Breakthrough ENGENUITY
"Where Engineering Meets Ingenuity"

Cut Chemical Costs
By 50% or more!

Oilfield chemical are a necessity in most production operations. Yet over 50% of most chemicals injected never reach their targets!

The methods of injection, not the chemicals themselves, are at fault. This paper explains what can be done to improve chemical delivery methods which can result in at least a 50% reduction in chemical usage and chemical costs!

CHEMICAL APPLICATIONS

The success or failure of most chemical treatment programs depends on two basic elements:

1. ***The selection of the right chemical product.***
2. ***The proper application method.***

Chemical selection is relatively easy, in most cases. There are only a handful of chemicals available for any one application. If one fails, another can be readily substituted. Also, chemical concentrations are relatively constant, so the opportunity to reduce chemical costs does not normally focus on the chemical selected. Instead, it is the application method that offers the real opportunity to reduce costs! While these opportunities might seem to be comparatively obvious, they are often completely overlooked. So, this paper focuses on the application methods that can significantly reduce chemical usage and associated costs.

TURBULENCE POINTS

Injection points are normally installed where it is easiest to install them, and very little thought is given to anything else. While it should be fairly obvious that the ideal point to inject any chemical is immediately upstream of a point where turbulence and mixing exists, the fact is that chemical injection points are rarely selected based on anything other than convenience! This needs to change!

Injecting a chemical immediately upstream of a point where downstream turbulence exists is certain to mix most of the injected chemical with most of the produced fluid. This mixing assures that more of the chemical is exposed to more of the produced fluid. Accomplishing this can reduce chemical usage by 25% or more. This should be obvious, but it is often overlooked. Again, this needs to change!

To bring about this change we need to ask ourselves, "Where do ideal chemical injection points exist?" The answer is, "Anyplace where turbulence exists."

Here's a short list of a few examples:

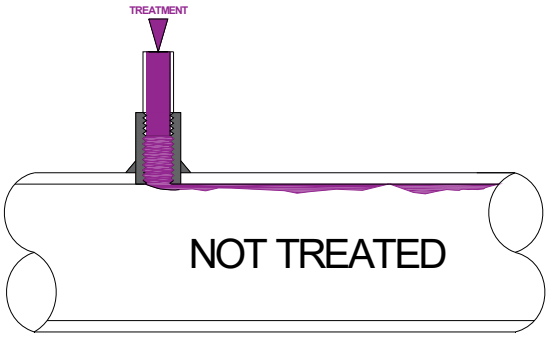
- *The inlet to downhole or surface pumps.*
- *The upstream side of a wellhead choke.*
- *The upstream side of a gas-liquid separator.*

Mixing is key. Wherever mixing occurs, chemical consumption will be reduced, and costs will be reduced.

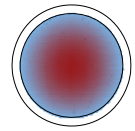
By relocating a chemical injection point to a point just upstream of a turbulent area chemical usage will be reduced by up to 25% or more.

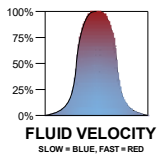
WHY INJECTING INTO PIPE WALLS DOESN'T WORK

The most common chemical injection occurs when chemical are injected into a coupling or Thread-o-let welded to the sidewall of the pipeline to be treated. A chemical pump, usually the pulsating type, draws chemicals from a drum or tote, and injects a few cc's with each stroke into the injection point. It looks something like this:



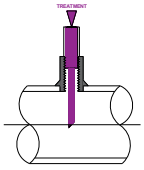
The problem here is the lack of turbulence and mixing at the ID of the pipe wall. The reality of laminar flow in pipes is that over 80% of the flow concentrates in the 20% of the cross section right in the center of the pipe as shown in the graphic at the left. Velocity is high in this 20% area, but the velocity falls off to very near zero at the pipe wall where the chemical is supposed to enter the fluid stream. Since there is almost no flow at the wall, the injected treating chemical tends to concentrate on the pipe wall where it fails to mix with the passing fluid. With almost no flow at the pipe wall the injected chemical has no way of mixing with the produced fluids in the pipeline, and most chemical goes unused.





In an effort to overcome this and achieve some measure of mixing and treating efficiency, most chemical technicians increase dosages. This over-treatment simply means the chemical pumps pump more chemical more frequently in an effort to force more of the treating chemical into the fluids flowing past the injection point. This works to some degree, but increases chemical consumption and treatment costs …not good!

