

GLOBAL EXPLORATION & PRODUCTION NEWS

November 2009

MEOR finds oil where it has already been discovered

On average, with the best currently available technology, only 35% to 45% of the original-oil-in-place in an oil field can be recovered. A new technology has the potential to bring a large quantity of that trapped oil into production.

By Brian Marcotte, Bradley Govreau, and C. Paul Davis, Titan Oil Recovery Inc.

There is much debate on the topic of global supply and demand for crude oil. Many believe that peak oil production has occurred or will occur shortly. Others argue that there are still ample reserves to meet foreseeable need. Both camps agree, however, that production efficiency is important for the long-term supply of the world's energy demand. Few new giant oil fields have been discovered since the early 1970s, and most existing fields are experiencing significant production decline. There is a critical need for technology that increases oil recovery.

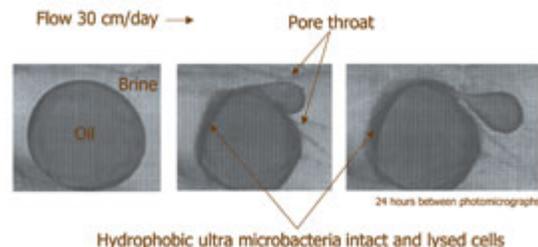
The Titan Process uses microbial enhanced oil recovery (MEOR) to “find” oil where it has already been discovered by releasing oil that is trapped in the formation. The Titan Process has been successfully demonstrated on both onshore and offshore fields on three continents with ongoing commercial field projects.

Current (2007-2009) applications have yielded 16 production increases in 19 applications for an 84% success rate.

The scientific solution

MEOR has been discussed for decades, but until recently has been dismissed as “snake oil.” The principles of the process, however, are sound, and a new twist on this technology is beginning to emerge for increasing oil recovery in existing fields. Technically this is a new tertiary process, but, in reality, it is being recognized as a new category of recovery.

When combined with existing waterflood projects, this “bioflood” accesses naturally occurring microbes living in the reservoir to cause the oil to flow more freely.



Activating certain identified species of microbes effects changes in flow characteristics of oil and induces the reservoir system to release additional oil to the active flow channels. (Image courtesy of Titan Oil Recovery Inc.)

Laboratory analysis indicates that Titan's MEOR technology can add up to 10% additional oil recovery from the existing original-oil-in-place. Globally, this could result in many billions of additional barrels of oil. The MEOR process also can be used in conjunction with other secondary or tertiary recovery methods to further enhance those processes when conditions allow.

The Titan Process uses a proprietary approach to MEOR, targeting mature oil fields currently using conventional waterflood operations as a means of secondary recovery. Unlike previous attempts at MEOR, this process does not introduce microbes into the oil-producing reservoir. Instead, through sophisticated analysis of field-specific crude oil and water samples, microbes that are naturally indigenous to the oil reservoir are identified and quantified, allowing a "designer mixture" of environmentally benign nutrients to be formulated and released into the reservoir via the water injection system.

Each reservoir is treated with a specific, unique, targeted nutrient formula. The process is designed for crude oil production and is not currently suitable for natural gas or condensate fields or for heavy oil reservoirs.

Activating certain identified species of microbes effects changes in flow characteristics of oil and induces the reservoir system to release additional oil to the active flow channels. In very highly permeable portions of the reservoir ("thief zones"), newly released oil, water, and microbes can interact to form a transient micro-emulsion that effectively alters the sweep efficiency of the injected water as it moves through the reservoir to improve production.

The problem

Of the oil being produced today, 80% is from fields discovered before 1973. Many (if not most) of these fields are now in terminal production declines, yet 55% to 65% of the oil remains trapped. Mature fields being maintained with increasingly more expensive recovery methods are experiencing annual production declines of 4% to 15% and are struggling to maintain profitability. The Titan Process has proven to be effective in increasing, stabilizing, or mitigating production declines.

More than 20,000 wells are abandoned every year in the US as they become noncommercial. Approximately 285,000 shut-in wells in the US are potential targets for MEOR revival. Internationally there are about 800,000 more shut-in wells, a significant percentage of which could benefit from the Titan Process.

The answer

The mechanics of MEOR at a molecular level are quite simple. The microbes used in the Titan MEOR process are organic-nutrient-utilizing, non-pathogenic microorganisms that occur naturally in oil reservoirs. They are non-threatening for plants, animals, and humans. They ingest organic material as a food source, which they metabolize during their life cycle.

