WELL OPTIMIZATION

RAW BIOCHEM
Nature's Chemistry

RAW's revolutionary nano-technology formulation; "Increases production & Reduces lift costs"

EXECUTIVE SUMMARY

The oil and gas industry is increasingly being forced to convert heavier fractions of crude to meet surging global energy demand. These heavier fractions however contain a significant concentration of paraffin waxes and asphaltenes as well as numerous other macromolecules that require treatment before going to market. Without treatment, these waxes can cause hazardous and other more severe problems.

The overwhelming challenge for engineers is to prevent and reduce deposition in well bores, pipes, transfer and transmission lines.

Increased paraffin deposition on the inner surfaces of the well reduces flow diameter, decreases overall throughput and results in a higher pressure drop as the crude is pumped.

Asphaltenes add another layer of difficulty for paraffin wax treatment because it is almost always found in association with other waxes retrieved from wells, storage tanks and pipelines. Increasing flow velocity of crude may reduce paraffin wax deposition as less time in transition means less time for deposits to form, however; increasing fluid velocity also increases the likelihood of asphaltene deposition.

The issues of simultaneously treating both paraffin and asphaltenes is both difficult and costly using conventional petrochemical treatment programs and processes. RAW's revolutionary 2-step, water miscible nano-technology formulation has a proven track record in concurrently treating paraffin and asphaltenes.

The colloidal solution is comprised of electrically charged micelle measuring from 1 – 4 nanometers. Micelle are easily able to penetrate and separate long chain molecules before emulsifying paraffins, asphaltenes and other macromolecules without changing the API or characteristics of the crude.

RAW's formulation is activated with brine, fresh or produced water to create ceaselessly random micelle movement. The extreme micelle surface area to volume ratio enables far greater efficacy than conventional petrochemicals or other treatment processes.

The added benefits of using domestically grown formula ingredients are that product will not damage ferrous or non-ferrous metals, gaskets and seals.

Product is non-reactive. It will not create new and unwanted compounds or chemical reactions and will not foul gauges, valves or systems which then require additional chemical treatment to cure. RAW's formulation will continue to aid in scouring and cleaning pipelines, valves and componentry as it is transported to market.

Harnessing the power of micelle!

"Maximize existing resources and stave off production declines by focusing on reducing production costs, maintaining production rates and extending reserves."

PARAFFIN: Problem, Cause & Effect

Problem: Oil, gas and condensate wells experience product declines due to a variety of factors. One such factor is the buildup of paraffin wax, formed of long chain saturated hydrocarbons which result in wellbore blockages. Similarly, asphaltenes forged of fused aromatic rings can flocculate causing arterial and formation blockages. Traditional methodologies generally consist of flushing the well and near wellbore formation with solvents or acids. Too often, these methods are accompanied by their own inherent problems including costly solutions and environmental damage.

Cause & Effect: Generally, paraffin issues within a wellbore consist of macro crystalline structures. These structures are primarily composed of long chain, linear, saturated hydrocarbons. These structures prefer to remain in a liquid state if the temperature of the crude is high, or at the low end, the light hydrocarbon portion of the crude remains in the condensed phase rather than transforming into a gas phase; a condition clearly dependent upon pressure. As hydrocarbons move into the wellbore with temperature and pressure drops below that of the formation, nucleation occurs. These nucleation sites consist of, but are no limited to asphaltenes, corrosion, scale, silt or sand from the formation, and in hydraulically fracked wells the proppant itself tends to be an excellent nucleation site for paraffin. Once the nuclei are formed, continuous growth is an inevitable result.

Conventional Methods & Risks: There are a number of conventional methods used to remove the buildup of paraffin wax in oil wells with each carrying significant risks.

One method consists of flushing wells with heated oil to melt paraffin. Normally this heated oil would be run down the annulus into the bottom of the wellbore, melting the paraffin wax then returning it up the tubing. This method creates a significant risk that the melted paraffin can be carried back into the formation resulting in greater complications.

Another method involves the injection of solvents or heated water with a surfactant package. Traditionally, solvents such as xylene are used to dissolve the wax into a solution which is then pumped and removed from the well. Xylene and other benzene derived solvents lack desirability on two fronts, one is volatility and flammability and the other is its carcinogenic properties.

