VenPure® Polisher

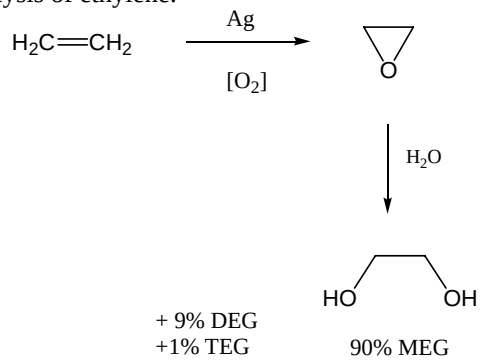
Upgrading the quality of glycols

Summary

Rohm and Haas Company offers a convenient technology to upgrade the quality of glycols. The VenPure technology proceeds by scavenging oxidized and metallic impurities, and may (partially) replace the need for a post-purification over Activated Carbon.

Technology Description

Glycols are produced by oxidation and subsequent hydrolysis of ethylene.



The above reaction conditions may yield some over-oxidation, resulting in oxidized contaminants, such as aldehydes, ketones, peroxides, etc. Those may cause discoloration upon the subsequent reaction, e.g. of MEG towards PET resins.

VenPure technology is especially useful in the quality enhancement of spent (or recycled) glycol and heavy glycol fractions from Ethylene Glycol production.
Heavy glycol fractions are known to contain a significant amount of oxidized contaminants, whereas spent glycol from PolyEster production may contain both oxidized impurities and substantial amounts of soluble inorganic transesterification catalysts (e.g. Antimony).

VenPure Polisher acts as a scavenger of all oxidized and metallic species, thereby inhibiting color formation. The inhibition is not only obtained at room temperature, but remains upon subsequent glycerol processing at high pH / high T°C.

VenPure treatment mode

Heavy and Spent Glycols are typically treated by circulation over a VenPure caplet bed.
High-quality Glycols are typically treated by adding (pumpable) VenPure Polisher 2 prior to or during fractional distillation. VenPure treatment will not only enhance the glycol quality, it will also improve the efficiency of the distillation.

VenPure products are sufficiently soluble in lower glycols and in polyester-polyols. Low levels of residual VenPure are often desirable in the final product to assure longer-term stability. If VenPure residues were to interfere with the subsequent application, then complete neutralization is required. This can be obtained by lowering the pH to less than 6 and/or by increasing the reaction temperature. Solvolysis of VenPure will generate some hydrogen gaz evolution. By-Products from the VenPure reaction are removed during distillation.

VenPure products are stable in alkaline media (pH > 8). Formulations such as VenPure Polisher 2 contain all ingredients to guarantee sufficient stability when added as such to glycol product streams. In cases where the impurity to be separated is a metal ion, the Venpure chemistry is sufficiently rapid to tolerate treatment at pH 5 – 6 without excessive loss of active VenPure product.

VenPure benefits

The VenPure technology offers the following benefits when used to upgrade the quality of glycols :

- various ***oxidized impurities*** are ***scavenged***
- soluble ***metal complexes are precipitated***, allowing separation by filtration
- UV Transmittance, ***color*** and ***color stability*** of the glycol product is improved.
- VenPure treatment can ***easily*** be added to the production process
- VenPure may ***improve fractional distillation efficiency***

Results of lab trials

As a preparation to application on industrial scale, Rohm and Haas Company has tested the efficiency of VenPure treatment by trials in the lab. Such trials can obviously not mimic the reaction conditions on industrial installation, however they serve as a scale-up guideline.

A first series of trials was set up to mimic post-purification of spent glycol : VenPure Polisher P was added at 22°C, and reaction was allowed for 4 hours, under atmospheric conditions.

	VenPure Polisher P (%)	Total Carbonyl (mg CO /kg)	Peroxide (Y/N)
Propylene Glycol	0%	75	Y
Propylene Glycol	0.01%	57	N
Propylene Glycol	0.1%	27	N
DiPropylene Glycol	0%	68	Y
DiPropylene Glycol	0.01%	32	N
DiPropylene Glycol	0.1%	26	N
TEG	0%	44	Y
TEG	0.01%	25	N
TEG	0.1%	10	N
TEG	0%	210	Y
TEG	0.01%	110	N
TEG	0.1%	55	N
TriPropylene Glycol	0%	3,100	Y
TriPropylene Glycol	0.01%	2,900	Y
TriPropylene Glycol	0.1%	470	N

Another treatment mode : 2 hours reaction of at 49°C under inert N_2 blanket.

