PMI-SC3

H_2S & RSH REMOVAL

1 PRODUCT DESCRIPTION

PMI-SC3 is a water-soluble blend hydroxyl solution in a complex alcohol with an amine facing agent. This product is extremely effective in removing H_2S from gas, water, crude oil and fuel oils.

PMI-SC3 is **not** a scavenger in chemical terms. Rather than *'scavenging'* H_2S, it converts H_2S & RSH into a stable non-hazardous Sulphate salt. This eliminates several issues in the process system, often associated with triazine / formaldehyde-based scavengers.

PMI-SC3 is also effective in removing mercaptans from liquids in the same manner, however, the reaction time required to remove the mercaptans is slightly longer.

2 PRODUCT CHARACTERISTICS

PMI-SC3 converts H_2S & RSH into a non-toxic sulphate salt and water:

1. **PMI-SC3** will chelate the H_2S & RSH molecules
2. It then converts the molecules into a harmless liquid salt
3. This solution then attaches to the Amine molecule
4. The water-based molecule then mixes with the produced water
5. The result is a water salt with a very low COD
6. The water salt is stable and the reaction is irreversible

3 DOSAGE RATES

Gas: 1ppm of H_2S requires 0.2 ppm of **PMI-SC3** (measured in gas phase)

Water: 1ppm of H_2S requires 1-3 ppm of **PMI-SC3** (measured in liquid phase)

Crude: 1ppm of H_2S requires 3–4 ppm of **PMI-SC3** (measured in liquid phase)

Fuel Oils: 1ppm of H_2S requires 3-4 ppm of **PMI-SC3** (measured in liquid phase)

Removal of mercaptans: for each ppm of mercaptans you will require between 3–5 ppm of **PMI-SC3** depending on the sulphur speciation of the mercaptans.

4 APPLICATION

Like any chemical, application is the key. Applied with a good mixing mechanism, the performance of the chemical will be enhanced. For oil and gas production, **PMI-SC3** can be injected down hole, at the tree or post separation. **PMI-SC3** is not affected by high temperatures.

For treatment of crude, condensates or fuels oils, ideally **PMI-SC3** should be injected at or near the inlet valve of the transfer pump as the product is being transferred from one tank to another. Alternatively, **PMI-SC3** can be added to a storage tank and circulated.

5 COMPATIBILITY WITH PMI-107

PMI-107 is a highly effective Wax and corrosion inhibitor (see appropriate data sheets).
PMI-SC3 is wholly compatible With **PMI-107** and the two products can be mixed prior to application to provide a broad spectrum treatment. The blending of the formulations in the correct proportions to meet the local requirements ensures that there is no diminution of performance in any aspect of their intended application.

6 GAS

PMI-SC3 needs to be injected under pressure to ensure good migration. The reaction is instantaneous in the gaseous phase and the separation of the newly formed Sulphate salts is very fast. Note that **PMI-SC3** cannot be used where there are high levels of CO^2 as **PMI-SC3** will treat the CO^2 simultaneous to the H_2S and RSH.

When treating multi-phase lines, proper mixing is the key. With proper mixing **PMI-SC3** will remove H_2S from all phases and the by product will stay in the water phase.

7 CRUDE OIL & FUELS

PMI-SC3 converts the H_2S and Mercaptans into sulphate salts. The chemical then separates from the hydrocarbons due to the higher specific gravity. For extremely heavy crudes, adjustments to the chemical can be made to increase the specific gravity and speed up the separation process. **PMI-SC3** will not affect the hydrocarbons in any way.

Naphtha Sample: H2S = 112ppm; RSH = 191 (ASTM D3227)

PMI-SC3	100 ppm		400 ppm		800 ppm	
	H_2S	RSH	H_2S	RSH	H_2S	RSH
Sample	112	191	112	191	112	191
Immediate	63	131	59	96	42	80
After 4 hrs	49	97	14	63	Nil	39
After 8 hrs	40	73	Nil	34	Nil	22
After 12 hrs	33	62	Nil	24	Nil	3.4

The amount of **PMI-SC3** required to remove H_2S from any system is typically around 30% less than that of a triazine based scavenger. The reaction is stable and the result is a nontoxic sulphate salt that can be easily handled.

8 WATER

PMI-SC3 is extremely effective in removing H_2S and all sulphides from water. The effect of the chemical (both used and unused) on water is very interesting. The chart below shows changes to the water after different rates of injection.

