H_2S & THIOLS TREATMENT TECHNOLOGY THIOSCAV FE^{17}

NON TRIAZINE OR FORMALDEHYDE COMPOUNDS

by Ecoil Technologies Lab.

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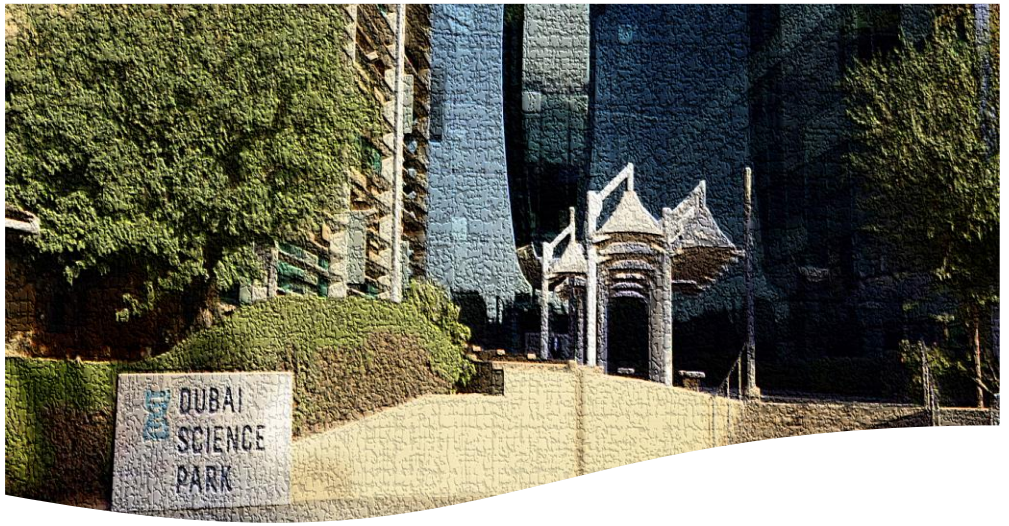
ABOUT US

THE ECOIL TECHNOLOGIES COMPANY WAS ESTABLISHED IN 2016 AND LOCATED IN DUBAI SCIENCE PARK, UAE



A fast growing independent research company focused on the development of oilfield chemicals and bioorganic products with outstanding quality and potential.

The Ecoil Technologies is a multidisciplinary research company with a broad spectrum of research lines, services and products.

The company was established by a group of qualified professionals having extensive knowledge and experience in research and development in oil and gas industry, agriculture and ecology in close cooperation with academic experts.

The company aims at developing products technical know how and providing other contract services.

The company is also active in the area of technology consultancy.

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The Issue of H_2S & THIOLS in Oil & Gas Sector

H_2S & THIOLS in the oil and gas sector poses significant challenges due to its toxicity, corrosiveness, and flammability. Below are the major problems it causes:

Health and Safety Risks

- Toxicity: It is highly toxic even at low concentrations. Prolonged exposure can cause serious health issues, including respiratory failure and death.
- Lethality: At higher concentrations, it can cause immediate collapse and death, making it a severe safety hazard for workers in the industry.

Corrosion of Equipment

- Sulfide Stress Corrosion Cracking (SSCC): H_2S & THIOLS can lead to sulfide stress cracking, causing equipment to fail. This can result in leaks, spills, or even catastrophic blowouts.
- Material Degradation: Pipelines, storage tanks, and other infrastructure are vulnerable to accelerated corrosion, necessitating frequent inspections, repairs, or replacements, which increase maintenance costs.

Operational Issues

- Shutdowns: In the presence of high H_2S & THIOLS concentrations, operational shutdowns may be necessary to ensure safety, leading to production losses.
- Processing Challenges: Removing H_2S from crude oil and natural gas requires specialized equipment and processes, such as gas sweetening and sulfur recovery units. This increases the complexity and cost of operations.