INJECTION QUILLS - A BETTER APPROACH



As seen above, the majority of flowing fluids flow through the center of any pipeline. Since the most turbulent zone in a pipeline is in the very middle of the line, a system that moves the concentrated chemical into this area vastly improves the distribution and mixing of the chemical with the produced fluid. Injecting chemicals into the turbulent zone improves mixing. This simply means that more of the produced fluid is exposed to treating chemical, which increases its effectiveness, reduces usage and chemical costs.

Again, any increase in treating effectiveness translates to less chemical usage, and reduced chemical costs. In this case, the use of an injection quill ***reduces chemical usage and costs by at least 25%****!*

And, when chemical injection through an injection quill can be accomplished immediately upstream of a turbulent zone like the inlet to a separator, ***overall chemical usage can be reduced by 50% or mor****e!*

THE ROLE OF CHEMICAL PUMPS – WHAT'S BEST

Most chemical pumps are either plunger types or diaphragm types. These chemical injection pumps are designed to inject a few cc's of the treating chemical with each stroke or pulse, stroking or pulsing a few times each minute in an effort to achieve the average daily injection concentration. Ideal injection concentrations typically range from 5 to 240 parts per million.

PLUNGER PUMP

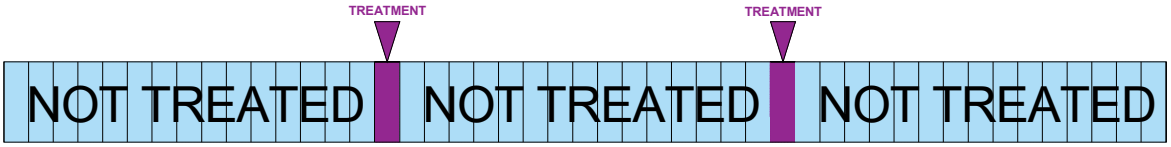
DIAPHRAM PUMP

For instance, one quart of a treating chemical injected into 100 barrels of produced fluid per day is roughly equivalent to 60 parts per million. This means a 10,000 waterflood treated with 15 ppm of scale inhibitor will need 25 quarts or 6.25 gallons of scale inhibitor each day. If each gallon costs $15.00, the annual cost will be $34,218.75 annually. The opportunity to save 50% of this means an annual saving of over $17,000 annually. The suggestions above will go a long way in providing these savings.

However, the use of these industry-standard chemical pumps has a serious drawback. That drawback is the fact that only small amounts of treating chemicals are injected intermittently into only a small percentage of the produced fluids flowing past the point of chemical injection. Each pulse of the pump represents a very small volume of the treating chemical injected in a very small increment of time.

The fluid flow in pipelines is ideally laminar. This avoids turbulent flow, erosion corrosion, and intimate fluid mixing. Ideal laminar flow velocities range from 5 to 10 feet per second; the velocity needed to keep entrained solids from settling into the bottom of the pipeline, building up, and eventually choking it off. However, with fluids flowing at the 5-10'/second velocity, and chemical pumps only intermittently injecting chemicals in small bursts, a very small percentage of the produced fluid gets exposed to the chemical.

Using the example of a 10,000 barrel per day waterflood, the diaphragm chemical pump injects treating chemicals into an injection quill once every 15 seconds, injecting the treating chemical treating only 1/15th (0.067%) of the time! And the reality of this is that an even lesser fraction of the fluid is treated! You see, properly sized the line would be a 4" line and the flow velocity would be 7.45 feet per second. In the half-second chemical pump pulse of treating chemical only 3.725 feet of moving fluid, or 2.43 gallons (0.058 barrels) would be exposed to the treating chemical. Another 111.75 feet of fluid, or 72.93 gallons (1.73 barrels) would flow past the injection quill before the next dose of chemical was injected. So, only 3.3% of the fluid would actually be treated in this example. We can see this in the graphic below where the purple chemical is injected into stream of produced fluid.