The microbial “digestive” process can form various bio-products such as alcohols, gases, acids, surfactants, and polymers, which, because of their origin, are all natural. For many microbial processes, bio-products (which are excreted by the microorganisms) cause a series of desirable changes in the physical-chemical properties of the crude oil. Almost all previous and competing MEOR methods attempt to modify the behavior of microbes to produce bio-gas, bio-surfactants (soapy substance), and bio-polymers (molecules that can thicken liquids) to effect the desired changes in the oil.

The Titan Process is unique because it does not require the microbes to excrete anything. The microbes are induced to become attracted to trapped oil causing it to break into smaller droplets with reduced interfacial tension (“frictional” effects between oil and water) so oil can flow more freely through the rock.

The oil characteristics do not change, but the flow characteristics and viscosity are significantly improved.

Combining bio-science with conventional petroleum engineering sciences can improve oil recovery. Many reservoirs contain naturally occurring microbes within the subsurface oil-water system. In other words, the reservoir harbors a natural bio-mass that comprises trillions of microbes. Feeding and managing the ecology of the biomass with a specific nutrient formula allows potentially large amounts of oil to be recovered.

The Titan Process only uses biodegradable, microbe-free nutrients that are formulated to direct the work in the reservoir. The Titan Process is environmentally safe.

Non-glucose nutrient formulas are reservoir-specific based on thousands of empirical tests on many diverse types of crude oil. The existing natural microbial population is fed a small amount of food that is assimilated by the microbes. There is no change to the biological or chemical makeup of the reservoir oil. There is no adverse environmental impact. Harmful chemicals, acids, and corrosive gas injections are eliminated from this enhanced oil recovery process. Sulfate reducing bacteria, which produce a detrimental substance, hydrogen sulfide (H₂S), are crowded out by the microbes that are fed the Titan nutrients. Field tests show that H₂S levels have been reduced in treated portions of the reservoir.

physical geoscience with the biological science of microbiology to allow the production of oil by managing and utilizing the biological energy of the oil reservoir itself.

Success in the field

Titan's MEOR Process has been field tested in commercial applications. Approximately 50 individual well treatments have been performed with more than half of these in the past twenty months. Recent and ongoing field successes have proven the commercial viability of the Titan Process. Five oil fields on three continents where Titan's process was applied during the research and development "proof of concept" phase increased oil production of 19% to 100%. Current (2007-2009) applications have yielded 16 production increases in 19 applications for an 84% success rate.

The current commercial phase of operations (2007-2009) has led to 35 individual treatments on both producing and water injection wells. In accordance with treatment protocols, several of the wells received multiple treatments to prolong the effectiveness. These have yielded 13 production increases in 14 wells or pilot study areas for a 93% success rate.

Highlights for wells and production areas treated with the Titan Process.

CURRENT OPERATIONS	PER CENT INCREASE PRE TREAT VS.POST-TREAT PEAK	COMMENTS
California onshore	24% single producer	Short-term increase
Canada pilot injector	27% on adjacent producers	
California onshore	32% single producer	
Canada pilot injector	44% on adjacent producers	
California pilot	45% on six offset producers	
California offshore	47% single producer	Short-term increase
Canada pilot injector	64% on adjacent producers	
Canada	100% single producer	
Canada	225% single producer	
Canada pilot injector	261% on adjacent producers	
Canada	387% single producer	
Canada	525% single producer	
California	550% single producer	
Canada	850% idle well return*	
California	900% idle well return*	Response to Injection Pilot Not a direct treatment
Canada	1000% single producer	
California onshore	0%	
Canada	0%	
California offshore	0%	
California pilot injector	Not Available	Results Pending

Production increases are based on peak post-treatment well tests as a common comparative measurement.

* Since these wells were idle pre-treatment, the increase is technically infinite, but they ranged from 17-38 barrels of "new" oil in post treatment production. Percentages are based on previous last production test before being shut in.



July 8 2011

[HOME](#)

[DRILLING](#) [PRODUCTION](#) [OFFSHORE](#)



Microbes Could Mitigate Effects of Peak Oil

At first, peak oil and microbial enhanced oil recovery (MEOR) would not seem to be related. However, within the oil industry both issues are being debated more seriously today than at any time in the past. Both have to do with oil supply.