Environmental Impact

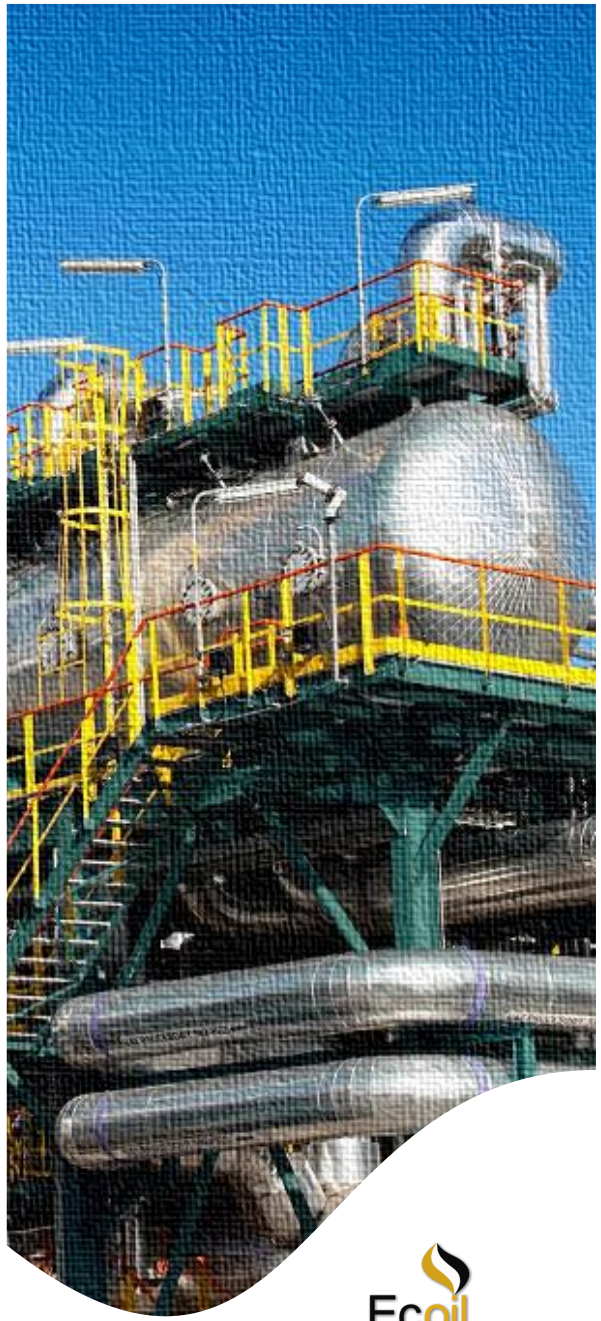
- Sulfur Emissions: If not properly managed, H_2S & THIOLS can be released into the atmosphere, contributing to air pollution and forming sulfur dioxide (SO_2), which causes acid rain.
- Waste Management: Handling the byproducts of H_2S removal (e.g., sulfur) also poses environmental challenges, requiring proper disposal or utilization strategies.

Regulatory Compliance

- Stringent Regulations: Governments impose strict regulations on H_2S emissions and worker exposure, requiring companies to invest in compliance measures such as continuous monitoring, reporting, and safety training programs.
- Penalties: Non-compliance with these regulations can result in hefty fines, legal action, and damage to the company's reputation.

Increased Operational Costs

- Infrastructure Upgrades: To handle H_2S & THIOLS, companies often need to upgrade infrastructure with corrosion-resistant materials, such as stainless steel or special alloys.
- Specialized Equipment: Additional investments are needed for gas sweetening plants, H_2S detectors, and personal protective equipment for workers.



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TECHNICAL ASPECTS OF THE OTHER TECHNOLOGIES IMPLEMINTATION

Several methods were used to treat H_2S in the oil and gas sector. Some of theme were of high initial capital-intensive solutions. On the other hand, usage of chemical scavengers were widely used due to its flexibility, ease of application and low initial cost.

