VenPure® AC

A Quality Enhancer/Corrosion Inhibitor for Caustic Soda Manufacturing

Product Description

Rohm and Haas Company offers a convenient technology that will increase the product quality of caustic soda solutions. The technology involves inhibition of corrosion reactions prevalent in nickel and nickel clad caustic evaporator systems thereby decreasing nickel contamination in the final product. Rohm and Haas Company has licensed this patented technology from ElTech Systems, Inc. and is authorized to grant sublicenses to chloralkali manufacturers.

In addition to improving the NaOH product quality, VenPure AC (Anti-Corrosion) also reduces corrosion and erosion in nickel evaporators and ancillary components. Treatment with VenPure AC can reduce nickel pickup across evaporators by 50 to 80%, thus extending the life of nickel equipment by typically 50%, as well as reducing downtime for repairs and maintenance.

Typical Properties

VenPure AC is a aqueous formulation, which contains min. 20% of NaOH

Specific Gravity:	1.4 (11.5 lb/gal)
Appearance:	Off-white liquid
Viscosity:	79 cps @ 23 °C

Chemistry

1. *Corrosion of Nickel*

Based on the technology described in U.S. Patent 4,585,579, the corrosion of nickel in 50% caustic solution at 300-320°F (150-160°C) proceeds by the following reaction:

$$Ni + OH^- + H_2O \leftrightarrows HNiO_2^- + H_2$$

While nickel is an excellent material of construction for caustic evaporators, it is prone to increased general corrosion at high temperatures and high turbulence in the evaporators. This results in ppm levels of nickel leaching into the final product.

This technology has also proven to be cost-efficient for first effect evaporators to produce 98% NaOH.

2. *Role of VenPure AC*

The suppression of nickel corrosion can be accomplished by shifting the equilibrium of the nickel corrosion reaction to the left. VenPure AC can be added at several stages of the caustic manufacturing process. The solution can be added to the cell liquor prior to evaporation or during the evaporation stage. Typically, VenPure AC is added directly into the feed of the evaporator line of the first and hottest stage evaporator.

Recommended Use Level

Treat levels as low as 100 mg/L VenPure AC can decrease nickel levels in the final caustic product by 50 to 80%. Typically, at dosage of 40 – 80 mg/L VenPure AC, nickel levels are reduced to less than 1.0 ppm, whereas using a dosage of 80 to 300 mg/L, nickel levels of less than 0.5 ppm can be achieved!

The rate of addition and efficiency of VenPure AC is dependent upon temperature and flow velocity in the evaporator. Consequently, the actual use level must be experimentally derived.

Since the nickel pickup across the evaporator can be reduced by 50 to 80%, one can project at least a two to three-fold increase in the life of various nickel or nickel clad equipment. This can result in significant cost savings associated with replacement of expensive nickel evaporators and components, such as heat exchangers.

The following chart shows the nickel reduction achieved in 50% caustic soda with VenPure treatment at several different chlor-alkali plants.

Nickel Reduction in manufacturing 50% Caustic Soda with VenPure AC

Chlor-Alkali Plant	VenPure Treatment Level* (ppm)	Nickel Level Without VenPure (ppm)	Nickel Level With VenPure (ppm)	% Nickel Reduction
A	58	3.3	0.75	77
B	42	2.0	1.00	50
C	67	2.7	0.50	81
D	83	3.0	0.55	82
E	67	2.5	1.00	60
F	292	1.5	0.25	83

***** calculated on feed rate, first-effect evaporator

Toxicity and First Aid

Composition	CAS Number
sodium borohydride ($NaBH_4$)	16940-66-2
sodium hydroxide (NaOH)	1310-73-2
water	NA

1. VenPure solution 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 solution is 500-1000 mg/kg.
2. VenPure solution 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, and safety goggles should always be worn when handling VenPure solution.
2. *Handling:* In general, VenPure solution 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 solution absorbs CO_2 forming insoluble carbonates. Consequently, it should not be unnecessarily exposed to air for extended periods.

   VenPure solution 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 solution are the same as those for 50% liquid caustic soda.

   Under normal storage conditions, the decomposition of VenPure AC 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 solution 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 solution 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 solution 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 solution 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 solution may decompose, resulting in the evolution of hydrogen gas and possible excessive line pressure.

Shipping and Waste Disposal

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

1. VenPure solution is a corrosive material (EPA hazardous waste #D002) and must be disposed of accordingly. VenPure solution 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 solution should not be flushed to the sewer.

2. In case of accidental spillage, absorb the VenPure solution 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 solution 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