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Corrosion Protection of Head Space Crude Oil Storage Tanks with VpCI Products

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Background: Customer has severe corrosion in headspace of storage tanks of crude oil. This corrosion is caused by hydrogen sulfide and carbon dioxide contamination in the crude oil. Cortec suggested using liquid VpCI inhibitors for their corrosion protection. Another approach is to hang Corrosorber and Eco Pouches in the headspace.

Purpose: To evaluate effectiveness of VpCI-337, VpCI-639 HFB, VpCI-705 and a combination of Corrosorber, Cor-Pak 1-MUL, and EcoPouches for corrosion protection of steel from H_2S and CO_2 vapors.

Method: H_2S Test (modified)
VpCI Sensor Strip Test

Materials:
1) Acetic acid
2) Sodium sulfide hydrate (Na2S x 9H_2O)
3) 1010 carbon steel panels
4) one-gallon size glass jars
5) VpCI-705 (batch #08842)
6) VpCI-337 (batch #13872)
7) VpCI-639 (batch #90291)
8) EcoPouch (VpCI-609 batch #10962)
9) Corrosorber Pouch
10) Cor-Pak 1-MUL (batch #20136)
11) CO_2 tank
12) Methanol, lab grade
13) VpCI Sensor Strips
14) VpCI Sensor Test Solution

Procedure: The following procedure was followed for the modified H_2S Test:
1) Spray the inside of the one gallon size jars with the products to be tested: one jar with VpCI-705, one jar with VpCI-337, and another jar with VpCI-639. (note: about 5g. of product was sprayed into each jar). For testing with Corrosorber and EcoPouch, tape one pouch of each to the side of the jar. (note- the EcoPouch contains 5grams of VpCI-609). Another test was also set up with Corrosorber and Cor-Pak 1-MUL.
2) Hang a carbon steel panel (cleaned with methanol) from each of the jar lids, and seal the jars shut.
3) Condition the jars for 24 hours.
4) Saturate DI water with CO_2.
5) Add 0.5 liters of DI water saturated with CO_2 to each of the jars, and then add 2 drops of acetic acid and 0.2grams of sodium sulfide hydrate (Na2S x 9H_2O) to each of the jars and mix to dissolve.
6) With the panels still attached to the lid, seal the jars shut.
7) Test under a fume hood at room temperature for 24 hours.
8) After testing, take the panels out of the jars, and inspect for corrosion.
9) Grade each panel according to the following on the next page:

Grade 0 - Extensive corrosion (25% or more)
Grade 1 – Moderate corrosion (10-25%)
Grade 2 – Slight corrosion (5-10%)
Grade 3 – Very slight corrosion (0-5%)
Grade 4 – No visible corrosion

The following procedure was followed for the VpCI Sensor Strip Test:

1) After the H_2S Test was completed, a VpCI Sensor Strip was dipped into the VpCI Sensor Solution, then taped to the lid of the jar containing the Cor-Pak 1-MUL pouch and Corrosorber pouch..
2) Seal the jar shut, then note the time it takes for the VpCI Sensor strip to turn from blue to red.

Results: The following results were found from the modified H_2S Test:

Sample	Results	Pass/Fail*
Control	Grade 0	Fail
VpCI-705	Grade 3	Pass
VpCI-337	Grade 3	Pass
VpCI-639	Grade 3	Pass
EcoPouch + Corrosorber Pouch	Grade 3	Pass
Cor-Pak 1-MUL Pouch + Corrosorber Pouch	Grade 3	Pass

*Grade 3 & 4 are passing

Interpretations:

1. According to the modified H_2S test, each of the Cortec products that were tested performed with passing results.

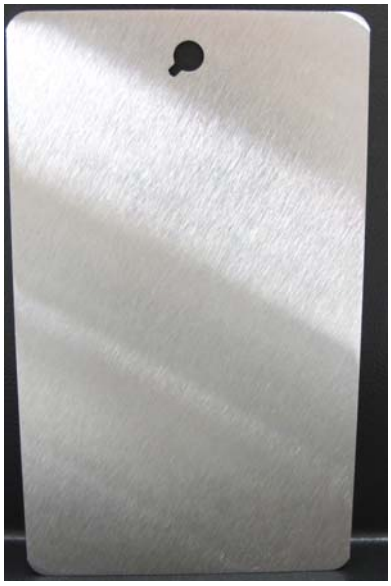
2. Powder in Corrosorber pouch changed color to black, which confirmed absorption of H_2S.

3. The VpCI Sensor test indicates the presence of VpCI in the vapor phase even after the saturation of the area with H_2S.

All of the tested products can be recommended for the mentioned above application.

Photos from the modified H_2S Test:

Control



EcoPouch + Corrosorber Pouch

VpCI-639

VpCI-705

VpCI-337

Cor-Pak 1-MUL + Corrosorber Pouch

VpCI Sensor Strip Test

Cor-Pak 1-MUL + Corrosorber Pouch

after 10 minutes, the VpCI Sensor Strip changes from blue to red