplied by PPG from its Lake Charles, Louisiana, plant is inhibited with hydroquinone monomethyl ether (HQMME or MEHQ) to prevent polymerization during shipment and storage. It is shipped under a nitrogen blanket to avoid contact with air and to prevent the formation of a peroxide that can act as a polymerization initiator.

For most applications, the MEHQ inhibitor in PPG vinylidene chloride need not be removed. If uninhibited monomer is required, however, the MEHQ can be removed by distillation or alkali extraction.

PPG Industries operates two pilot reactors — one of 500 gallons capacity, the other of 50 gallons — for polymerization experiments at its Barberton, Ohio, Research Center. PPG researchers use these pilot plants to conduct polymerization studies involving VDC, vinyl chloride, and other monomers as well as PPG's peroxide polymerization initiators.

GRADES

The standard grade of VDC manufactured by PPG is inhibited with hydroquinone monomethyl ether at approximately 200 parts per million. PPG can also supply, on request, a special grade inhibited with phenol at 0.6% to 0.8%.

USES

Vinylidene chloride monomer has been used for many years, primarily as a copolymer with such monomers as vinyl chloride, vinyl acetate, acrylonitrile, and acrylic acid esters. The copolymer resins and latices are formed into films, fibers, coatings and linings.

VDC imparts to finished products qualities of flame retardance, chemical resis-

tance, and impermeability to water vapor and gases.

Data on reactivity ratios of VDC copolymerizations with 36 monomers are presented in a booklet, "Vinylidene Chloride (Inhibited), handling, properties and reactivity ratios" Form A967, available on request from PPG Industries, Chemical Division.

PROPERTIES

Chemical Names: Vinylidene chloride; vinylidene chloride monomer; 1,1-dichloroethylene

Chemical Formula: CH_2CCl_2 ; $\begin{array}{c} \text{H} \quad \text{Cl} \\ \diagdown \quad / \\ \text{C} = \text{C} \\ / \quad \diagdown \\ \text{H} \quad \text{Cl} \end{array}$

Molecular Weight: 96.95. Contains 73.14% chlorine.

Description: At ordinary handling temperatures, below its boiling point of 88.9°F (31.6°C), vinylidene chloride is a liquid. It is clear and colorless and has a sweet odor. Vinylidene chloride is highly volatile and its vapor is toxic and extremely flammable.

Boiling Point, °C	+31.6	Critical Pressure, atmospheres	51.3
°F	+88.9	Critical Temperature, °C	222
Freezing Point, °C	-122.5	°F	432
°F	-188.5	Absolute Viscosity at 20°C, cps	0.330
Explosive Limits, volume % in air	7 to 16	Specific Gravity, 20°/20°C	1.213
Flash Point, Cleveland open cup, °C	-15	Density at 20°C, pounds/gallon	10.1
°F	+5	Refractive Index, n_D at 20°C	1.4247
Autoignition Temperature, °C	570.0	Vapor Pressure, mm Hg, at 20°C	475.1
°F	1058	Solubility, water in monomer, weight %	0.035

Solubility: Vinylidene chloride is practically insoluble in water but soluble in most organic solvents.

Reactivity: Uninhibited, or inhibitor-depleted, vinylidene chloride may polymerize very slowly even in the absence of oxygen. To further retard polymerization, the uninhibited monomer should be maintained in darkness below 14°F (-10°C)

Uninhibited, or inhibitor-depleted, vinylidene chloride reacts readily with oxygen or air to form a peroxide at temperatures as low as -40°F or C.

Specification for regular grade:

Appearance	clear, free of suspended matter
Color, maximum APIA	25
Vinylidene Chloride, minimum weight % (excluding inhibitor)	99.6
Acetylene, Acetylides, as C_2H_2 , maximum ppm	25
Other Chlorinated Hydrocarbons, no one to exceed this maximum weight %	0.25
Acidity, as HCl, maximum ppm	10
Peroxide, as H_2O_2 , maximum ppm	10
Water, maximum ppm	50
Inhibitor, HQMME*, ppm	180 to 220

*Hydroquinone monomethyl ether is sometimes referred to as MEHQ (monomethyl ether of hydroquinone).

