

INNOVATIONS

from Desktop to Drill Site



Biotech Microbial Platform Lands in the Oil Patch

Bringing Molecular Methods to the Forefront of the Industry

Brent Mulliniks of AES Water Solutions demonstrating their HydroFlow Technology.

BY MIKA BRADFORD, VIVIONE BIOSCIENCES

The oil and gas industry faces real challenges in managing the water used for hydraulic fracturing, drilling operations and enhanced recovery efforts. These processes use millions of gallons of water typically laden with bacteria that can compromise the environment, contaminate wells and render the water unsuitable for various drilling, injection and recycling. If left untreated, the waterborne bacteria may corrode pipes, clog wells and damage the infrastructure, all of which can eventually lead to the costly slowdown of operations and production.

Drilling and completion-service companies try to combat this problem by treating water sources or producing wells with a predetermined amount of chemicals to kill the bacteria. Quite often the chemical dosing suggestions are standardized and do not take into consideration the extent of bacterial contamination, the type of bacteria present or the chemistry that is unique to that particular water source. While there have been great advancements in drilling and completions technology over the years, there has been a deficit in the development of diagnostic assays. The industry needs accurate, real-time information that identifies and enumerates the bacterial load of a given fluid sample.

OUR APPROACH

Vivione Biosciences is a biotech company focused on delivering bacteria-specific diagnostics to the oil and gas industry. Our technology, RAPID-B, was born of a collaboration with the FDA. Vivione commercialized the technology to change the way bacterial issues are diagnosed in hospitals. Late last year, the company brought its technology to the oil patch. “It seemed like a natural fit,” according to Vivione’s CEO Kevin

Kuykendall. “The oil and gas industry is on the cutting edge of drilling and seismic technology, but the microbial-testing methods haven’t progressed past the days of the cable tool and wooden derrick.”

Vivione’s new testing procedure known as the Total Bacteria Count (TBC) “provides significant advantages by speeding up the detection of bacteria, thus allowing for water-treatment and service companies to adjust and fine-tune their water-treatment protocols for a given water source. The RAPID-B technology has expanded to multiple markets in water quality, food safety, clinical diagnostics, and oil and gas.

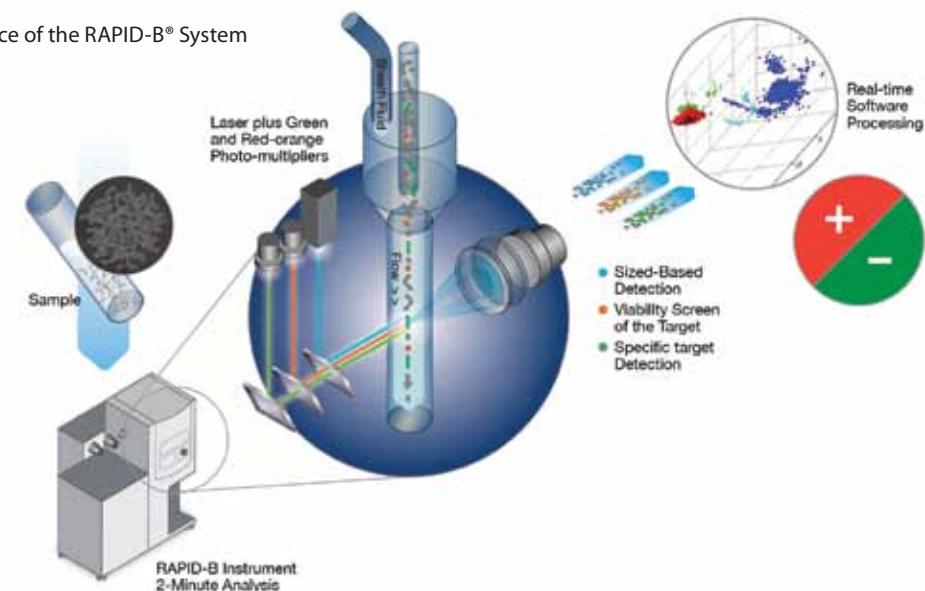
Companies like Apache Energy Services (AES) have been early adopters of the technology and are incorporating it into their service offerings as yet another level of quality assurance.