Transversely, when using a hot water surfactant application, the surfactant allows for dispersal of the waxes into the water phase through a combination of heat and micelle formation. This method is often difficult to successfully employ due to variations in interfacial tensions, micro and macro crystalline wax structures and formation water qualities. This makes it difficult to accurately predict and create the appropriate surfactant/cosurfactant package.

Traditional methods create costly solutions.

Same treatment processes and equipment; major improvements to production volumes and extended treatment cycles using RAW's proprietary formulations.

ASPHALTENES: Problem, Cause & Effect

Problem: Asphaltenes are not unlike paraffin and create difficult to manage down-hole well blockages. The mode of asphaltene blockage formation is flocculation, precipitation and deposition, all of which are difficult to model and predict.

Cause & Effect: There can be high percentages of fused aromatic and naphthenic rings in specific crude oils, but they exist as dissolved aggregates, creating very little issue with deposition. The asphaltene concentration levels in crude oil is not necessarily an accurate predictor of problems associated with blockages.

Rather, a combination of circumstances including water cut, shear forces and reservoir pressure help to determine the extent to which precipitation and blockages will occur. Additionally, an imbalance in the crude between basic nitrogen containing components such as primary amines and acidic functional groups such as carboxylic acids can help create accurate working models.

Conventional Methods & Risks: Traditional methodologies for treating well blockages due to asphaltene deposition are often like the treatments used for paraffin, although strong acids such as hydrofluoric and sulfuric are also commonly used.

These acid technologies have major drawbacks including significant regulatory and worker safety issues and serious questions regarding their effectiveness.

They undeniably contribute to the removal of blockages, but they can also contribute to formation damage, as well as potentially souring crude and creating imbalances in the pH down-hole which leads to more favourable conditions for rapid redeposition of asphaltenes.

Restore pH imbalance with RAW well optimization.

"Not only did these formerly shut-in wells come back to or exceed their former production levels, treatment cycles were extended from every 10 days to 2 – 3 months.

CASE STUDY

Well #1: After repeated doses using conventional chemical treatment methods to well #1, it had shown there was no production value in keeping the well operating. The well was shut-in and had no production for 16 months prior to RAW's stimulation program. Prior to shut-in its maximum production had been 152 barrels of oil/day. After RAW's Paraffin/Asphaltene Well Optimizer products were used, production rose to 350 barrels per day and remained open 5 times longer than the best traditional chemical treatments could affect. The comparison of open production times was compared to the wells 3-year prior operating history.

Well #2: Historical production figures for well #2 showed that flow had ranged from 92 barrels/day to a maximum of 134 barrels/day. This well had not been in production for several years when pumping gas oil and wire line work were unsuccessfully attempted to stimulate the well. After RAW Paraffin/Asphaltene Well Optimizer products were introduced, the well was successfully brought back to production and averaged 40 barrels of oil/day.

Well #3: Well #3 had been in continuous production since 1956 with its last production date of March 2012. Prior to complete shut-down due to paraffin issues, this well had produced an average of 50 barrels/day. After RAW's Well Optimizer product were applied and allowed to soak for 12 hours, production once again registered 50 barrels/day.

Well #4: Well #4 was completed in 1986. In 2011, it was producing an average of 54 barrels/day but by Jan 5, 2012 it showed no communication between well and head (*no production*) and was shut-in. RAW's Well Optimizer products were forced down-hole and allowed to soak for 4 days. Following this, production was resumed and exceeded 150 barrels of oil/day for a net production increase of 180%.

Well #5: In 2010, the last test performed on this well showed production at 18 barrels/day, but the well was shut-in two months later due to paraffin/wax build-up issues. RAW's Well Optimizer was injected down-hole and allowed to soak for 24 hours. When production was reinstated, well #5 resumed its production and averaged 10 barrels/day. 2 months later and without further stimulation it maintained production of 18 barrels/day.

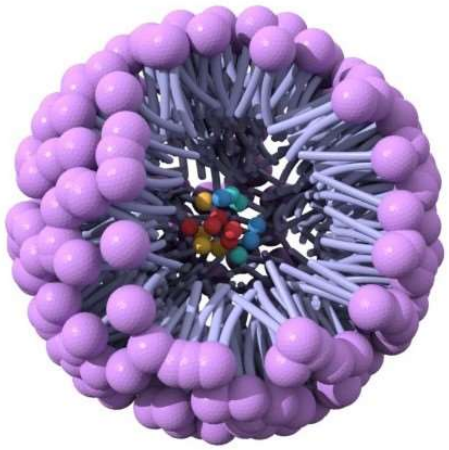
Even with an API of 8, wells flowed freely once again.

