

Flowfect Inc

Restores and Maximizes oil production by removing paraffin, asphaltenes, and other line blocking materials with its new **ParaGONE™ TECHNOLOGY**, a combination of **Paraflean™ (chemical)** and **Flowpal™ (process)**

Crude Oil and Waxes

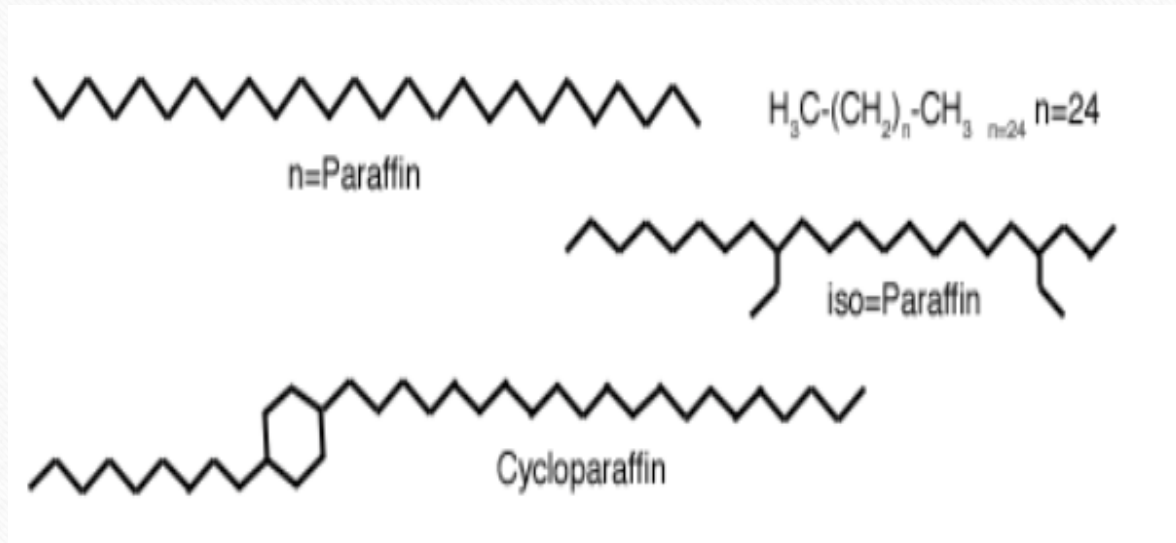
- Crude oil is a mixture of various hydrocarbons.
- They are divided into light, medium, and heavy materials based on their molecular weights and molecular sizes. Heavier materials are generally classified as “waxes” and more specifically as “paraffins” and “asphaltenes” depending upon their chemical composition.
- As the molecular weight of a crude oil component increases, its propensity to precipitate out of oil, over a falling temperature range, increases as well.
- As these waxes precipitate out, they clog and block the production lines.

Paraffin Problems Defined



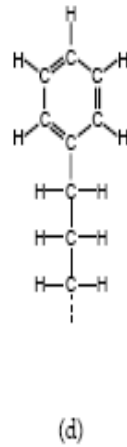
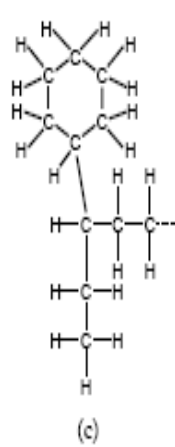
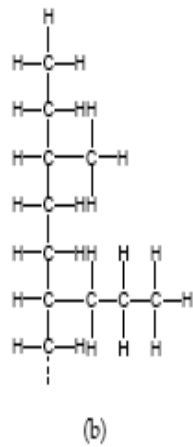
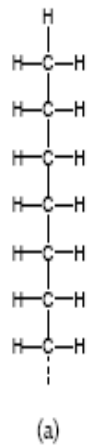
- Oil extraction industry is very familiar with paraffin and asphaltenes (wax) build-up.
- Approximately 85% world's oil is prone to precipitate deposits over time.
- The crippling effects of these deposits are evident when they restrict oil flow to the extent of ceasing the production altogether.
- If left untreated, paraffin deposits drastically reduce the efficiency of all oil recovery including flow lines, pipes, tube, even reservoir/formation itself

Structural Examples of Various Paraffin



- Open Chain-Unbranched
- Branched
- Cyclic Unbranched
- Cyclic Branched
- Longer chains are flexible and have very high tendency to “coil” or self-crosslink