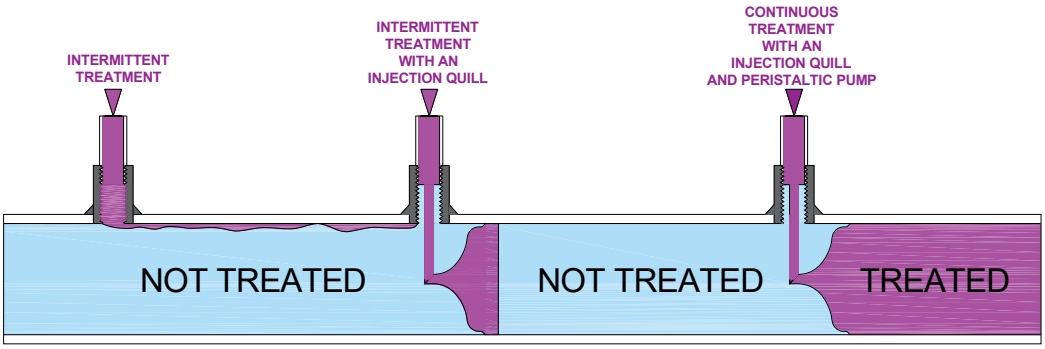
In order to treat a larger percentage of the passing fluids in this example, and since most injection points are not in ideal locations, we are forced to over-treat with higher concentrations! Since over-treatment increases usage, chemical costs increase … just the opposite of our objective!

A BETTER APPRAOCH


PERISTALTIC PUMP

There is a better way! The best and surest way to achieve the ideal treating efficiency and the savings that come with it is to add one more feature to the above recommendations. That feature involves the use of a specialty chemical pump known as the peristaltic pump. This pump is unlike either the plunger or diaphragm chemical pump. Instead of injecting the treating chemical in small squirts or pulses, it ***continuously feeds*** *a stream of the treating chemical into the injection quill. It accomplishes this by using a rotating eccentric cam that squeezes a small by continuous stream of treating chemical out of a loop of silicon tubing. This type of pump was first developed for use during open heart surgery, and only found its way into industry in the past decade or so. It looks like the picture above-right. While peristaltic chemical feed pumps do cost more (from 25% to 100%), the added cost pays out in a matter of weeks through reduced chemical usage and costs.*

METHODS COMPARISON



By comparing the three methods of introducing treating chemicals to produced fluid streams described above we can easily see the benefits of doing it right using injection quills and peristaltic chemical pumps.

CONCLUSION

Using the same age-old method of injecting treating chemicals into flow lines or any pipeline is wasteful and costly. Adding simple chemical injection quills, available in most reputable supply stores for under $50 each, and using peristaltic chemical feed pumps wherever possible can ***reduce chemical usage by at least 50%*** *… and often more.*

ABOUT THE AUTHOR

Bill Ball is the founder and owner of Breakthrough Engenuity LLC. He has had a distinguished career in the field of oilfield separation, and has a comprehensive list of related patents. Bill's hands-on oilfield experience and career portfolio make him one of the industry's leading separation authorities today. After his university studies he launched his career in a 1,000,000 b/d waterflood operation where he was responsible for the evaluation and performance improvement of all surface facilities. He sent most of his work days crawling through the process equipment of the day, gaining knowledge, and making improvements wherever possible.

This hands-on experience was the foundation Bill needed to improve, develop, and advance the technologies necessary to improve process equipment efficiencies across the board. In the early years Bill learned what works, and what doesn't! In the decades since his accumulated separation knowledge and experience led to his many patents, each of which speaks for itself.

The result is a unique approach; one where, "Engineering meets ingenuity!"

Bill's efforts continue to innovate improvements like the patent pending combination free water knockout- heater treater in one vessel. It's called "KOTREAT®". Each new KOTREAT® eliminates the time and expense of installing two separate vessels. And, through the use of highly efficient internals, KOTREAT® is a game changer when it comes to performance.

Another example of ingenious innovation is the MorOil™ system. MorOil™ is a patent pending system designed to condense the valuable C4+ hydrocarbon liquids from produced natural gas streams to generate a new producer stream of cash flow in the form of saleable, highly valued NGLs.

And yet another is the L-POD® System. This patented system brings the subject of crude oil dehydration into the 21st century. Using the most advanced components L-POD® reduces the BS&W concentration of crude oils to below the 0.1% level (that's 99.9% oil purity!), eliminating all rejects!

These are just a few of Breakthrough Engenuity's unique contributions.

Today, Breakthrough Engenuity is one of the industry's leading low-cost engineering and design firms. We specialize developing designs for the industry's most efficient high and low pressure, two and three-phase heated and unheated separators, as well as providing general engineering services for most other oilfield process needs.

Now, more than ever, Breakthrough Engenuity can be found in every sector of the oil and gas industry, adding cash flow to operators and efficiency to their operations. We're a full service engineering firm. We pledge to meet and exceed every client expectation.

CONTACT US

If all else fails, or if you just have a question, don't hesitate to call Bill Ball at ***Breakthrough Engenuity*** *for assistance. You can reach Bill at the office at 918-298-6841, or on his cell phone at 918-231-9698.*