All RAW Biochem ingredients and products are classified as non-reactive. They will not form new or unwanted chemicals and compounds through an association with various other types of natural or man-made chemicals.

The underlying foundation to all RAW products is readily biodegradable, non-toxic surfactants.

Surfactants (*Surface Active Agents*) form masses with a Lipophilic (*oil-compatible*) tail and Hydrophilic (*water-compatible*) head which enables solvents (*active ingredients*) and other ingredients to be applied in unison rather than as separate processes.

Solvents contained within RAW formulations enable surfactants to penetrate through the FOG (*Fats, Oils & Grease*) to the water interface (*water, hydrocarbon, glycols*).



At the interface, surfactants reduce the surface tension which allows the fat, oil or grease to separate from other FOG components or other substrates and surfaces. The liberated FOG components enter the water as tiny droplets.

In many cases the surfactant has also been designed as a demulsification agent which in turn forces these now emulsified FOG particles to be lifted to the surface for immediate recovery.

After demulsification, the remaining colloidal solution can remain in-situ for repeated use, or can be disposed of through standard discharge protocols.

NON-REACTIVE

Disposal processes should follow local municipal guidelines and regulations.

This non-reactive nature enables the creative design of alternative formulations which can perform new and increasingly difficult tasks by multi-tasking or by working in unison.

RAW products will not create new and unwanted compounds!

Their inability to chemically "react" offers the opportunity to design formulations which continue to perform their original function even with additional ingredient components. This new recipe will now carry on multiple diverse functions within the same application process.

It may as an example remove or separate adhered FOG components from a variety of substrates while concurrently scavenging H2S as well as removing mineral scale/calcium build-up.

This new non-reactive formulation may also incorporate petrochemicals or other man-made compounds without negatively impacting the original non-reactive ingredients.

At RAW Biochem, we are using nature's ingredients to solve problems.

It's called "Bio-utilization"!

HISTORY

Man's use of nature to overcome problems can be traced back to the early 1800's when pyrethrum flowers (*Chrysanthemum's*) were used as insecticides. By 1828 this earliest insecticide was being used extensively in Persia, Yugoslavia and even imported to the US for this purpose.

The origin of colloidal chemistry can be traced to the 1880's when it was evolved by David Graham, a British chemist. This discovery was so monumental that 50 years later one of the world's great scholars publicly enthused "There is as I see it, just one great development left for our time. That is in the understanding of colloidal metals. It is the "Fourth Estate of Matter", the other three being land, water and air".

Agriculturists, scientists and industrial leaders coined the term Chemurgy to describe the use of farm products for industry

Early leaders included Henry Ford who claimed every car had at least a bushel of soybean in it.

The science of "green" chemistry soon waned and eventually lapsed as major discoveries of oil & gas combined with breakthrough's in catalytic cracking with an almost endless supply of oil became available to create new compounds which became known as chemicals.

Recent gains in our knowledge and understanding of "the science" have launched the green chemical and lubricant industry into the forefront through a better understanding of bio-based ingredients.

"Nature's Chemistry"

As an example, the electron microscope has enabled researchers to view ingredients at the molecular level.

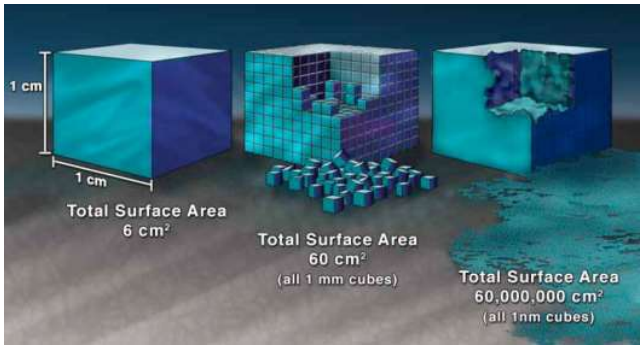
This; combined with a greater understanding of plant characteristics has permitted green chemistries and lubricants to make great strides forward to where they are now able to perform tasks which in many cases are not achievable through conventional petrochemicals.

