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PE3 Chemical Process Technologies for Oil & Gas

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PE3 Oil & Gas Chemical Process Technology

Oil & Gas Industry

- Global oil companies are the largest chemical processing companies on earth
- The chemical processes they use are designed to: 1) separate oil & gas from impurities, 2) separate selective product portions with desirable characteristic from the crude and from one another, and 3) blend various grades of products and additives to get higher value products
- The primary tools are heat, pressure, filtration, catalysts, solvents and additives
- Heat and pressure are the primary contributors to energy use which ranges from 30% to 50% of refinery operating costs

PE3 Oil & Gas Chemical Processes

- PE3 has licensed a portfolio of chemical processes to enhance the performance of oil & gas production and refining processes
- PE3's line of specialty processes includes ionic fluids that are capable of expediting chemical reactions involving hydrogen-based products including petrochemicals and water
- The ionic fluids can be used as solvents and catalysts to reduce the use of heat, pressure and various filtration operations used in petroleum chemical processes
- The ionic fluids replace sulfuric acids and other acids commonly used in the petroleum chemical industry

PE3 Mission is the Oil Producer's Mission

Petroleum Production Mission

Petroleum Producers' and Refiners' Mission is to extract hydrocarbons gas from the earth and **to chemically change them into hydrocarbon products with the highest possible value.** The oil industry accomplishes this by purifying the raw oil and gas and then rearranging their hydrogen and carbon molecules to make the products that refiners want. Success requires investment in equipment, energy, and chemistry. **Using superior chemistries and processes** helps oil producers and refiners to optimize their operations and to maximize earnings.

PE3 Oil & Gas Mission

PE3 Mission is to produce the world's best chemistries to maximize the performance of oil and gas operations through improved process efficiencies, better quality products, improved environmental performance and lower operating costs. PE3 designs specific chemistries for oil clients to meet operational needs for filtration, products separation, and managing hydrocarbon molecules. PE3 will improve clients' oil and gas environmental performance by eliminating carbon waste, purifying wastewater and by generating clean hydrogen energy to power the plant.



PE3 OIL & Gas SOLUTIONS

PROCESS	PURPOSE	BENEFIT
Water separation	Water removed from crude and natural gas at the wellhead	Improves raw crude and methane value and makes it easier to refine
Desulphurization	Sulfur removed from oil and gas streams	Sulfur removal converts “sour crudes” to “sweet crudes” significantly increasing their market value. Required for compliance with modern fuel standards
Organics Treatment	Bacteria killed and removed from oil and gas streams	Removal of these contaminants' controls odor and emissions
Gas Separation	CO ₂ , CO and other gas removed from methane (natural gas)	Delivers purer and more marketable natural gas and captures for alternative use
Production Water & Wastewater Treatment	Contaminates removed from production water	Reduces requirement for replace process water through reuse, eliminates potential contamination of ground water, provides source of water for hydrogen production
Hydrogen Production	Produce hydrogen without petroleum feedstock	Produces the extra hydrogen needed for refining processes

PE3 Petroleum Desulfurization

Desulphurization

An innovative desulfurization process that addresses the 3 most common key performance indicators (KPIs): odor, sulfur levels, and color. Our team has been working on desulfurization since 2014. Our environmentally-friendly solution for the desulfurization of natural crudes is patented.

We utilize proprietary ionic fluid technology to replace acids that are typically used as solvents and catalysts in the refining process. We are able to extract sulfur from either petroleum or water used in oil production and refining including frack water

Desulfurization Benefits

- Significantly reduces sulfur content and sulfur odor
- Reduces bacteria associated with sulfur
- Reduce catalyst poisoning
- Creates lighter sweeter crudes and more valuable crudes for refining
- Reduces corrosion in pipeline and equipment
- Reduces equipment scaling
- Allows any crude source to meet Ultra Low Sulfur content in fuel production
- Enhances product pipeline flow rates
- Process removes other contaminants

PE3 Wastewater Treatment

Wastewater Problem

Oil production and refining generates a lot of wastewater-- up to 10 barrels for every barrel of oil products produced and refined. Chemical treatment processes, oil production fluids and even naturally -occurring water mixed in the petroleum must be treated unless it is injected it back into the well or other underground injection site.