C. Paul Davis, Titan Oil Recovery Inc.

As recently as 2005 very few oil people believed in peak oil. The fact that oil supply could no longer keep up with demand, or oil production had reached its maximum level of production, or more than half of the world's original oil supply (estimated to be about 3 trillion barrels) has been used was not accepted nor even widely discussed. Most believed peak oil was really a "myth" and that the problems regarding adequate oil supply were "above the ground and not below the ground." Perhaps less than 10% of oil people believed in peak oil at that time.

Six years later, the tide has shifted and as many as 50% of those involved in the industry may now believe in (or have a concern about) peak oil. The topic finally has been brought to the forefront for serious discussion.

MEOR

The debate about using microbes to recover oil has been ongoing for more than 70 years. Is MEOR a viable and economical way to recover a portion of the estimated 6.2 trillion barrels of oil trapped in global oil fields? Until recently, most oil people would have said MEOR is “old technology that doesn’t work.”

There used to be a good reason for this position. Most prior MEOR applications for recovering oil simply did not work, or if they did, the results (recovering oil) were sporadic, unreliable, and simply a “hit or miss” proposition that created a negative reputation for MEOR.

Since its inception 10 years ago, Titan has invested \$30 million to refine its technology. Documented field treatment results indicate the company has developed viable MEOR technology.

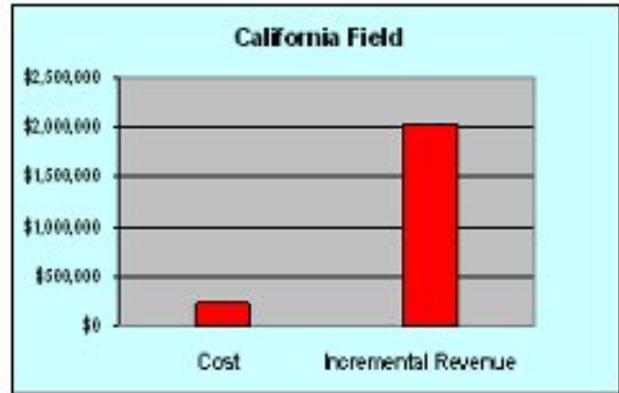
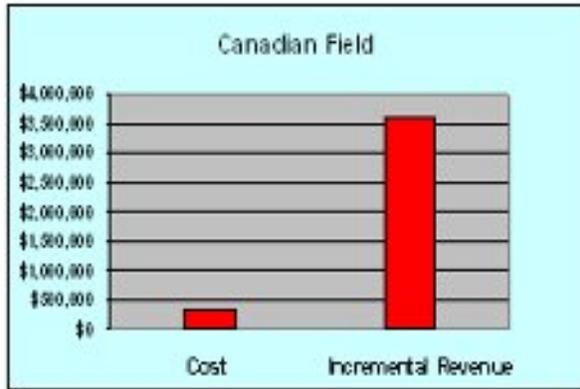
Titan Oil Field Applications (July 2007 to December 2010)

Titan has gathered and analyzed data from 106 treatment applications on 15 oil fields. Highlights Include:

- 100% success rate on injector well treatments;
- 80% success rate on producer well treatments;
- 55 wells with 88 treatments showed an average production increase of 127%;
- 98 treatments of the 106 planned treatments are completed (eight pending);
- The Titan process creates positive oil production response in oil fields;
- The average cost per incremental barrel for two full-field applications was less than US \$10/bbl (compared to \$20-50/incremental bbl for other EOR methods).

The table below shows that organic oil recovery creates the desired oil production response in oil fields by releasing trapped oil from the reservoir. This table indicates the performance as measured by an increase in oil production rate comparing pre-treatment rate with post-treatment “peak rate” measured by operator well tests.

Two Fields with Full Field Applications of the Titan Process



As organic oil recovery technologies achieve wider use with proven success, the process has the potential to become a widely accepted “norm” as an adjunct to waterflooding in appropriate types of oil reservoirs. Then, organic oil recovery will be an accepted process to mitigate the serious impact of peak oil as it, too, becomes a more widely accepted concept.

Production Rate Increase Performance

Summary	# of Wells	# of TMTs	# of Increases	Success Rate	% Oil Increase
PRODUCERS	35	38	28	80%	205%
INJECTORS					
Confirmed Results	27	60	27	100%	47%
Pending	3	8			
ALL WELLS					
Wells Treated-Confirmed Results	62	98	55	89%	127%
Wells Treated - Pending	3	8			
TOTAL	65	106			