“We have introduced the HydroFLOW for non-chemical bacteria reduction in upstream-water treatment at a reduced cost compared to chemical-based biocides, and the RAPID-B has been ideal for verifying the effectiveness of the HydroFLOW in real time,” according to Brent Mulliniks, President of AES. “It has the ability to operate quickly in the field to verify actual bacteria counts in advance of a frac so that proper dosing of biocide can be applied and confirmed by testing the treated water. RAPID-B’s ability to deliver laboratory-quality results in the field within 15 minutes, at a reasonable cost, has allowed AES to successfully implement our technology.”

THE SCIENCE OF THE RAPID-B PLATFORM

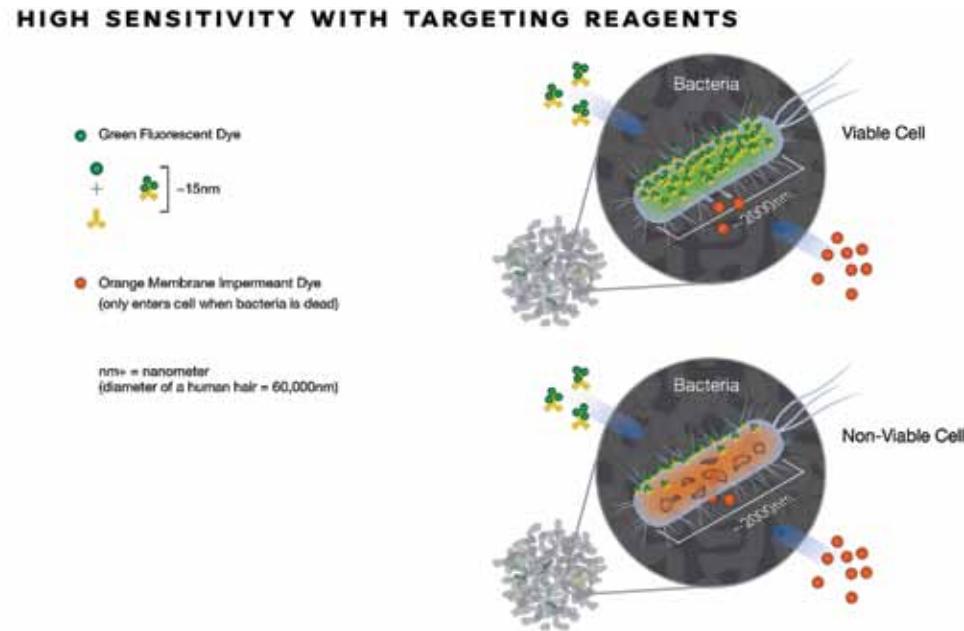
RAPID-B is a high-performance, integrated microbiology/infectious-disease diagnostic system. It uses hardware, software and wetware that are specifically designed for optimal performance.