If the water can successfully be treated for recycling or sale, the cost of its treatment can be greatly offset. Oilfield production water can contain valuable minerals that can be extracted from the water including oil entrained in the water. **PE3 provides ionic fluid treatment solutions** to separate heavy metals, biologicals, oil, sulfur and other products from the water.

Benefits of PE3 Water treatment

- Safe and easy-to-use
- Can extract water contaminants at low-cost
- Environmentally safe
- Sulfur can be extracted from water and sold
- Sale of extracted oil can fund the water treatment
- Water can be treated sufficiently for recycling as production or frackwater
- Safe for direct sewer disposal
- 100% environmentally-friendly
- Avoids cost of deep well injection and possible earthquakes

Ionic Fluids—What Are They

Ionic Fluid Description

- Ionic liquid salts are made by pairing organic cations with organic or inorganic anions. Their irregular structures delocalize their charges, leading to properties—such as sub-100 °C melting points—use in petrochemical processes, cellulose extraction, and battery electrolytes.
- Strong acid properties, which allow them to take the place of the hydrofluoric and sulfuric acids
- They are also conductive and often used as solvents in chemical processes and biomass refining. Ionic liquids are also employed as auxiliaries and catalysts in chemical synthesis. They can be found as lubricants and coolants. Polymers are starting to incorporate ionic liquids as additives.

Benefits of Ionic Fluids vs Acids

- Significantly less fluid is required for reaction (3-6% versus 50% in some reactions)
- Significantly reduced the handling requirements and the volume requirements in the reactor
- Less reactant consumed in chemical reactions with higher amounts available for regeneration than typical acids
- Safer to handle and can be regenerated inexpensively on-site.
- Higher boiling points and low freezing points
- Negligible vapor pressure
- Less flammable than organic solvents.
- Cleaner solvents and more efficient chemical processes
- Less toxic and less corrosive
- Large operational range

Petroleum Processors Using Ionic Fluids

- Chevron
- Honeywell UOP
- Sinochem Hongrun Petrochemical,
- Big West Oil
- Well Resources, Inc (6 facilities)
- Sinopec installed a 7,500-barrel-per-day unit at its refinery in Wuhan.
- Petronas



Well Resources, Inc.



Upstream vs Downstream Oil Treatment

- Reduce transport distance
- Reduced shipping volumes (weight of water, sulfur, contaminants eliminated)
- Reduced pipeline corrosion
- Refinery treatment costs reduced due to smaller volumes and less required processing
- More focused allows better concentration—fewer costs
- Minimize or eliminate other refining processes (dewatering, desulfurizing, removal of sediments and heavy metals etc.)
- Less energy than refinery operating temperatures
- Government national controlled oil companies
- Highest values
- For export, avoid trip to the refinery
- Reuse extracted water for wellhead operations including fracking



PE3 IONIC FLUIDS PROCESSES FOR OIL FIELD

- Chemistry does work no heat or energy required
- Easily scalable to well output
- Modular
- Portable
- Permits process control per well—or well groupings
- Redundancy
- Few specialized parts or storage vessels
- Safe for workers
- No fire or explosion hazard
- Minimize transport distance
- Recycle or dispose treated water on-site



PE3 Pods for dosing and mixing ionic fluid into oil

Reduction of Oil Sulfur Lab Test Results

Total sulfur testing was performed on two oil samples:

- Untreated: Untreated pyrolytic oil that has NOT been treated with chemical treatment
- Treated: Treated pyrolytic oil with chemical treatment

Raw pyrolytic oil	ASTM	Sulfur % m/m
Untreated	D4294	2.86
Treated	D4294	<0.99



**CONTROL
UNTREATED OIL**



TREATED OIL



Certificate of Analysis: DP21-04420.001

Date: 06-May-2021

GENERAL RESOURCES
1430 HAINES AVE
STES 108-186
RAPID CITY
SD
UNITED STATES
57701

The results shown in this test report specifically refer to the sample(s) tested as received unless otherwise stated. All tests have been performed using the latest revision of the methods indicated, unless specifically marked otherwise on the report. Precision parameters apply in the determination of the above results. Users of analytical results, when establishing conformance with commercial or regulatory requirements should note the full provisions of ASTM D3244, IP 367 and ISO 4259 in that context, the default confidence level of petroleum testing having been set at the 95% confidence level. Your attention is specifically drawn to Sections 7.3.6., 7.3.7 and 7.3.8 of ASTM D3244. With respect to the UOP methods listed in the report below the user is referred to the method and the statement within it specifying that the precision statements were determined using UOP Method 999. This Test Report is issued under the Company's General Conditions of Service (copy available upon request or on the company website at <https://www.sgs.com/en/terms-and-conditions>). Attention is drawn to the limitations of liability, indemnification and jurisdictional issues defined therein. This report shall not be reproduced except in full, without the written approval of the laboratory.