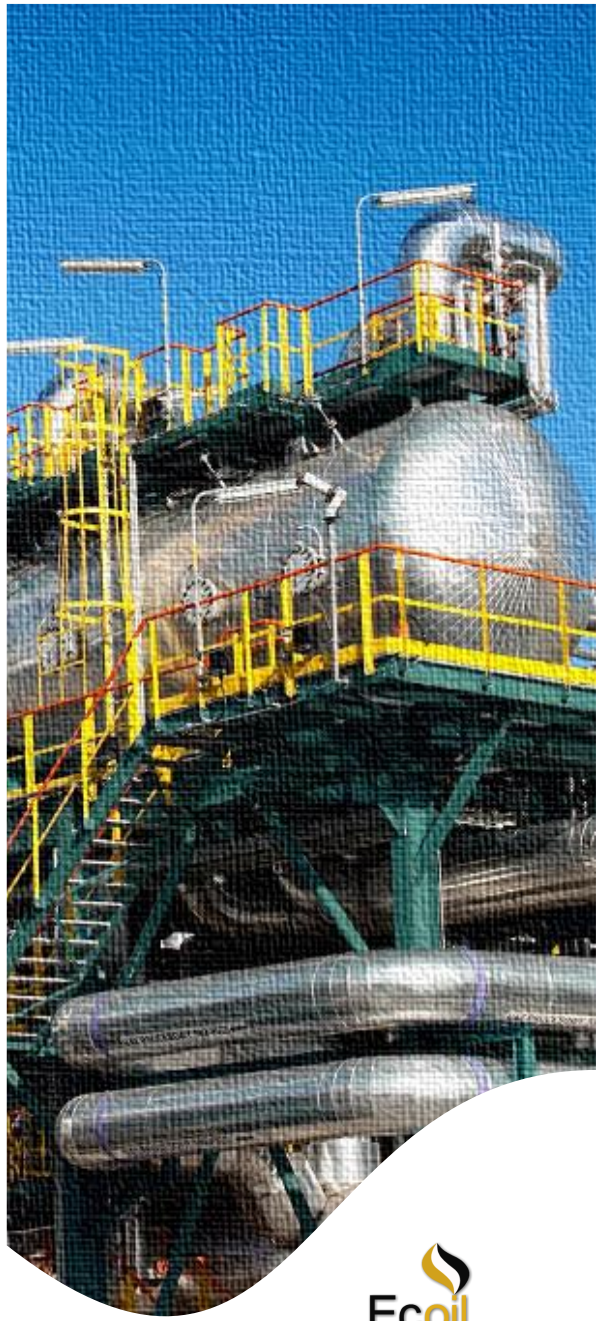
The most commonly used H_2S scavengers were Triazine based scavengers. Advantages of these scavengers can be summarized as follows:

- Triazine scavengers are available in liquid form which makes it easy to apply through injection or dosing into the hydrocarbon flow stream.
- Triazine high reactivity with H_2S converting it into byproducts (dithiazine compounds). This reaction occurs quickly and efficiently.
- Triazine scavengers, due to its versatility, are suitable for both gas and liquid streams, making them a flexible choice for treating H_2S in a variety of environments.
- Compared to some other scavengers, triazine is cost-effective for use in all operations. Its prevalent availability and ease in application contribute to its economic appeal.

Triazine, nevertheless, have several limitations that can be summarized in the following:

- Byproduct Formation (Dithiazine) Leading to Scaling and Fouling
- Incomplete Reaction and Potential Residual H_2S
- High Dosage Requirements Compared to Other Media
- Environmental and Disposal Concerns due to Dithiazine
- Potential for Higher Operational Costs

For the removal of methyl and ethyl mercaptans, the most widely used are those or other options for alkaline treatment, in which large volumes of highly toxic sulfurous-alkaline wastewater that are difficult to dispose of are formed



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ABOUT TECHNOLOGY

THIOSCAV Fe^{17} – is a technology researched and developed by Ecoil Technologies Lab. for the removal of hydrogen sulfide and thiols from different environments.