Sample Description	pH	Conductivity uS/cm	Turbidity (NTU)	Silica as SiO^2 (ppm)	Total Iron (ppm)	H_2S in Liquid Phase (ppm)
Raw Water Feed	7.67	29, 400	211	7.5	3.0	5.5
PMI-SC3 @ 15 ppm	8.35	29600	203	7.6	0.8	Nil
PMI-SC3 @ 25 ppm	8.45	29300	198	7.3	0.8	Nil
PMI-SC3 @ 30 ppm	8.51	29200	199	8.7	0.5	Nil
PMI-SC3 @ 40 ppm	8.59	29000	199	10.7	0.5	Nil
PMI-SC3 @ 50 ppm	8.52	30000	199	8.5	0.5	Nil
PMI-SC3 @ 60 ppm	8.52	30100	180	6.0	0.8	Nil
PMI-SC3 @ 80 ppm	8.67	30000	166	3.8	0.8	Nil
PMI-SC3 @ 120 ppm	8.65	30000	133	10.0	0.8	Nil
PMI-SC3 @ 160 ppm	8.72	30000	75	9.0	0.5	Nil
PMI-SC3 @ 200 ppm	8.84	30000	2.93	9.9	0.3	Nil
PMI-SC3 @ 1000 ppm	10.02	29800	3.78	Nil	0.0	Nil

Total Iron is dramatically reduced even at low dosage whereas H_2S is reduced to NIL as both un-dissociated H_2S and dissociated HS ions are neutralized by **PMI-SC3**. This is important as it represents a drastic reduction in Total Suspended Solids (TSS). The pH remains within 8 – 9, which indicates that the chemical does not bestow higher alkalinity on the produced water. This is an important finding where there are high levels of TSS.

When treating water, there is no separation. There will be a slight increase in the pH of the water (see above chart), so if there are scaling issues then tests need to be conducted first and if necessary **PMI-107** will be blended and applied in the correct proportion.

PMI-SC3 should be injected first to remove all sulphides then a scale inhibitor can be injected downstream to reduce the pH and avoid potential scaling. The reaction with sulphides and **PMI-SC3** is stable so the addition of a scale inhibitor (acid) will not reverse the reaction.

9 WASTE WATER TREATMENT

PMI-SC3 separates completely from hydrocarbons and typically the chemical remains quite clear. Often **PMI-SC3** can reduce water content of some crude after dosing, so this must be noted. The by-product will contain reacted **PMI-SC3**, sulphate salts, water and a portion of reacted chemical. The amount of unreacted chemical remaining will depend on the dosing rates used and the effectiveness of the mixing. The better the mixing – the less chemical required and the less unreacted chemical will remain.

10 FREQUENTLY ASKED QUESTIONS

How fast is PMI-SC3 able to remove H_2S?

- The reaction with **PMI-SC3** and H_2S is instant once contact is made. RSH reaction time can take longer depending on the RSH species. Typically, the treatment time required is more a function of the efficiency of the application and nature of the asset that is being treated.

Are light thiols or other sulphur compounds affected or only H_2S?

- All sulphur compounds react with **PMI-SC3**.

What is the level of effectiveness of PMI-SC3 to remove H_2S / RSH in the liquid phase?

- 4000 mg/L (combined H2S & RSH) in liquid phase was tested and was successful. No upper limit has been established.

How do you remove the used and unused PMI-SC3 from Fuel Oil?

- The product is 100% miscible with water and this is a SINGLE PHASE system only. In liquid hydrocarbon applications, the sulphates which are created by **PMI-SC3** stay in the water phase and are separated from hydrocarbons during normal separation.

What is the effect of the scaling potential of the system?

- **PMI-SC3** will slightly increase the pH of the water, therefore, analysis has to be carried out to determine the effect of this increase in pH, particularly where there are high levels or suspended solids or calcium carbonates in the produced water. Where scaling is a potential issue, a blend of **PMI-SC3** with **PMI-107** will prevent an occurrence of such.

What is the potential of scaling with the reacted or un-reacted PMI-SC3?

- NONE. No potential scaling in ordinary environments.

Do you use an air oxidiser? If so, how can you ensure that you have enough O2 under anaerobic conditions?

- No, enclosed system; hence no Oxygen ingress.

What is formed at higher temperatures?

- It does not decompose thermally within the operating temperature range up to 300˚C

Did you find increased sulphate levels in the water after treatment?

- Yes - the amount of increase is directly related to the amount of H_2S / RSH treated by the chemical.

How effective does the mixing have to be?

- No special mixing tooling required with water – but for optimal results, it is recommended to always inject at the inlet of the inline / transfer pump. In gas lines, inject with sprayer nozzle under positive pressure. For heavy crudes and HSFO, it is recommended to inject as early as possible or at pump inlet to ensure efficient mixing.

How fast or complete is the phase separation afterwards?

- There is complete separation from the hydrocarbon phase, and the speed of the separation can be adjusted by adjusting the specific gravity of the chemical.