Figure 1
The science of the RAPID-B® System



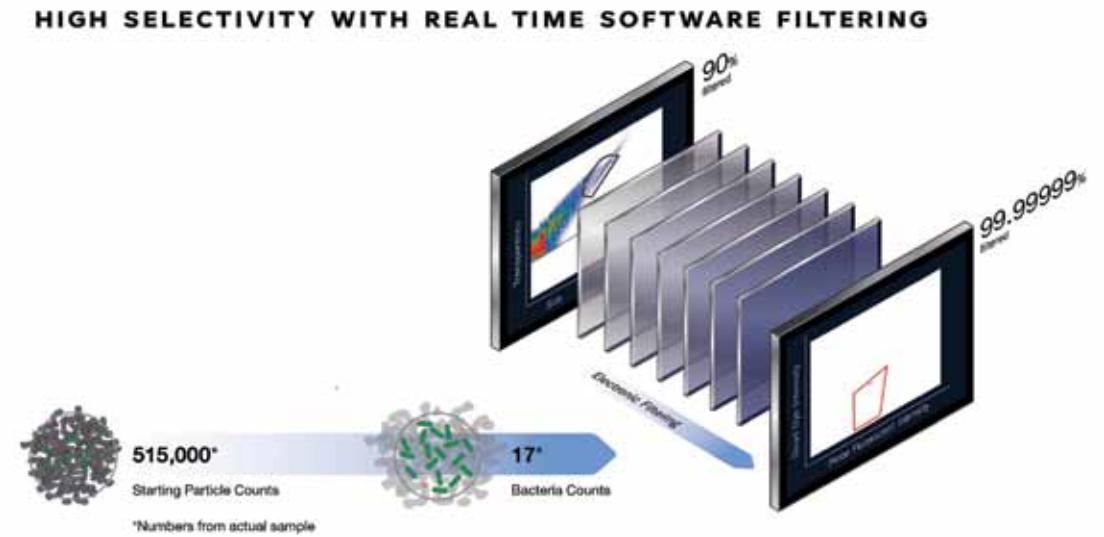
Wetware refers to the chemical reagents that target bacteria in a given sample. Primary targeting is accomplished with customized reagents designed to broadly target the DNA of the bacteria cell. An additional probe is used to identify only the bacteria that are live viable cells. Buffers, conditioners and other additives allow use within a complex sample matrix without the need for isolation or elaborate sample-preparation requirements.

Figure 2
Reagents binding to viable and non-viable cells



Each particle within the sample is analyzed in a many dimensions including size, shape, aspect ratio and viability stain-fluorescent response. This simultaneous, multi-dimensional analysis enables comprehensive assessment of each particle and identification of the bacteria within the sample. Further, RAPID-B's multi-dimensional electronic analysis filters noise without impacting bacteria signal. Analysis is possible even in the presence of substantial amounts of background matrix. This results in faster analysis, less sample preparation, while yielding enumeration of live bacteria within the sample in five minutes or fewer.

Figure 3
Series of electronic filters multi-dimensional analysis enables comprehensive assessment of each particle



Which solution makes sense for your injection pump application?

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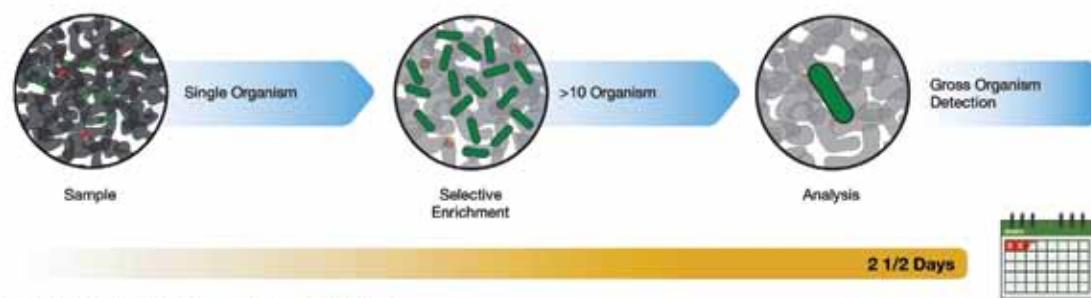
COMPARING RAPID-B TECHNOLOGY WITH OTHER TESTING METHODS

Typical technologies that the RAPID-B platform outperforms include current oilfield applications that rely on cellular byproducts, incomplete or slow methods of testing, some of which can take 28 days or longer to deliver results.

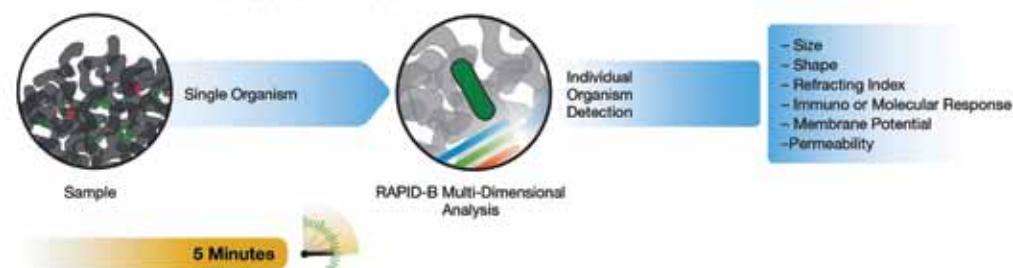
Culture Media/Bug bottles: Culturing bacteria from a sample involves feeding the bacteria specialized media until cellular byproducts cause the bottle to “pop positive,” indicating a positive test for bacteria. The method takes up to 28 days and has a lot of vulnerabilities based on the bacteria’s ability to grow. The long time frame precludes the information being actionable in the field.