Technical characteristic:

Scavenging hydrogen sulfide and thiols (methyl and ethyl mercaptans) by conversion to neutral disulfides through the following:-

$$2[O]^- + 6H_2S \rightarrow 3(SS)^{2-} + 6H_2O \quad \text{.....(1)}$$

$$H_2O + 4[O]^- + 6H_2S \rightarrow 3S_2O_3^{2-} + 4[O]\ H4 \quad \text{.....(2)}$$

$$2[O]^- + 6RSH \rightarrow 3RSSR + H_2O \quad \text{.....(3)}$$

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THIOSCAV Fe^{17} REAGENTS OUTLINES

Product Features		
THIOSCAV Fe^{17}	**Status**	**Note**
Free of Triazine or formaldehydes products	✚ ◆	Most commonly used scavenger is triazine based
Stable and functional under high temperatures and pressures	✚ ◆	Triazines are not stable at high temperatures or pressures
THIOSCAV Fe^{17} effective on H_2S & wide range of mercaptans (not limited to light mercaptan).	✚ ◆	Triazine scavengers are not effective to treat mercaptans
High versatility and if needed, can be provided to be liquid even at lower than -50 C°	✚ ◆	THIOSCAV Fe^{17} formula can be modified to accommodate challenging environments.

Treatment Advantages		
THIOSCAV Fe^{17}	**Status**	**Note**
By irreversible conversion of H_2S & mercaptans, no risks of reappearance of those compounds.	✚ ◆	Triazin reaction is reversable, thus, due to changes conditions H_2S may reappear in the flow.
All treatment reaction outcomes are water soluble, thus, no deposits or risks of scale formation.	✚ ◆	Triazine treatment will produce Dithiazine which is not soluble in water, thus, high risk of scaling.
All treatment reaction outcomes are non-toxic materials, thus no issue of waste management.	✚ ◆	Triazine treatment will produce Dithiazine which is highly toxic and form deposits in treated media.
THIOSCAV Fe^{17} products are of high efficiency and fast reaction (2-3 ppm per 1 ppm of H_2S)	✚ ◆	Triazine application ration is 3-5, in many cases it goes up to 8 or even 12 ppm for 1 H_2S ppm

✚ **Advantaged for Thioscav Fe^{17} over all other scavengers**

◆ **Unique for Thioscav Fe^{17}**

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THIOSCAV Fe^{17} REAGENTS OUTLINES

Scop of application		
THIOSCAV Fe^{17}	**Status**	**Note**
Treating H_2S and Mercaptan in oil	✚ ◆	Other products are less efficient in treating H_2S in oil and not effective in treating mercaptan
Treating H_2S and Mercaptan in gas	✚ ◆	Other products are less efficient in treating H_2S in gas and not effective in treating mercaptan
Treating H_2S and Mercaptan in water	✚ ◆	Other products are not suitable in treating H_2S in water and not effective in treating mercaptan
Treating H_2S and Mercaptan of the 3-phase flow	✚ ◆	Other products are not suitable in treating H_2S 3-phase and not effective in treating mercaptan

✚ **Advantaged for Thioscav Fe^{17} over all other scavengers**

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OPPORTUNITIES DUE TO THIOSCAV Fe^{17} FEATURES

RED OCEAN

Replace currently used Scavenger in every and each application due to the following:

- higher efficiency,
- better environmental status,
- elimination of any post treatment issues.
- Lower total cost of treatment

BLUE OCEAN

Expand the domain of using Fe^{17} products in:

- New media, like produced water and 3 phase application.
- Different stages of production chain like application in the well head.
- Range of treatment, by treating H_2S and mercaptan

