Speedy Breedy - Lab Memo 37

Measurement of Bacterial contamination and effect of Biocides in Drilling Head Water.

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Objective

The objective is to establish Speedy Breedy as an on-site, rapid technique to quantify microbial contamination in process water, assess the efficacy of biocide systems, and monitor the rate of degradation.
The aim is to set up a surveillance system to mitigate the risk of process water contamination in drilling heads and other processes, reducing chemicals usage, costly corrosion and equipment failures.

Principle & background

Inadequate microbial control can have a significant impact on down-hole corrosion rates and can create both economic cost and sustainability concerns. Sulphate Reducing Bacteria (SRBs) are the primary cause of microbial-induced corrosion.

SRB organisms are very slow growing and inconsistent in their growth pattern, have ill-defined growth media for the purposes of rapid growth and detection and are often affected by the sample itself. Industry experts confirm that SRB detection systems are highly unreliable.

Basic assumptions made in this document are:

- SRB organisms will be a significant contributor to corrosion but will be only one part of a larger community of microbes in the water.

- Microbial flora will be reasonably consistent over time so determinations will also be consistent from test to test. This assumption is based on observations in a number of similar industries where the process is basically stable.

- Biocide will be equally effective on SRB's as the other microflora - however the point of this proposal will be to show when biocide is degraded, not how effective that particular biocide is against SRB's. It is the remit of the biocide supplier to provide efficacy data against different species.

An independent industry expert has been consulted and agrees the logic of the assumptions and proposed testing regime.

Proposed regime for testing drilling head (or other process) water for microbial contamination and biocide efficacy.

SRB's are difficult to detect so this proposal aims to use one or more common marker organisms which will be present in the sample alongside SRB's and measure their numbers and importantly the effect of Biocides. Since the water used in the process is likely to become anaerobic at certain times, this study will monitor facultative anaerobes which can survive and grow in either aerobic or anaerobic environments.
The proposal is to monitor water over a period of time in order to determine:

The inherent background level of contamination if present.

The change in bacterial numbers with time in order to show whether this is getting worse and remedial action needs to be taken.

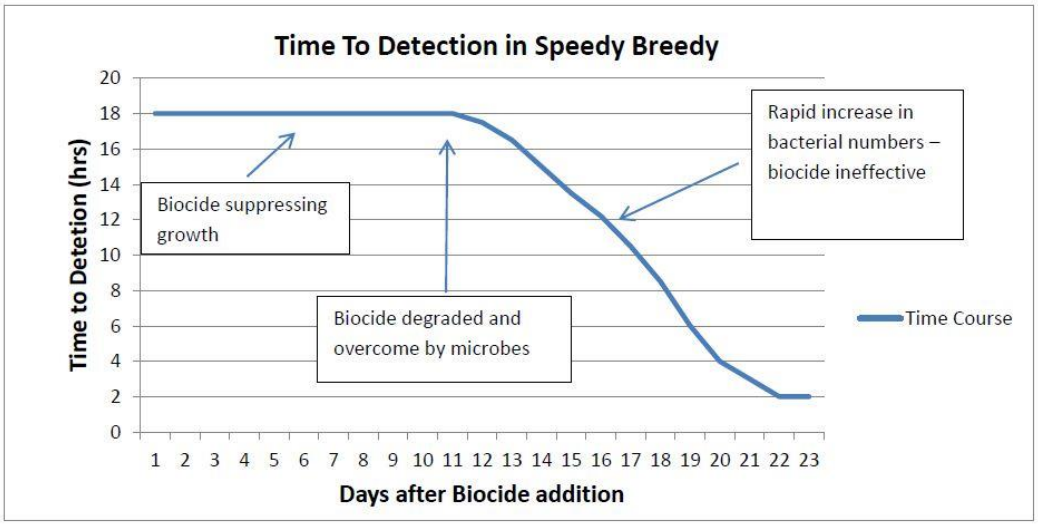
The effectiveness of any biocides used.

By taking samples each day (or similar) and plotting them, it will be possible to determine whether there is A net increase or decrease in numbers indicating the effectiveness of the biocides used.

Hypothesis

The hypothesis is that when biocide is added to the process water it will suppress the growth of microbial contaminants for an unknown period of time but will eventually degrade and become ineffective against the bacteria.
This is typical of biocide action in many industries. When samples are taken regularly in a test sequence and Time To Detection (TTD) in Speedy Breedy plotted against the time from addition of biocide it is expected that Speedy Breedy will effectively determine when the biocide in inactive because the microbes will grow more quickly.

The period that the biocide will be active cannot be predicted because each biocide and concentration will work differently however after several test sequences a body of knowledge will be built up that will aid in determining the frequency of testing required to identify when biocide is degraded.



Explanation

In this test sequence the water has been sampled on a daily basis, run in Speedy Breedy, the TTD logged and then plotted vs. for each day after addition of biocide. An arbitrary cut-off TTD at 18 hours was set up but this may be longer – a 24 hour protocol might work better taking into account shift patterns and so forth.
Anything taking longer than this to detect is assumed to be effectively suppressed by the biocide.

At the start of the sequence when the biocide is new and fully active it is expected that bacterial suppression will be high and a TTD of greater than 18 hours is likely.
As seen in the example.

In the example given, at Day 11 however the TTD falls below the 18 hour threshold and on subsequent days the TTD becomes increasingly shorter indicating that the bacterial load is rising rapidly because the biocide is degrading and is no longer effective.
The test therefore supports a better understanding of the effectiveness and longevity of the biocide and aids in managing replacement and addition of biocide. This can result in considerable savings in chemicals usage and gives an indication whether other problematic organisms such as SRB's are under control.

Proposed Protocol

It is proposed to use TSB culture vessels to detect Total Viable Count (TVC) of the broad spectrum of organisms in the water, with a culture temperature of 36 Deg C and a mixing speed of 90 rpm.

NOTE: Bactest can provide a TVC protocol for use in Speedy Breedy in this application.

- 50 ml samples of the drilling water are taken daily using a clean sample vessel (50 ml disposable syringes are good for this purpose) and added to a Speedy Breedy TSB vessel.
- Samples are run in Speedy Breedy using the TVC protocol provided.
- Time to Detection is monitored for each day in the test sequence and plotted as indicated on the graph above.
- The efficacy of the biocide is determined from the graph and new biocide added as required.
- Further testing continues to show effectiveness of the new biocide addition.

This document is for general guidance only and sets out a proposed start point for experiments to establish Speedy Breedy as a microbial monitoring system for process water. It provides no guarantee of success as each process is different and it is the responsibility of the user to establish efficacy of procedures and Protocols used in their process.