Nano-technology is a term defined as particles with dimensions of between 1 – 100 nano-meters (*nm*).

To put that in perspective;

- A human hair is between 50-100,000 nm.
- Your DNA is ~ 2nm
- Your fingernails grow 1 nm/second

A solid cube of a material 1 cm on each side has 6 square centimeters of surface area, about equal to one side of half a stick of gum. But if that volume of 1 cubic centimeter of volume is filled with 1-nanometer-sized cubes—10^{21} of them, their total surface area comes to 6,000 square meters.



In other words, a single cubic centimeter of cubic nanoparticles has a total surface area one-third larger than a football field when reduced to nano-size!

At this scale, many of the properties which you have been taught are true or are visible at the physical level significantly change.

This is the point where so-called quantum effects rule the behavior and properties of particles.

When particle size is made to be nanoscale, properties such as melting point, fluorescence, electrical conductivity, magnetic permeability, and chemical reactivity change as a function of the size of the particle.

Several examples of these changes include:

- Gold at the nano-scale is a deep pink or rose colour

NANO-TECHNOLOGY

- At the physical level positive magnetic poles are attracted to negative poles but like poles are attracted to each other at the nano-scale.

Nano-technology is integral to the success and efficacy of RAW Biochem products but are also playing a major part in many of the advancements we are seeing in industry.

Scientists are improving solar cells by adding nano-scale texture that traps light so that less is reflected away allowing more to be converted into energy.

Engineers have made nano-scale wearable sensors for plants enabling measurements for water use in crops.

In medicine, nano-technology is being adapted to deliver medicine directly to cancer cells and minimizing damage to healthy tissue.

In transportation, cars have nano-enabled stronger car parts, rechargeable batteries, cleaner exhaust and materials for better temperature control.

Nanotechnology surrounds us and we use its benefits everyday.

Product strength and efficacy is only part of the story!
HR & Environmental budgets will thank you too

RAW Biochem:

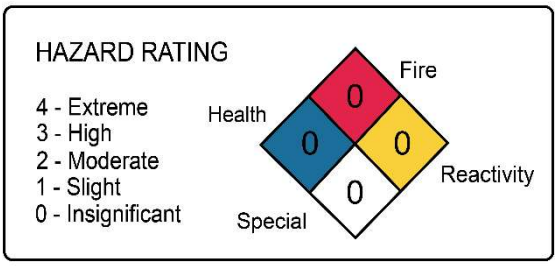
- Non-reactive
- Non-toxic
- Non-flammable
- No VOC's
- Non-corrosive
- Non-caustic
- Non-hazardous
- Non-comedogenic

HR & ENVIRONMENTAL

Improved HR budgets!

The benefits of RAW's extraordinary ZERO hazard rating will reduce or eliminate:

- Worker liability premiums
- Personal protective equipment
- Sick days & time off from chemical injuries
- Handling, transportation and storage costs



Extended Equipment Life

RAW's safe-to-use products are also easy on valuable equipment components. They will not damage, scar or harm substrates while they complete their tasks.

- Extend equipment duty cycles and increase operational hours.
- Reduce parts and infrastructure replacement costs
- Maximize valuable employees by minimizing maintenance costs.

Environmental Remediation Budgets

If remediation budgets are at the tipping point, RAW chemicals will help!

The readily biodegradable status carried by all RAW products allow them to biodegrade to their natural state within 28 days when exposed to sunlight, water and microbial activity.

- Environmental budgets are reduced
- Transportation and disposal costs are lessened
- GHG emissions are less intense
- Discharge fees are minimized
- On-site hazard safety measures are mitigated

GREAT BENEFITS

BOTTOM LINE: Competitively priced RAW formulations perform at superior levels and add bottom line value to your operations.

SUPERIOR EFFICACY: These proprietary nano-technology formulations are proven to perform tasks petrochemicals are unable to complete.

WORKER SAFETY: The RAW advantage includes fewer days lost from health and safety issues when using SAFE nano-technology products.

The ENVIRONMENT: Products meet or exceed all of the guidelines and regulations for environmental safety through ***GREEN*** ingredients.

PEACE OF MIND: Eliminates trade offs between budgets, environmental consequences or healthy and safety programs

CUSTOM SOLUTIONS: Can't find what you are looking for? Ask us! If we don't already have the answer you are looking for, we will create one.

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