	VenPure Polisher P (%)	Total Carbonyl (mg CO /kg)
MEG	0%	35
MEG	0.003%	30
MEG	0.01%	<10

Recommendations for industrial application

VenPure is efficient at low dosage concentrations – the magnitude of order can be less than grams of VenPure™ Polisher per kg of glycol. The optimum dosage is best determined during an industrial trial, as it depends on a variety of parameters, such as the required purity, the level of peroxide contaminants, ...

VenPure products contain 'Active Hydrogen', which under certain reaction conditions causes hydrogen gaz to evolve. Inadequate implementation of a Venpure treatment can represent an inherent safety hazard. Important safety information will be obtained by performing certain (simple) lab tests mimicking worst case scenario-situations.
Please contact the Rohm and Haas VenPure team for assistance in safe engineering and implementation of you VenPure purification step.

Toxicity and First Aid

1. VenPure Polisher has dermal LD_{50} of 100-500 mg/kg and, like 50% caustic soda, (NaOH) solutions can cause skin burns and irritations. The acute oral LD_{50} of VenPure Polisher is 500-1000 mg/kg.
2. VenPure Polisher is *very corrosive to the eye* and should be handled according to generally accepted procedures for corrosive chemicals. In case of accidental contact, flush eyes with water and *seek immediate medical attention.*
3. Precautions should be taken to avoid direct skin contact or ingestion. In case of accidental contact, flood the affected area with copious amounts of water and then wash skin with soap and water.

Product Handling

1. *Personal Protection:* Protective rubber gloves, clothing, face shield or safety (splash) goggles should always be worn when handling VenPure Polisher .
2. *Handling:* In general, VenPure Polisher should be handled in the same manner as 50% caustic soda. It is classified as a non-flammable, corrosive liquid, and it is stable to shock. Due to the presence of NaOH, VenPure Polisher absorbs CO_2 forming insoluble carbonates. Consequently, it should not be unnecessarily exposed to air for extended periods.
   VenPure Polisher will decompose and evolve hydrogen if overheated, subjected to neutral or acidic pH conditions, or brought into contact with oxidizing agents, metal salts or fine metallic precipitates of Ni, Co, Cu or Fe. VenPure reactions should always be carried out in adequately vented vessels with standard provisions for pressure relief. A nitrogen atmosphere is also recommended, as well as explosion proof equipment with proper grounding.
3. *Storage:* Accepted storage procedures for VenPure Polisher are the same as those for 50% liquid caustic soda.

   Under normal storage conditions, the decomposition of VenPure Polisher is less than 0.01% per year. During extended storage under adverse conditions, H_2 pressure may develop over the solution. All closed containers should have at least 10% free volume and be checked periodically. Under these conditions, pressure build-up will be less than 1 psi per year at normal storage temperatures.

Storage

VenPure Polisher can be stored in stainless steel, mild steel, or approved fiberglass vessels. Stainless steel (316 SS or 304 SS) is recommended for piping, valves, pumps, etc. VenPure Polisher must NOT be stored in vessels which react with caustic soda, such as aluminum. Storage tanks should be adequately vented to minimize hydrogen gas build-up.

VenPure Polisher should be stored at *temperatures* above 65º F (18º C) to improve handling. The solution becomes viscous below 60º F (16º C) and can crystallize at temperatures below 55º F (13º C). To liquify, warm slowly to 70-90º F (21-32º C), making sure the container is vented; do not use live steam. The warmed material should then be agitated by rolling the container, or recirculated with a high volume pump until a homogeneous solution is obtained.

If piping used to transfer VenPure Polisher is exposed to temperatures below 55ºF (13ºC), it should be heat traced to improve handling. However, precautions should be taken to avoid excessively high temperature since VenPure may decompose resulting in the evolution of hydrogen gas and possible excessive line pressure.

Shipping and Waste Disposal

VenPure Polisher has been classed as a 'corrosive liquid' under US DOT regulations.

1. VenPure Polisher is a corrosive material (EPA hazardous waste #D002) and must be disposed of accordingly. VenPure Polisher can be disposed of (hydrolyzed) by initial dilution with a large excess of water, followed by slow addition of a dilute solution of acetic acid or acetone to the mixture. This procedure should be performed in a well ventilated area.
   Provisions should be made to safely vent hydrogen gas given off during neutralization. VenPure Polisher should not be flushed to the sewer.
2. In case of accidental spillage, absorb the VenPure Polisher with an inert material such as sand or dolomite. Absorbed material should be hydrolyzed as described above.
3. Any vessels which have been used for reactions or storage of VenPure Polisher should be carefully vented, drained, washed, and adequately flushed with nitrogen and air before any repair operations are undertaken. Exposure to an open flame (e.g., welding torch) should be avoided.

Please feel free to contact us via … venpure@rohmhaas.com

Updated information can be found at : http://www.venpure.com/

Find your local Rohm and Haas Representative : http://www.venpure.com/contact.html