Chemical structures of common waxes found in crude oil



COMMON BLOCKAGE REMEDIATION OPTIONS

Heat Treatments

- Melting the wax/plug by injecting hot fluid into the flowlines or wellbore area
- Hot oiling or hot watering

Mechanical Treatments

- Scrapping tools, sharp spears/scrappers/ knives
- Pigging

Chemical Treatments

- Use of paraffin dissolving solvents/chemicals

Heat Treatments and Their Challenges

- In hot oiling treatment, hot fluid is injected into the upper wellbore region or flowlines to remove the paraffin plugs by melting the wax.
- Due to their apparent low cost per treatment, heat treatment is the first choice of many operators for paraffin remediation, but very few operators recognize the cumulative costs and the long-term detrimental nature of these processes.
- Sandia National Laboratories for US Department of Energy (DOE) highlight the detrimental nature of hot oiling in their research in OSTI (DOE'S Office of Scientific and Technical Information) **Report # 10127994**

Heat Treatments and Their Challenges

- Formation damage
 - Formation damage occurs due to deposition of organic and particulate materials over time.
 - Melted wax has to be produced back, and therefore a pump is needed.
 - Even if a pump is running, it may not produce all of the wax, leaving a chance for the wax to potentially cause formation damage.
 - Unrecovered paraffin resulting from hot oiling runs deeper into the wellbore.

Heat Treatments and Their Challenges

- Thermal Effects
 - Crude oil is natural mixture of low and high molecular weight compounds. Paraffins are middle (C30-C50) and high (C50-C75) molecular weight species that precipitate out over a range of falling temperature.
 - Small quantities of low molecular weight (LMW) species present in paraffins keep them soft and helps them breakdown easily.
 - Since heat treatments supply “one temperature for all” they vaporizes LMWs and makes paraffin deposit harder and more compact. Also, straight long chain aliphatic paraffin molecules coil together as a result of repeated heat treatments to form even a harder and denser plugs. These newly formed materials cannot be melted anymore by simple heat treatment as their melting values reach above the melting capacity of the hot fluids.

Mechanical Treatments and Their Challenges

- Mechanical methods include the use of tools such as scrappers, knives, pigs, and other sharp devices to cut through the paraffin plugs.
- These methods are most effective, but their costs are significantly higher than heat and chemical treatments.
- Mechanical tools, especially pigs, regularly get stuck and lost in the flowlines, and their reclamation can take several days of suspended production, adding additional cost to the treatment.
- They do not recover solids, sediments, and other residues from the lines which leave the lines susceptible to subsequent clogging. Lines do open to their full inner diameter

Chemical Treatments and Their Challenges

- Removal of paraffin and other materials blocking the flowlines by the use of a solvent/chemical is the most obvious definition of a chemical treatment for blockage remediation.
- These chemicals are expected to soften and completely dissolve blockage materials.
- Accessibility to the plug, compatibility (chemicals ability to dissolve the wax), and health, occupational, and safety hazards are the main the challenges of a chemical treatment.

Chemical Treatments and Their Challenges

- **Accessibility to the plug**

- Most chemical treatments fail because their contact to the waxes is restricted by other materials in the line. Since they do not touch the waxes, chemicals cannot penetrate the wax matrix. Some users keep introducing more and more chemical to counter this effect.
- The treatment becomes expensive without producing any significant and positive results.

- **Chemical compatibility with the blockage material**

- Compositions of waxes and blockage materials differ widely
- Approaches like “one solvent works for all” cannot and does not work.
- Chemical suppliers do not put required effort and research in developing customized solutions for the end users. Instead, the end users end up spending their valuable revenues for “test products” that mostly do not work until the chemical company gives up on this trial and error approach or comes up with a new viable product.

Chemical Treatments and Their Challenges

- **Health, Occupational, and Safety Hazards**

Many paraffin remediation chemicals contain solvents like Benzene, Toluene, Xylenes, Methyl Ethyl Ketones, and Phenols.