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CLIENT ORDER NUMBER :		SGS ORDER NO.:	4768058
LOCATION :	TEMPE, AZ	PRODUCT DESCRIPTION :	Oil
SAMPLE SOURCE :	As Supplied	SOURCE ID :	[REDACTED]
SAMPLE TYPE :	As Submitted	SAMPLED BY :	Client
SAMPLED :	--	RECEIVED	06-May-2021
ANALYSED :	06-May-2021	COMPLETED :	06-May-2021

PROPERTY	METHOD	RESULT UNITS	MIN	MAX
Total Sulfur Content	ASTM D4294	2.86 % (m/m)	--	--



Certificate of Analysis: DP21-04420.002

Date: 06-May-2021

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SAMPLE SOURCE :	As Supplied	SOURCE ID :	[REDACTED]
SAMPLE TYPE :	As Submitted	SAMPLED BY :	Client
SAMPLED :	--	RECEIVED	06-May-2021
ANALYSED :	06-May-2021	COMPLETED :	06-May-2021

PROPERTY	METHOD	RESULT UNITS	MIN	MAX
Total Sulfur Content	ASTM D4294	0.961 % (m/m)	--	--
** End of Analytical Results **				

Treated Oily Water Specimen Lab Results

(Candidate for deep well injection Disposal)

Oily Water Treated March 2022	
	<p>Untreated sample (left) compared to treated sample (right) immediately after the ionic fluid has been added.</p> <p>Untreated</p> <p>Sulfur 11.3 % API Gravity 18.3 Viscosity 207</p>
	<p>The treated sample after several hours of residence time. The aqueous solution is completely separated and the oil fraction is surrounded by layers of unidentified materials.</p> <p>Treated</p> <p>Sulfur 1.8 % API Gravity 32.3 Viscosity 395</p>

Single Treatment Operation

- ✓ Separate the oil from the wastewater
- ✓ Reduce the oil sulfur content from 11.3% to 1.8% (**84% reduction**)
- ✓ Remove all the other sediment from the oil
- ✓ Remove the same sediment from the water
- ✓ Increase the oil viscosity and viscosity of the extracted oil to a good quality oil sellable on commercial market
- ✓ Improve the quality of the water perhaps making the water re-usable or at least not require deep well injection disposal



Certificate of Analysis: DP22-10688.01

Date: 09-March-2022

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CLIENT ORDER NUMBER :	Cochise, AZ	SGS ORDER NO. :	4834853		
LOCATION :	As Supplied	PRODUCT DESCRIPTION :	Oil		
SAMPLE SOURCE :	As Submitted	SOURCE ID :	C22-SBCO-CONTROL		
SAMPLE TYPE :	--	SAMPLED BY :	Client		
SAMPLED :	09-March-2022	RECEIVED :	09-March-2022		
ANALYSED :	09-March-2022	COMPLETED :	09-March-2022		
PROPERTY	METHOD	RESULT	UNITS	MIN	MAX
Density at 60°F	ASTM D4052	905	kg/m³	--	--
API at 60°F	ASTM D4052	18.3	°API	--	--
Kinematic Viscosity at 40°C	ASTM D446	207.2	cSt	--	--
Total Sulfur Content	ASTM D4294	11.3	% (m/m)	--	--

**** End of Analytical Results ****

Certificate of Analysis: DP22-10688.02

Date: 09-March-2022

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CLIENT ORDER NUMBER :		SGS ORDER NO.:	4834853
LOCATION :	Cochise, AZ	PRODUCT DESCRIPTION :	Oil
SAMPLE SOURCE :	As Supplied	SOURCE ID :	C22-SBCO-TREATED
SAMPLE TYPE :	As Submitted	SAMPLED BY :	Client
SAMPLED :	-	RECEIVED	09-March-2022
ANALYSED :	09-March-2022	COMPLETED :	09-March-2022