RAPID-B METHODOLOGY

Current Methods (excluding RAPID-B):



RAPID-B Multi-Dimensional Method:



RAPID-B provides information on the level of bacterial contamination in a matter of minutes and can be used to quantify the effectiveness of a specific bio-treatment application.

ATP-based methods: These use adenosine triphosphate (ATP) to identify a bacterial presence in a water sample. ATP is a chemical that is fundamental to cellular life, but it can also exist outside viable cells. The method does not solely identify bacteria as algae, and other chemicals in the water can skew the results. This test provides only an estimate of the bacteria assuming that concentration of ATP is proportional to the bacteria present.

RAPID-B looks at the individual cells of bacteria and does not rely on cellular markers. It interrogates and identifies each individual bacteria cell.

Membrane Filtration testing: Using membrane filters to collect bacteria that may be low in concentration in a given sample are then applied to a medium in hopes that colony-forming units will grow out allowing for more specific analysis. This approach is very difficult with oil and gas samples because of the large amount of particles and oils in the samples. Also, the bacteria require unusual environments, and so can be difficult to grow in a laboratory setting.

RAPID-B does not rely on bacteria growth in the assay, but looks at each component in a sample to decide if it is a viable bacteria cell. The system enumerates the viable cells in minutes to provide an accurate measure of the microbial contamination.

The RAPID-B system means companies can perform a Total Bacteria Count (TBC) test onsite, however, recognizing that some companies will not choose to purchase their own RAPID-B platform, Vivione Biosci-

ences partnered with the world-renowned IEH Laboratories through a strategic alliance to form Petro Chemical Bio-Diagnostics. IEH Laboratories has more than 119 locations and 65 Ph.D.’s on staff.

Through their main laboratory in Seattle, Petro Chemical Bio-Diagnostics provides the TBC test that is performed with the RAPID-B platform along with an expanded suite of testing services specifically designed for the oil and gas industry using a combination of molecular methods. Through Petro Chemical Bio-Diagnostics, customers access q-PCR testing, which identifies one to three bacteria of interest in a given sample. The Bio-Treatment Efficacy Test (BET) provides specific quantitative information related to the direct effects of industry biocides on the bacterial population provided. Multiple sample sets can be analyzed individually. Each sample is assessed both pre-and post-treatment to enumerate the bacterial kill rate. The Well Characterization Test (WCT) is a comprehensive high-resolution analysis of the microbial contamination of a given sample. It provides a detailed report identifying the type and quantity of every specific bacterial species, including SRBs (sulfate reducing bacteria) and APBs (acid producing bacteria).

Sample collection kits can be ordered from Petro Chemical Bio-Diagnostics. Fluid samples are shipped overnight to the laboratory in Seattle. □

Vivione Biosciences is a TSX Venture Exchange listed biosciences company focused on the commercialization of its proprietary RAPID-B platform. For more information, visit VivioneBiosciences.com.

Petro Chemical Bio-Diagnostics was created through a strategic alliance with Vivione Biosciences, a bacteria-detection company, and the Institute for Environmental Health, Inc. (IEH), an international microbiological laboratory network. More information is available at pcbdservices.com.

About the Author:



Mika Bradford joined Vivione Biosciences in 2014 as Director of Sales and Marketing. With more than 16 years of experience in the field of biosciences, she has worked with companies in the pharmaceutical and healthcare industry. She is often called upon to convey complex medical concepts through her writings for a variety of health and wellness publications.

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