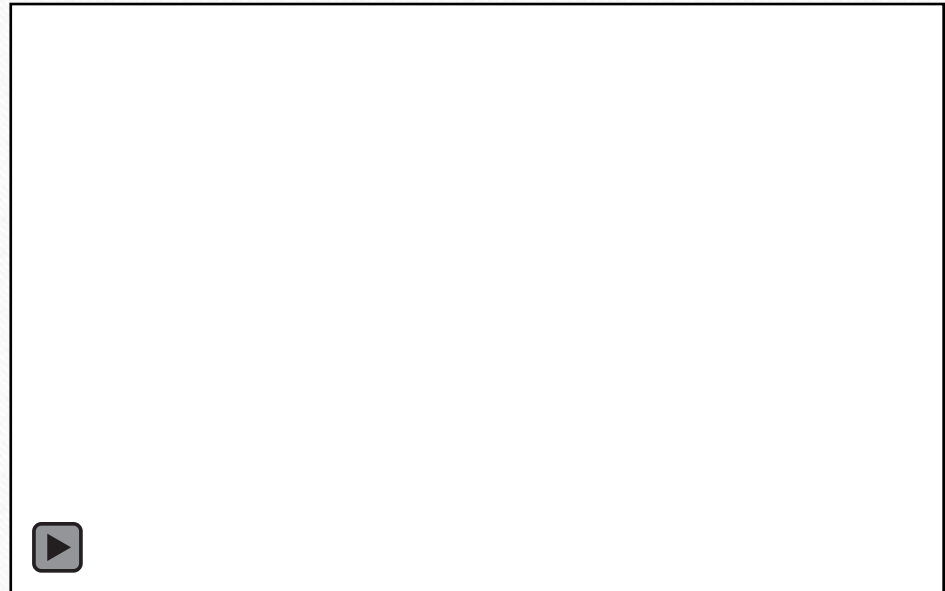
- Health
 - Many of these solvents are known carcinogens
 - Their volatile nature causes them to release fumes that impairs and negatively affect central nervous system
- Occupational
 - They are highly flammable and require extreme caution during their use.
- Safety
 - They require special safety gear specifically designed to handle these solvents.
 - Added expense

Flowfect Introduces ParaGONE™

ParaGONE™ Fundamentals

- **ParaGONE™** is Flowfect's new technology for paraffin, asphaltenes, and other blockage materials' remediation from the flowlines.
- **ParaGONE™** combines Flowfect's chemical product **Paraflean™** and wax cutting tool **Flowpal™** to offer a complete and full service solution to paraffin, asphaltenes, scale, hydrate, and other materials' remediation.
- **ParaGONE™** reclaims paraffin for potential sales and extra revenue generation.
- **ParaGONE™** combines the benefits of chemical and mechanical treatments and minimizes their challenges.

ParaGONE™ at Work (video)