PROPERTY	METHOD	RESULT UNITS	MIN	MAX
Density at 60°F	ASTM D4052	865.3 kg/m ³	--	--
API at 60°F	ASTM D4052	32.3 °API	--	--
Kinematic Viscosity at 40°C	ASTM D445	395.1 cSt	--	--
Total Sulfur Content	ASTM D4294	1.8 % (m/m)	--	--

** End of Analytical Results **

Process Flow in the Oilfield

Oil derrick pumps oil to pod for dosing and mixing with ionic fluid



Ionic fluid pumped From drums to pod For dosing oil



Pod doses oil with ionic fluid (incl. recycled)

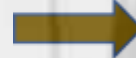
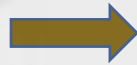
Settling tank for contaminants and ionic fluid to drop out



Pipeline or Tanker Truck To Refinery or Market



Transport by-products to landfill or markets



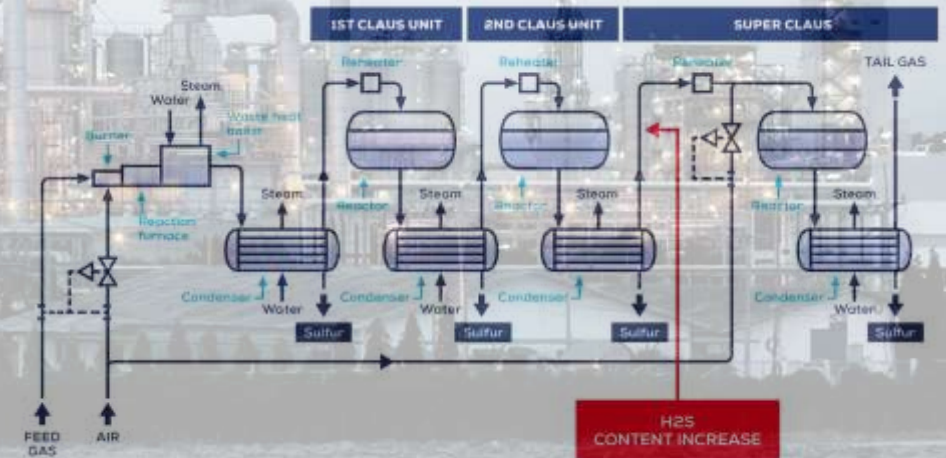
PE3 Provides Low Risk Offer to Upgrade

- No cost sample analysis of Client oil or water samples
- Provide initial recommendation based on results
- Provide client with sample product to conduct their own lab tests or experiments
- Work with client to design pilot to provide data for “full scale system” and real cost data and analysis
- Equipment can be leased during pilot
- Customer is never at financial or technical jeopardy as the original process is easily restored and can be taken off at any time or moved to another well site if needed.



Ionic Fluid Sulfur Recovery vs Refinery Desulfurization Unit

- Refinery sulfur recovery units are big, costly and costly to maintain.
- Alterations in crude quality cause major problems
- Not all potential crude buyers have this type of equipment to enable them to operate off sour crudes
- Crude providers can broaden their markets by removing sulfur at the wellhead
- PE3 system requires little fixed equipment purchases. Its processes are easily downsized or expanded unlike refinery sulfur recovery units
- PE3 process is cost effective enough to permit use to extract sulfur and other materials from wastewater as well.



KEY SUMMARY POINTS

- 1) PE3 provides inexpensive technology to desulfurize crude, to dewater it, and to remove other contaminants in a few short process steps
- 2) Technology is an ionic fluid targeted specifically for treating oil and wastewater
- 3) The capital equipment is leased negating any large risky capital investment.
- 4) The technology is flexible and will permit immediate scaling up or down.
- 5) Treating oil at the wellhead with our ionic fluid offers many cost advantages. The process does not require heat energy to work while refinery-based sulfur extraction requires 1,000 plus temperatures to work
- 6) The technology can reduce sulfur levels in petroleum products to meet European Union standards for ultra low Sulfur fuels
- 7) The company provides a free oil or wastewater analysis to get clients started on their solution. We also provide a product sample for the client to experiment with.
- 8) We work with clients to customize the technology meet client objectives and keep their formulations and other sensitive information secret



CAPTURE THE FUTURE...



Contact Us

✉ jay@prestige3e.com

📞 +1 707 335 6863

🌐 <https://prestige3e.com/>