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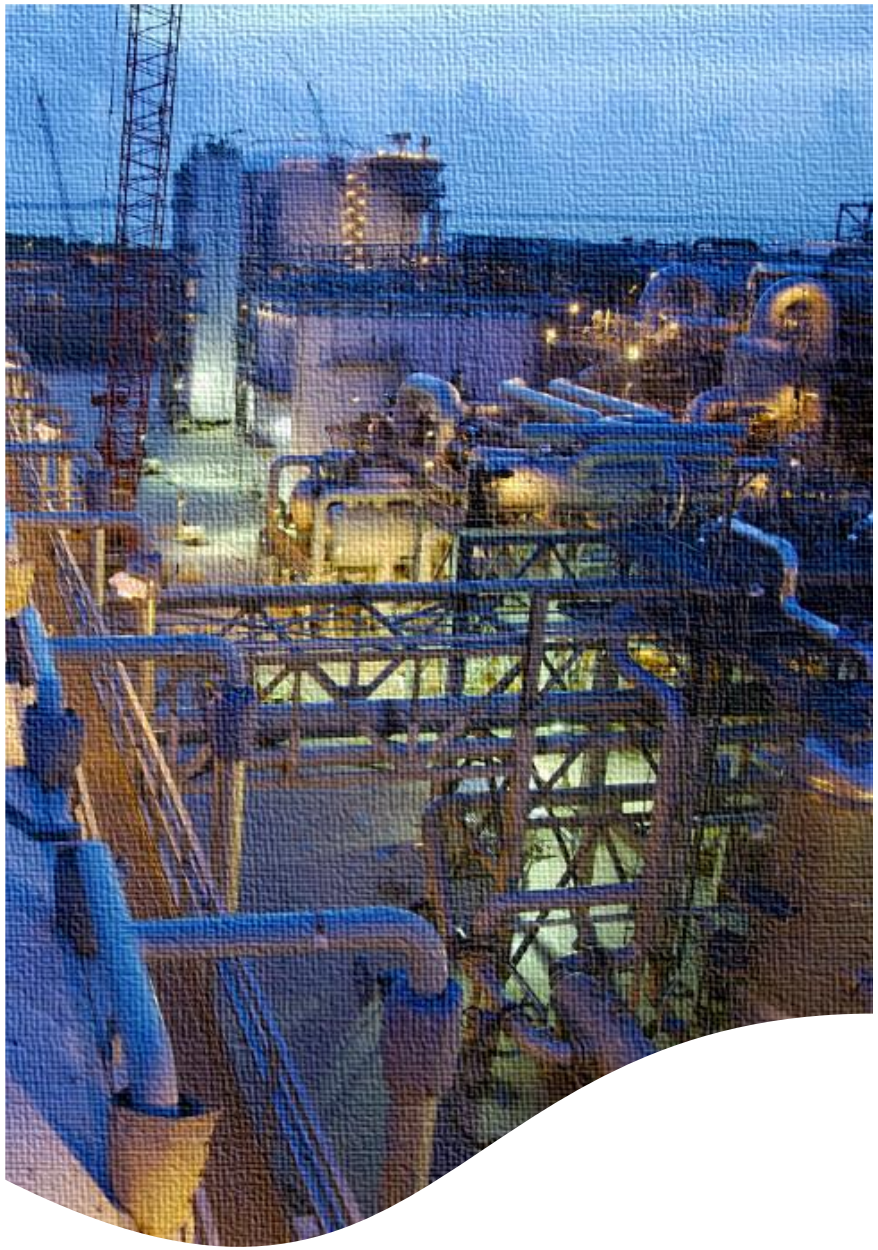
CASES

- **Rosneft- Krasnodar,** wellhead H_2S treatment in three- phase flow.
- **Gazprom Dobycha- Krasnodar,** wellhead H_2S treatment in three-phase flow.
- **Arkema Group, Iraq**, H_2S treatment in crude oil.
- **Uralnefteservice JSC ,** Mercaptans treatment in crude oil.
- **JSC "TAIF NK",** H_2S treatment of straight run gasoline.
- **Kazakhoil Aktobe LLP ,** H_2S and mercaptans treatment in crude oil.
- **Karachaganak Petroleum Operating B. V.,** Mercaptans treatment in gas condensate.
- **Gazprom Dobycha Astrakhan LLC ,** H_2S and mercaptans treatment in fuel oil.
- **Irkutsk Oil Company LLC** , H_2S and mercaptan treatment in crude oil and formation water.
- **Arris Petroleum Corp.,** H_2S treatment in APG



THANK YOU

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