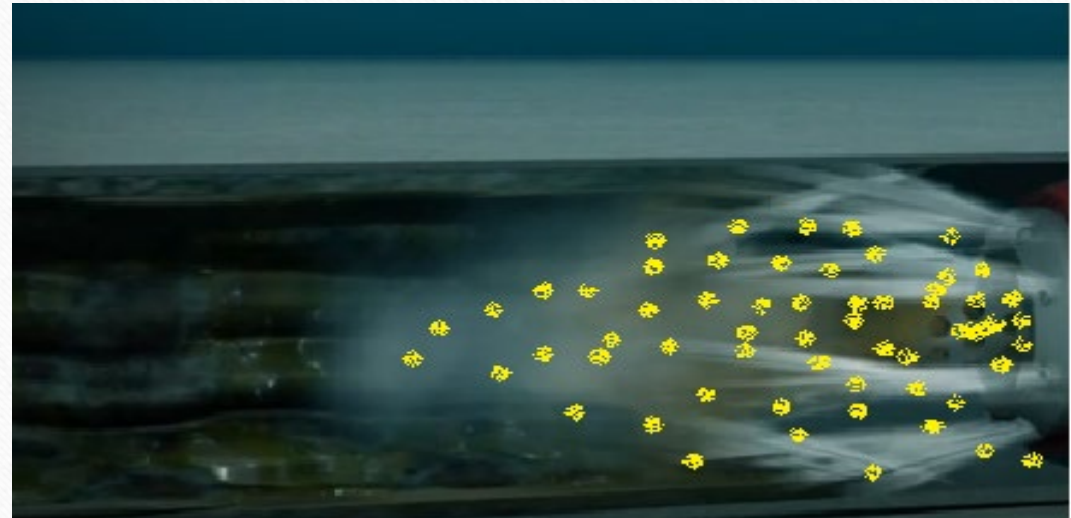


Flowfect Inc. Introduces Flowpal™

Flowpal™ Fundamentals

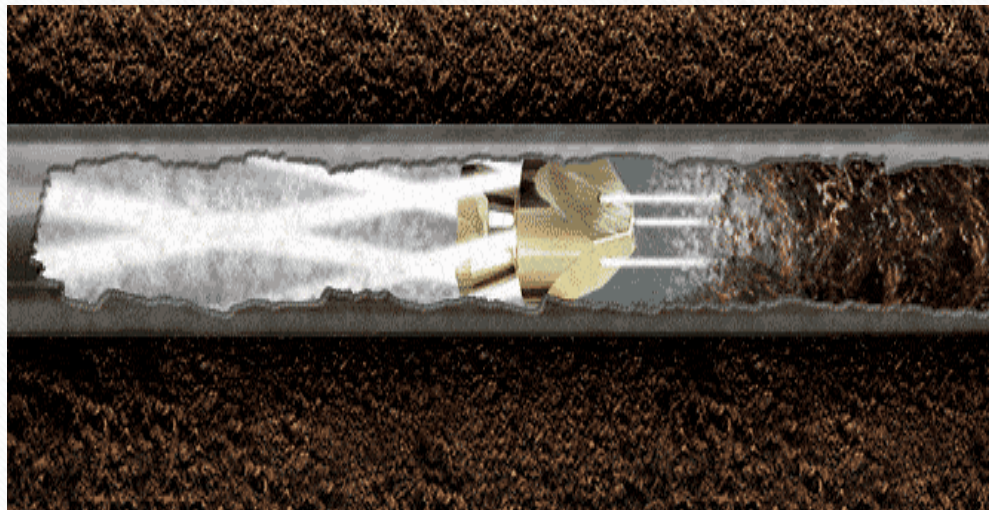
- Flowpal™ is Flowfect's new and innovative wax cutting tool.
- It self-propels itself to the location of the plug
- It cuts the waxes by injecting high velocity fluid jets into the plug matrix.

Flowpal™ in Action



Flowfect Introduces Flowpal™

Visual Representation Flowpal™ Cutting and Reclaiming Waxes



Flowpal™ Fundamentals

- **Flowpal™** delivers **Paraflean™**, Flowfect's wax softening and dissolving chemical, directly to the plug for maximum functionality.
- **Flowpal™** captures and return the solids, waxes, and other blockage materials to recovery vessel, minimizing residual debris and chances of tool being lost or stuck in the lines.

Flowfect Introduces Paraflean™

Paraflean™ Fundamentals

- **Paraflean™** is a proprietary blend of surfactants and solvents that chemically breaks down paraffin and asphaltenes.
- It decomposes high and middle molecular weight hydrocarbons into low molecular weight hydrocarbons, and thus reduces their pour point and wax appearance temperatures significantly.
- **Paraflean™** works very effectively in flow lines, wellbore, and injection or drip line applications.

Paraflean™ Sample



Flowfect Introduces Paraflean™

Paraflean™ Fundamentals

- **Paraflean™** does not require heating.
- **Paraflean™** is available in 3 three different formulations.
- Flowfect's in-house laboratory works with the users to customize the most suitable formulation.
- **Paraflean™** is free of Benzene, Toluene, Xylene, Phenols, Methyl Ethyl Ketone, and many other CNS affecting chemicals.

Paraflean™ induces and improves
paraffin flow at 40F



More On Paraflean™

- **Paraflean™** utilized in well treatment process had resulted in drastically increased production when paraffin deposition had restricted well flow. Production increases of 50% are not uncommon. In addition, flow lines are simultaneously cleaned and production is enhanced.
- Flowfect's products are currently being used very successfully in Eagle Ford Shale Basin with a major hydrocarbon producer. No other product and process have worked as effectively as Flowfect's.

Summary

- Flowfect provides a full services paraffin and flowline blockage material remediation with its new technology, **ParaGONE™**.
- It combines the benefits of heat, mechanical, and chemical remediation methods for wax removal from flowlines, and minimizes their challenges.
- **Paraflean™** is Flowfect's chemical product for paraffin and asphaltenes dissolution. It works best with **ParaGONE™** system, but it can also be used as a stand alone product.
- **Flowpal™** is Flowfect's wax cutting tool that breaks down flowline blocking materials and reclaims them.

FOR MORE INFORMATION AND INQUIRIES

PLEASE CONTACT
FLOWFECT INC.
AT

830-663-9858

Johnny.m@flowfect.com (Office and Field Services)

Syed.a@flowfect.com (Technical Inquiries and Laboratory Services)