TOXICITY

Inhibited vinylidene chloride is irritating to the eyes and skin. Upon evaporating, the inhibitor can cause local skin irritations or burns unless washed off thoroughly.

Vinylidene chloride is highly volatile and its vapor is heavy. Its odor-warning properties are not adequate. Overexposure to vapor can lead to anesthesia, irrational behavior and if continued to unconsciousness. In all cases of overexposure, medical attention should be obtained. Prolonged or repeated exposures can cause damage to liver and kidneys.

The toxicity of vinylidene chloride vapor considered to be greater than that of ethylene dichloride but less than that of carbon tetrachloride. Vapor concentrations in work areas should not exceed 25 ppm as a time-weighted average atmospheric concentration for an 8-hour day to avoid adverse effects on workmen. Above a level of 200 ppm, respiratory protection is recommended. Workmen cleaning up spills or stopping leaks should have self-contained or air-supplied breathing apparatus.

More information appears in "Industrial Hygiene and Toxicology," second revised edition, volume II, edited by Irish and Fassett, Interscience Publishers, New York, N.Y., 1967, pages 1305-1307.

HANDLING AND STORAGE

If tank car valves are defective or leaky, do not unload. Telephone the PPG Chem-

icals plant at Lake Charles, Louisiana, 318-882-1200.

Nitrogen used with vinylidene chloride should have a maximum oxygen content of 10 ppm.

Information on unloading tank cars and drums, handling spills and leaks, construction materials, storage tanks and transfer lines is presented in a booklet on "Vinylidene Chloride (inhibited)," Form A967 available on request from PPG Industries Chemical Division.

Fire hazard

Vinylidene chloride vapor is extremely flammable and burns vigorously at concentrations between 7 and 16% by volume in air. Proper ventilation and the elimination of ignition sources are mandatory in areas where vapor concentrations may reach a flammable level due to spills or leaks.

Firemen should be warned that the products of combustion include toxic hydrogen chloride and that vinylidene chloride vapors in high concentrations are toxic. Carbon dioxide or dry chemical agents can extinguish fires effectively, also water spray or foam may be used. Water may also be sprayed to cool equipment. No one without proper protective respiratory equipment should enter an area where there has been a fire until the area has been adequately ventilated.

Explosion hazard

The peroxide compound that forms when uninhibited vinylidene chloride has been

exposed to atmospheric oxygen is potentially dangerous. This peroxide can also form if the inhibitor content has been depleted. Depletion can result from any of several causes including distillation or exposure to oxygen due to improper storage. The presence of peroxide can be detected by sharp, acrid odors or by the precipitation of a white flocculant polymer.

Dried polymer residues may contain adsorbed peroxide which can be exploded by a slight mechanical shock or by heat. These residues should be handled with extreme caution. Adding water that is at room temperature to polymer residues containing peroxide renders them inactive. However, the hazard may return if the water evaporates. The peroxide can be destroyed by several washes with fresh 5% sodium bisulfite solution or with 10% sodium hydroxide solution that is at room temperature. Vinylidene chloride monomer that contains peroxide may be purified by washing in the same manner. Separation and handling of precipitated polymer, and its potentially dangerous adsorbed peroxide, must be done with extreme caution.

Equipment not used continually should be filled with water when shut down.

PACKAGING AND SHIPPING

PPG Industries ships vinylidene chloride (inhibited) in tank cars of 10,000-gallon (105,000-pound) capacity from Lake Charles, Louisiana, and in 55-gallon (500-pound) drums from Bayonne, New Jersey.

SAMPLES AND SERVICE

Samples of Vinylidene Chloride are available, on request in 1 pint and 5 gallon containers. The technical service staff of PPG Industries Chemical Division is available for consulting on handling, storage and use.